India 2015

Population
Human Development

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monograph provide a good understanding of contemporary issues related to population and human development in India and in its constituent states.

The first paper of the monograph analyses the human development situation in Madhya Pradesh on the basis of the data available through the 2011 population census. Using the data available through the 2011 population census, the paper estimates a variant of the human development index at the state, district and sub-district level. Based on the human development index so estimated, the paper analyses, rural-urban, social class and spatial disparities in human development in the state. Madhya Pradesh was the first state in India to prepare state-specific human development report way back in 1995. The 1995 report was followed by similar reports in 1998, 2002 and 2007. An integral feature of these reports has been the estimation of the human development index for the districts of the state. There has however been little effort to estimate the human development index below the district level and to analyse social class and rural-urban disparities in human development as reflected through the human development index. The paper included in the present monograph attempts, for the first time, analysis of the human development situation below the district level in the state.

The second paper of the monograph is devoted to the interrelationship between the dynamics of population growth and development in Madhya Pradesh through a regional perspective. The paper highlights regional disparities in both demography and development in the state. The paper concludes that in most of the regions of the state, the pace of demographic transition is slow and this pace needs to be accelerated. The paper argues that there is a need to examine whether regional variation in the population dynamics is the result of the regional variation in the level of social and economic development or there are other factors that are responsible for the observed regional variation in the demographic situation in the state. Since a certain threshold of social and economic development is necessary to hasten the pace of demographic transition, the paper concludes on the basis of the analysis of the demographic situation in the state that the threshold of social and economic development necessary to hasten the pace of demographic transition is missing in most of the regions of the state.

The third paper of the monograph analysis the relationship between agricultural production and food security at macro and micro level in West Bengal in terms of food availability and food adequacy. The paper observes that at the state level, the per capita food grain availability has increased over time. However, there is huge spatio-temporal variation in food grain availability across the districts of the state. Similarly, the food adequacy also varies widely across the districts of the state. The situation, on the other hand, appears to be radically different at the micro, household, level. Taking the case of district Bankura as an example, the paper observes that in almost three-fourth of the households surveyed, the food availability is estimated to be very low. The paper argues that improving the productivity of agriculture is critical to improving both food availability and food adequacy in the state.

The fourth paper of the monograph discusses the population-poverty nexus in Madhya Pradesh. The paper argues that the prevailing situation in Madhya Pradesh demands that the people of the state should be made aware about how they can reduce poverty and raise social and economic standards and quality of life. The paper argues that if the general public becomes sensible then it can also be made responsible. Government actions can only be lucid if the receiver is aware and knowledgeable of their rights and how they can upgrade their life in a decent way.

The fifth paper of the monograph measures levels and analyses determinants of caesarean section deliveries in selected states of India on the basis of the data available through the National Family Health Survey. The paper finds that the prevalence of caesarean section deliveries in the selected states is well below the threshold set by the World Health Organization. In some states of the country, the caesarean section rate is found to be very low which indicates lack of necessary health facilities to meet the surgical obstetrical needs of pregnant women. The paper also observes that the prevalence of caesarean section deliveries is higher in the private as compared to public health care delivery institutions. Although, the prevalence of caesarean section deliveries in India appears to be lower than that in many developing countries, yet total number of caesarean section deliveries in India may be very large because of the very large population of the country.

The next paper of the monograph discusses the heavy burden of diarrhoea in children below five years of age in Bihar. The paper observes that only a small proportion of potential diarrhoea episodes in children below five years of age in the state are reported through the Health Management Information System launched by the Government of India under the National Rural Health Mission in most of the states of the country. However, this proportion is found to be very high in Bihar. The paper attributes the very high reporting of diarrhoea cases in the state to the Childhood Diarrhoea Management Program launched by the Micronutrient Initiative, a development organisation, in collaboration with the Government of Bihar. The programme has also resulted in the correct assessment and proper treatment of diarrhoea cases at the community level leading to a reduction in the severity of diarrhoea in children. As a result, the paper argues, a large number of deaths from diarrhoea in Bihar.

The seventh paper of the monograph analyses the status of basic vaccination of children against six vaccine preventable diseases in Uttar Pradesh where the full immunisation coverage rate of children aged 12 -23 months continues to be very low. The paper observes that the utilisation of immunisation services in the state is far from satisfactory and one important reason for poor performance of the immunisation services is the poor awareness about these services and the availability of these services at the health institutions in the state. The paper argues that the information, education and communication skills of the front line health workers should be enhanced so that the people at large can be motivated to get their children immunised. The paper also argues

that the surveillance and the referral system related to immunisation of children must be reinforced to improve the efficiency of the health care delivery system, especially in the context of universal immunisation of children to reduce the exceptionally high infant and child mortality in the state .

The eighth paper of the monograph develops a probability model to describe the child bearing patterns in young females. The model so developed has been used to observe the pattern of male and female births in an Indian migrant community in Houston, Texas, USA and in the rural and urban population of Uttar Pradesh, the most populous state of India. The paper also examines the correlation between male births and female births in different populations.

The next paper of the monograph analyses the relationship between tobacco use among youths and the tobacco consumption behaviour of their parents on the basis of a survey of youths carried out in six states of India. The paper confirms that parents' tobacco consumption behaviour has a strong impact on the tobacco consumption behaviour of their wards. The analysis also reveals that tobacco use by parents contributes to youths perceiving that tobacco use as a positive and acceptable behaviour and developing favourable personal beliefs and subjective norms. The analysis presented in the paper also finds that consumption of alcohol increases the risk of tobacco consumption among the youths. The paper argues that policies and programmes directed towards tobacco use by adolescents must take into account parents' history of tobacco use. Parents need to be counselled about the impact of their smoking and tobacco use behaviour on their children.

The next two papers of the monograph are related to the issues of the elderly in the family and the society. One of these two papers examines the liability status of the elderly in the family on the basis of a survey carried out in the rural population of district Sehore in Madhya Pradesh. The paper suggests that the liability status of the elderly in the family is influenced to a significant extent by the standard of living of the household. In households where the standard of living is high, the elderly in the family are generally not regarded as a liability. However, the situation is reversed in households where the standard of living is low. The analysis also revealed that in majority of the households surveyed, the elderly are regarded as advantageous to the family. In families where the elderly are regarded as a liability, the primary reason was the poor health of the elderly.

The second paper focussed on the elderly population, analysed, in detail, the phenomenon of polypharmacy or multiple medications in the old population on the basis of the data available through a study on ageing and adult health that was carried out in six states of the country - Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. This study was a part of the study on Global Ageing and Adult Health that was coordinated by the World Health organization and that covered six countries -China, India, Ghana, Mexico, Russia and South Africa. The paper concluded that polypharmacy was emerging as a major health concern among the elderly in the country. The paper also suggests that self-rated poor health, diabetes, depression and hypertension are the major

risk factors behind the use of polypharmacy among the elderly in the country. The paper recommends that effective communication between the elderly and the health services providers is necessary to reduce the prevalence of polypharmacy.

The last paper of the monograph presents a case study of women farmers in India. The study is based on interactions with women farmers in a village in the Bundelkhand region of India. The paper concludes that at the village level, the status of women remains poor to very poor. The paper also observes that most of the women in the studies village had little knowledge of different development and welfare schemes designed and implemented for the empowerment of women. The paper recommends that the situation can be changed through encouraging entrepreneurship among rural women. In this context, the argues for continuous attempt to inspire, encourage, motivate and co-operate with women entrepreneurs at the village level.

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Human Development in Madhya Pradesh

Evidence from 2011 Population Census

Aalok Ranjan

Introduction

Madhya Pradesh was the first state in India to prepare state specific human development report way back in 1995. The 1995 Report has been followed by similar reports in 1998, 2002 and 2007 (Government of Madhya Pradesh, 1995; 1998; 2002; 2007). An integral feature of these reports has been the estimation of human development index (HDI) for the districts of the state following the methodology popularised by United Nations (UNDP, 1990). The last report prepared by the state provides district level estimates of HDI for the year 2005. Since then, there has been little attempt to measure and monitor human progress by calculating HDI for the state and for its constituent districts. Latest estimates of HDI for the state are available through the national human development report 2011 but latest estimates of district HDI are now 10 years old and, therefore, largely irrelevant for development planning and programming.

The human development reports of the state are however silent about social class and rural-urban disparities in human development either at the state or at the district level. Chakraborty (2000) has questioned the logic of computing HDI without giving attention to inequalities in human development by socio-demographic groups. Chaurasia (2013) has estimated HDI for rural and urban areas for different social classes for the state and for its constituent districts and observed that social class and rural-urban disparities in human development in the state and in its constituent districts are very strong and appear to have persisted over time.

Although, Madhya Pradesh has pioneered state specific Human Development Reports in India, yet, there has been no attempt in the state to estimate HDI below the district level to measure and monitor human development. The primary reason for not estimating HDI below the district level has been the lack of appropriate data at the lower levels of the

administration system. The conventional HDI is based on macro-level indicators which cannot be easily estimated at the lower tiers of the administrative system because of a number of methodological considerations and because of the fact that there is no system to estimate these indicators at the grass roots level.

In this paper, we use the data available through the 2011 population census to analyse human progress at the local level by estimating a variant of (HDI) at sub-district level. We also estimate HDI for the districts and for the state whole to present a composite picture of human progress in the state. Data available through the 2011 population census also permit to analyse rural-urban disparities in human development across the administrative units. The approach adopted in the present paper can be extended up to village and municipal ward level to measure and monitor human progress.

The paper is organised as follows. The next section of the paper outlines the approach adopted to estimate HDI from the data available through the 2011 population census. We follow the same approach as adopted by the United Nations but uses a different set of indicators that can be estimated from the data available through the population census. The third section of the paper presents estimates of HDI for the state and for its constituent districts. The fourth section of the paper presents estimates of HDI for the sub-districts of the state and discusses rural-urban disparities in human development at the sub-district level. The last section of the paper summarises the findings of the analysis and discusses its policy implications.

Methodology and Data Source

HDI is a response to the need of a measure that could better represent human development in several basic capabilities than the conventional income based measures (Kelly, 1991; Anand and Sen, 1994; Haq, 1995). It is not a comprehensive measure of human development and well-being as it does not cover all dimensions of human development (Kovacevic, 2010). It focuses on three basic capabilities that are necessary for human progress - a long and healthy life, knowledge, and a decent standard of living. It is argued that if these three basic capabilities are achieved, they would open up opportunities in other dimensions of human development also (Jahan, *no date*). HDI has now been recognised universally as the standard yardstick to measure and monitor human progress. A high level of HDI is used as a means of aggrandisement whereas low level of HDI reflects insufficiencies in efforts directed towards human progress. HDI has also been used to measure the impact of economic policies on the quality of life (Davis and Quinlivan, 2006).

The framework of HDI is parallel to the framework of capabilities expansion propounded by Sen (1985, 1990). The capabilities expansion framework has three components - endowment, individual capacity and social opportunity. Endowment in Sen's framework is congruent with the standard of living in HDI; individual capacity is

congruent with longevity while social opportunity is congruent with education. This congruence suggests that improvements in HDI also reflect expansion in individual capabilities. In this sense, HDI may also be viewed as a measure of the performance of human development processes in terms of individual capabilities expansion. This perspective also argues that regional disparities in HDI are essentially a reflection of the disparities in the capabilities of the people across regions.

There is considerable variation in the set of indicators used for estimating HDI in India and in its constituent states as compared to the indicators used by the United Nations (Chaurasia, 2013). This variation is compelled primarily by the availability of the data required for estimating HDI, especially at lower levels of the development administration system. Indicators conventionally used for estimating HDI are generally not available at lower tiers of the development administration system. Estimates of per capita income, for example, are not available at sub-district level. Similarly, data required to estimate mean years of schooling, expected years of schooling and expectation of life at birth are not available at sub-district level. The only way out, therefore, is to use alternative indicators to estimate HDI at sub-district level.

Estimation of HDI involves measurement of 1) standard of living; 2) health status of the people; and 3) level of education. The most commonly used indicator to measure standard of living is the per capita income. On the other hand, health status of the people is commonly measured through the expectation of life at birth. Finally, level of education is measured in terms of literacy. Indicators used to measure the three components of HDI have evolved over time. For example, the HDI estimated in the first Human Development Report prepared by the United Nations is based on 1) gross national product per capita to measure the standard of living; 2) expectation of life at birth to measure the health status; and 3) adult literacy rate to measure the level of education (United Nations, 1990). By contrast, from 2010 onwards, HDI is estimated by the United Nations on the basis of four indicators: 1) gross national income per capita in terms of purchasing power parity to measure standard of living; expectation of life at birth to measure health status; and 3) mean years of schooling and expected years of schooling to measure the level of education (United Nations, 2010). Similarly, different indicators have been used to estimated HDI in different national and state human development reports (Chaurasia, 2013).

The major challenge to estimating HDI at the grass roots level is to identify indicators to capture progress in the three dimensions of human development. These indicators need to be combined to constitute the HDI. The identification of these indicators, obviously, depends upon the availability of appropriate data. The only source of data pertaining to human development available at the local level in India is the population census which has been carried out uninterrupted in the country since 1881. The last population in the country was carried out in 2011 which allows analysing human progress at the local level in Madhya Pradesh by estimating a variant of HDI at the sub-district level and to highlight rural-urban disparities in human development.

As is well-known, HDI is a composite index based on an index of the standard of living; an index of health; and an index of education. On the basis of the data available through the 2011 population census, we have selected the following indicators to construct the index of standard of living; the index of health; and the index of education and hence to estimate HDI:

Standard of living	1.	Proportion of households having none of the seven assets - radio/transistor; television; computer with or without internet; phone - landline or mobile or both; bicycle; moped/scooter/motorcycle, etc.; and car/jeep/van, etc. (A)
	2.	Proportion of households using banking facilities. (B)
Health	3.	Proportion of population 0-6 years of age. (H)
Education	4.	Effective literacy rate. (E)

The rationale for using availability of households assets and use of banking facilities as indicators of the household standard of living has been discussed at length elsewhere (Chaurasia, 2010; 2013). It is argued that household assets are related to household income in the sense that household income reflects the assets that the household commands and the returns that it is able to earn on these assets.

It is also argued that household assets reflect the accumulation of income and represent wealth and status, economic and social security, and easier access to credit, etc. Deprivation of household assets is a better measure of the persistence of 'ill-being' than the contemporary income or consumption-based measures of the standard of living. Lack of household assets and inadequate housing conditions are more likely to be associated with the deficiency of resources over a prolonged period of time than with the current income or consumption expenditure. In this context, deprivation indicators allow a broader look at exclusion because of the lack of either resources or opportunities or specific preferences or choices. On the other hand, it is also argued that use of banking facilities by the members of the household is related to the access to resources and the higher is the use of banking facilities the greater is the access to resources and hence better is the standard of living.

The primary census abstract 2011 does not provide any data related to the health of the population. However, it is possible to estimate the proportion of the population aged 0-6 years which can be taken as an indicator reflecting the health of the population. The logic of using the proportion of population aged 0-6 years to reflect as an indicator reflecting the health status of the population lies in the empirical relationship between the expectation of life at birth and the proportion of population aged 0-6 years. Based on the data on the expectation of life at birth and the proportion of population aged 0-6 years for 146 countries of the world for the period 2005-10, we found that the expectation of life at birth is inversely related to the proportion of population 0-6 years. The higher is the

proportion of population age 0-6 years the lower is the expectation of life at birth and vice versa.

Finally, the effective literacy rate or the proportion of population aged 7 years and above who can read and write with understanding has been taken as the indicator reflecting the level of education of the population simply because estimates of adult literacy rate and data related to schooling are not available at the local level.

Using the four indicators described above, we have follow the approach adopted by the United Nations (United Nations, 2010) to estimate HDI for Madhya Pradesh and for its constituent districts and sub-districts. First, all the variables were normalised. The goal posts used for normalisation were 0 and 1 for all indicators except the proportion of population 0-6 years of age for which minimum and maximum values were taken to be 0.05 and 0.30 respectively. A proportion of 0.30 implies an expectation of life at birth of 47 years whereas a proportion of 0.05 implies an expectation of life at birth of around 84 years.

The HDI has then been calculated as the product of the index of health (I_H), index of education (I_E) and index of household standard of living (I_S). In other words

$$HDI = I_H * I_E * I_S$$

where

$$I_H = h^{1/3}$$
$$I_E = e^{1/3}$$
$$I_S = s^{1/3} \text{ and } s = (a*b)^{½}$$

and a, b, e, h, and s are the normalised values of indicators A, B, E, H and S respectively.

We have calculated HDI for the combined population and separately for rural and urban population of the state, for its 50 constituent districts and 342 sub-districts. We have also decomposed the urban-rural difference in HDI into the urban-rural difference in the three components of HDI as follows:

$$\begin{aligned}\nabla_{UR} &= HDI_U - HDI_R \\ &= [I_{HU} * I_{EU} * I_{SU}] - [I_{HR} * I_{ER} * I_{SR}] \\ &= (I_{HU} - I_{HR}) * I_{ER} * I_{SR} + (I_{EU} - I_{ER}) * I_{HR} * I_{SR} + (I_{SU} - I_{SR}) * I_{HR} * I_{ER} + \\ &\quad + (I_{HU} - I_{HR}) * (I_{EU} - I_{ER}) * I_{SR} + (I_{HU} - I_{HR}) * I_{ER} * (I_{SU} - I_{SR}) + I_{HR} (I_{EU} - I_{ER}) * (I_{SU} - I_{SR}) + \\ &\quad + (I_{HU} - I_{HR}) * (I_{EU} - I_{ER}) * (I_{SU} - I_{SR}).\end{aligned}$$

or

$$\nabla_{UR} = \partial H_{UR} + \partial E_{UR} + \partial S_{UR} + \partial HE_{UR} + \partial HS_{UR} + \partial ES_{UR} + \partial HES_{UR}$$

where

$$\partial H_{UR} = (I_{HU} - I_{HR}) * I_{ER} * I_{SR}$$
$$\partial HE_{UR} = (I_{HU} - I_{HR}) * (I_{EU} - I_{ER}) * I_{SR}$$
$$\partial HES_{UR} = (I_{HU} - I_{HR}) * (I_{EU} - I_{ER}) * (I_{SU} - I_{SR})$$

Following the Goldberg's rule, the contribution of the urban-rural difference in the health index to the urban-rural difference in HDI, ∇_{UR}, can be estimated as

$$\nabla H_{UR} = \partial H_{UR} + (\partial HE_{UR} + \partial HS_{UR})/2 + \partial HES_{UR}/3.$$

In the same manner, contribution of the urban-rural difference in the index of education, and in the index of the standard of living s to the urban-rural difference in HDI can be calculated.

According to the United Nations, the level of human development is termed as low if the human development index is less than 0.5. Similarly, the level of human development is termed as medium if the index ranges between 0.5-0.7; high if the index ranges between 0.7-0.8; and very high if the index is at least 0.8. We have followed the same classification to class human development in the state.

Results

Level of human development. Estimates of HDI for Madhya Pradesh and for its constituent districts are given in appendix table 1 separately for rural, urban and combined population whereas estimates of HDI for the sub-districts of the state are given in appendix table 2. Data available through the 2011 population census suggests that the level of human development in Madhya Pradesh may be classified as medium with an HDI of 0.617 circa 2011. In the rural population, the HDI is estimated to be 0.563 which implies low level of human development whereas the HDI is estimated to be 0.761 in the urban areas which implies high level of human development. Using the data available through the 2001 population census, Chaurasia (2013) has estimated an HDI of 0.502 for the state around 2001 - 0.444 in the rural areas and 0.660 in the urban areas. The estimates of HDI obtained in the present paper are not strictly comparable to estimates of HDI obtained by Chaurasia (2013) because the two estimates are based on different set of indicators. Still, it appears that there has been some improvement in the human development situation in the state and the improvement appears to have been relatively faster in the rural population as compared to the urban population of the state as the increase in HDI has been relatively faster in the rural than in the urban population.

Summary measures of the variation of HDI across the districts and sub-districts are presented in table 1. Across the districts of the state, HDI varies from 0.748 in district Indore to 0.380 in district Alirajpur. In the rural population, HDI is the highest in district Balaghat (0.639) but the lowest in district Alirajpur (0.349). In the urban population, district Balaghat again has the highest HDI (0.809) but HDI is the lowest in district Sheopur (0.679). In all, in 43 (86 percent) districts of the state, the level of human development may be termed as medium as HDI ranges between 0.5 through 0.7 in these districts. On the other hand, in 3 districts, the level of human development may be termed as low as HDI ranges between 0.3 through 0.5 in these districts. These districts are Jhabua, Alirajpur and Barwani. All the three districts are located in the south-west corner of the state and are geographically contiguous. A important feature that is common to all the three districts is that a very high proportion of population in these districts is

Scheduled Tribes population. Moreover, there are 4 districts where the level of human development may be termed as high (HDI ranges between 0.7 through 0.8). These districts are Indore, Bhopal, Jabalpur and Gwalior. There is no district in the state where the level of human development is very high (HDI is at least 0.8). Similarly, there is no district in the state where the level of human development is very low (HDI less than 0.3).

The human development scenario in rural and urban population of different districts of the state is contrastingly different. HDI in the rural population is the highest in district Balaghat (0.639) but the lowest in district Alirajpur (0.349). There is no district in the state where the level of human development in the rural population is high or very high (HDI is at least 0.7). On the other hand, in 7 districts, the level of human development in the rural population is low (HDI ranges between 0.5-0.7). These seven districts are Alirajpur, Ashoknagar, Barwani, Burhanpur, Jhabua, Sheopur and Singrauli. Out of these seven districts, four districts - Alirajpur, Barwani, Burhanpur, Jhabua - are geographically contiguous and are located in the south-west corner of the state.

The human development scenario in the urban population of the districts is different. There are 2 districts - Betul and Jabalpur - where the level of human development appears to be very high (HDI is more than 0.8). In addition, in 42 districts, the level of human development appears to be high as HDI in the urban population of these districts ranges between 0.7-0.8. This leaves only 6 districts where the level of human development in the urban population is medium (HDI ranges between 0.5-0.7). These districts are Ashoknagar, Barwani, Burhanpur, Guna, Rajgarh and Sheopur. There is no district where the level of human development in the urban population is either low or very low (HDI less than 0.5). There are thus 4 districts in the state - Ashoknagar, Barwani, Burhanpur, and Sheopur - where the level of human development is low in the rural population and medium in the urban population.

The inter-district inequality in human development in the combined population is wider than that in rural and urban populations. The coefficient of variation in HDI across the districts is estimated to be 0.122 in the combined population but 0.115 in the rural population and only 0.048 in the urban population.

Across the sub-districts of the state, HDI is estimated to be the highest in sub-district Jabalpur in district Jabalpur (0.790) but the lowest in sub-district Pati in district Barwani (0.275). In the rural population, HDI is the highest in Kurai sub-district of district Seoni (0.694) but the lowest again in sub-district Pati of district Barwani (0.275). In the urban population, on the other hand, HDI has been estimated to be the highest in sub-district Dolariya of district Hoshangabad (0.894) but the lowest in sub-district Rahatgarh of district Sagar (0.571). The level of human development is medium in around 280 (81.67 percent) sub-districts of the state. There are only 26 sub-districts where the level of human development in the combined population is high (HDI ranges between 07-0.8) but there is no sub-district where the level of human development is very high. By contrast, there are 2 sub-districts where the level of human development is very low. These sub-

districts are Pati in district Barwani and Bajna in district Ratlam. Moreover, in 34 (9.94 percent) sub-districts, the level of human development is low. There is no sub-district where the level of human development is very high.

The urban-rural contrast in human development at the sub-district level is also very clear. There is no sub-district in the state where the level of human development in the rural population is either high or very high. At the same time, there is no sub-district in the state where the level of human development in the urban population is low or very low. In 21 (6.14 percent) sub-districts, the level of human development in the urban population is very high (HDI at least 0.8) and in 162 (47.37 percent) sub-districts, the level of human development in the urban population is high (HDI ranges between 0.7-0.8). By contrast, in two sub-districts, the level of human development in the rural population is very low and in 52 sub-districts, it is low.

Urban-Rural difference in HDI. The HDI in the urban population is higher than that in the rural population in the state in all districts and in all but one sub-districts of the state. At the state level, HDI in the urban population is higher than the HDI in the rural population by 0.198 absolute points which reflects the disparity in human development in urban and rural population in the state. At the district level, urban-rural difference in human development appears to be the widest in district Alirajpur as the difference between urban and rural HDI is 0.368. By contrast, the urban-rural difference in human development appears to be the narrowest in district Datia as the difference between urban and rural HDI is 0.128 in the district. The urban-rural difference in human development does not appear to be very large in the state as urban-rural difference in HDI is found to be less than 0.2 in three-fourth districts. There are however 11 districts where the disparity in human development in urban and rural population appears to be quite substantial. In these districts urban-rural difference in HDI ranges between 0.2-0.3. Finally, the urban-rural disparity in human development is very wide in two districts - Alirajpur and Jhabua.

At the sub-district level, the urban-rural difference in HDI is found to be positive in all but one sub-district of the state. In the sub-district Lalbarra of district Balaghat, HDI in the rural population is found to be higher than the HDI in the urban population. Among the remaining sub-districts of the state, the urban-rural difference in HDI has been found to be the lowest in sub-district Rahatgarh of district Sagar but the highest in sub-district Jhabua of district Jhabua. There are 46 sub-districts in the state where the urban-rural disparity in human development is quite narrow as the urban-rural difference in HDI, although positive, is less than 0.1. On the other hand, in 188 (55 percent) sub-districts, the disparity in human development may be termed as narrow as the urban-rural difference in HDI ranges between 0.1-0.2. However, in 47 (13.75 percent) sub-districts of the state, the urban-rural disparity in human development appears to be wide and in 10 sub-districts, it appears to be very wide. There are 3 sub-districts in the state - Jhabua in district Jhabua, Sailana in district Ratlam and Jobat in district Alirajpur - where the urban-

rural disparity in human development appears to be extremely wide. In sub-district Jhabua of district Jhabua, the HDI in the rural population is only 0.322 compared to an HDI of 0.782 in the urban population reflecting extreme disparity in human development situation in rural and urban population of the sub-district.

Decomposition of urban-rural difference in HDI. The observed urban-rural difference in HDI is the result of the urban-rural difference in the three components that constitute HDI. It is possible to decompose the urban-rural difference in HDI into the urban-rural difference in the three components of HDI. Appendix table 3 presents results of the decomposition exercise for the state and for its constituent districts whereas appendix table 4 presents decomposition results for those sub-districts which have both urban and rural population at the time of 2011 population census. There were 60 sub-districts in the state where there was no urban population at the 2011 population census and so these sub-districts were not included in the decomposition analysis.

The decomposition analysis suggests that, for the state as a whole, the urban rural difference in HDI is around 0.198 absolute points. Almost 47 percent of this difference is accounted by the difference in the index of standard of living whereas around 29 percent of the urban-rural difference in HDI is accounted by the urban-rural difference in the index of education. Finally, the urban-rural difference in the index of health accounts for less than one fourth of the urban-rural difference in HDI.

The contribution of the urban-rural difference in the three components of HDI to the urban-rural difference in HDI varies widely across districts and sub-districts. For example, urban-rural difference in index of standard of living accounts for more than 76 percent of the urban-rural difference in HDI in district Bhind but only about 28 percent of the difference in district Mandla. Similarly, urban-rural difference in the health index accounts for 39 percent of the urban-rural difference in HDI in district Umaria but only 9 percent of the difference in district Rajgarh. In district Alirajpur, urban-rural difference in literacy accounts for more than 42 percent of the urban-rural difference in HDI but only 10 percent in district Bhind.

Like the districts, the contribution of the urban-rural difference in different component of HDI to the urban-rural difference in HDI varies widely across sub-districts. An interesting observation of sub-district level decomposition analysis is that in 14 sub-districts, urban-rural difference in at least one component of HDI is negative which implies relatively better situation in rural than in urban population. For example, the standard of living index is higher in rural than in urban population in two sub-districts - Majholi in district Jabalpur and Lalbarra in district Balaghat. Similarly, the education index in the rural population is higher than that in the urban population in 5 sub-districts - Rahatgarh in district Sagar, Kotar in district Satna, Gohad and Gormi in district Bhind and Lalbarra in district Balaghat. On the other hand, the health index is higher in the rural population than in the urban population in 11 sub-districts - Rahatgarh of district Sagar; Gogaon in district Khargone; Lalbarra in district Balaghat; Gormi in district Bhind; Daloda in district

Mandsaur; Nalkhera in district Shajapur, Tonk-Khurd in district Dewas, Mangawan in district Rewa; Sawer in district Indore; Patan in district Jabalpur; and Pachchor in district Rajgarh.

In order to analyse further the pattern of contribution of the urban-rural difference in the three components of HDI to the urban-rural difference in HDI at the sub-district level, we have used two-step cluster analysis procedure to group sub-districts with similar pattern of contribution of urban-rural difference in the three components of HDI to the urban-rural difference in HDI. The analysis was limited to only those sub-districts where the urban-rural difference was positive in all the three components of HDI. The cluster analysis reveals that the 268 sub-districts of the state can be grouped into three clusters as far as the urban-rural difference in HDI is concerned. The first cluster comprises of 164 (48.0 percent) sub-districts whereas cluster two comprises of 91 (26.6 percent) sub-districts. Cluster three, on the other hand, is a small cluster comprising of only 13 (3.8 percent) sub-districts. Finally, there are 14 (4.1 percent) sub-districts where the urban-rural difference is negative in at least one component of HDI. In sub-district Lalbarra in district Balaghat, urban-rural difference is negative in all the three components of HDI whereas in sub-district Rahatgarh in district Sagar, the urban-rural difference is negative in two of the three components of HDI. In the remaining sub-districts, the urban-rural difference is negative in one component only.

The cluster-specific centroids of the three components of HDI are given in table 5 separately for the three clusters. The table suggests that the urban-rural difference in HDI is the narrowest in cluster one but the widest in cluster three. The urban-rural difference in HDI in cluster three is almost two times the urban-rural difference in cluster one. The sub-districts included in this cluster include all the five sub-districts of district Jhabua and two of the three sub-districts of district Alirajpur. Other sub-districts where urban-rural disparity in human development is found to be exceptionally high are Jamai in district Chhindwara; Barwani and Sendhwa in district Barwani; Chitrangi in district Singrauli; Nepanagar in district Burhanpur; and Sailana in district Ratlam.

Conclusions

Main conclusions of the present analysis may be summarised as under:

1. The level of human development in Madhya Pradesh may at best be termed as medium. In the rural population of the state also, the level of human development may be termed as medium on the basis of the human development index but, in the urban population, the level of human development appears to be high.
2. There are only 4 districts in the state where the level of human development may be termed as high. In majority of the districts (43), the level of human development may be termed as medium. There are however three districts in the state where the level of human development, at best, is low.

3. In the rural population, the level of human development appears to be low in 7 districts but medium in 43 districts. There is no district in the state where the level of human development in the rural population is either high or very high.
4. In the urban population, the level of human development is very high in 2 districts, high in 42 districts and medium in 6 districts. There is no district where the level of human development in the urban population is either low or very low.
5. The level of human development is very low in 2 sub-districts of the state; low in 34 sub-districts; medium in 280 sub-districts; and high in 26 sub-districts. There is no sub-district where the level of human development is very high. This indicates that disparity in human development across the sub-districts of the state is very wide.
6. In the rural population, the level of human development is found to be very low in 2 sub-districts; low in 52 sub-districts and medium in 288 sub-districts. There is no sub-district in the state where the level of human development in the rural population is high or very high.
7. In the urban population, the level of human development is very high in 21 sub-districts; high in 162 sub-districts; and medium in 99 sub-districts. There is no sub-district in the state where the level of human development in the urban population is either low or very low.
8. The urban-rural disparity in human development appears to be quite substantial in 13 districts of the state. This disparity is at its extreme in Jhabua and Alirajpur districts of the state where there is a big difference between the level of human development in rural and urban areas.
9. The urban-rural disparity in human development is very low in 46 sub-districts of the state; low in 188 sub-districts and medium in 37 sub-districts. The urban-rural disparity in human development is high in 7 sub-districts and very high in three sub-districts. In 60 sub-districts, there was no urban population at the time of 2011 population census. There is one sub-district, Lalbarra in district Balaghat where human development situation in the rural population is relatively better than that in the urban population.
10. The relative contribution of the disparity in different components of human development to the disparity in human development as a whole varies widely across districts and across sub-districts. At the state level, the contribution of the urban-rural disparity in the standard of living. On the other hand, the contribution of the urban-rural disparity in the health status of the population and the level of literacy is relatively small.
10. In 14 sub-districts, human development situation appears to be comparatively better in rural than in the urban population in at least one component of HDI.

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Table 1
Distribution of districts and sub-districts by level of human development

Districts/Sub-districts	Rural	Urban	Total
Districts			
Very low	0	0	0
Low	7	0	3
Medium	43	6	43
High	0	42	4
Very high	0	2	0
Minimum	0.349	0.675	0.380
Mean	0.557	0.745	0.601
Median	0.572	0.746	0.609
Maximum	0.639	0.809	0.748
SD	0.064	0.036	0.073
IQR	0.086	0.063	0.085
Skewness	-1.342	-0.111	-0.703
Kurtosis	2.291	-1.092	1.609
Coefficient of variation	0.115	0.048	0.122
Sub-districts			
Very low	2	0	2
Low	52	0	34
Medium	288	99	280
High	0	162	26
Very high	0	21	0
Minimum	0.275	0.571	0.275
Mean	0.559	0.720	0.587
Median	0.567	0.722	0.593
Maximum	0.694	0.894	0.790
SD	0.074	0.054	0.082
IQR	0.086	0.081	0.090
Skewness	-1.092	0.020	-0.641
Kurtosis	1.766	-0.311	1.368
Coefficient of variation	0.132	0.074	0.139

Source: Author's calculations

Remarks: There was no urban population in 60 sub-districts at the 2011 population census

Table 2
Summary measures of variation in HDI, urban-rural in HDI and urban-rural difference in different components of HDI

Summary measure	HDI	HDI_U-HDI_R	H_U-H_R	E_U-E_R	S_U-S_R
	Cluster 1 (164 sub-districts)				
Centroid	0.622	0.126	0.026	0.039	0.061
Minimum	0.496	0.047	0.002	0.002	0.006
Maximum	0.776	0.186	0.075	0.080	0.098
SD	0.060	0.031	0.015	0.016	0.020
	Cluster 2 (91 Sub-districts)				
Centroid	0.575	0.195	0.038	0.052	0.010
Minimum	0.419	0.138	0.003	0.014	0.062
Maximum	0.790	0.267	0.081	0.101	0.153
SD	0.069	0.029	0.017	0.019	0.018
	Cluster 3 (13 Sub-districts)				
Centroid	0.431	0.362	0.105	0.021	0.130
Minimum	0.369	0.241	0.077	0.085	0.056
Maximum	0.604	0.460	0.146	0.168	0.197
SD	0.071	0.066	0.021	0.026	0.037

Source: Author's calculations

Remarks: There is no urban population in 60 sub-districts. In 14 sub-districts, urban-rural difference is negative in at least one component of HDI. These sub-districts are not included in decomposition analysis.

Appendix Table 1
HDI in Madhya Pradesh and constituent districts, 2011

State/District	Rural		Urban		Total	
	HDI	Rank	HDI	Rank	HDI	Rank
Madhya Pradesh	0.563		0.761		0.617	
Sheopur	0.497	44	0.675	50	0.524	47
Morena	0.555	27	0.719	36	0.595	29
Bhind	0.587	21	0.720	35	0.623	23
Gwalior	0.578	25	0.792	4	0.713	4
Datia	0.609	12	0.736	30	0.637	15
Shivpuri	0.510	40	0.714	38	0.544	41
Tikamgarh	0.539	34	0.702	44	0.566	35
Chhatarpur	0.540	33	0.731	32	0.582	32
Panna	0.551	30	0.736	29	0.572	34
Sagar	0.554	28	0.750	23	0.610	25
Damoh	0.518	39	0.733	31	0.560	38
Satna	0.617	6	0.766	17	0.647	13
Rewa	0.596	17	0.765	18	0.622	24
Umaria	0.579	24	0.749	24	0.608	26
Neemuch	0.607	13	0.759	21	0.650	12
Mandsaur	0.605	14	0.764	19	0.639	14
Ratlam	0.530	36	0.773	16	0.602	28
Ujjain	0.588	18	0.775	14	0.662	7
Shajapur	0.581	22	0.713	39	0.607	27
Dewas	0.581	23	0.747	25	0.629	20
Dhar	0.504	43	0.705	42	0.543	42
Indore	0.637	3	0.785	9	0.748	1
Khargone	0.506	42	0.726	34	0.541	44
Barwani	0.401	48	0.695	47	0.446	48
Rajgarh	0.525	37	0.695	46	0.554	39
Vidisha	0.537	35	0.712	41	0.578	33
Bhopal	0.567	26	0.779	12	0.740	2
Sehore	0.610	11	0.754	22	0.637	16
Raisen	0.547	31	0.704	43	0.584	30
Betul	0.612	9	0.809	1	0.652	10
Harda	0.588	19	0.779	13	0.629	19
Hoshangabad	0.616	7	0.800	3	0.675	5

State/District	Rural		Urban		Total	
	HDI	Rank	HDI	Rank	HDI	Rank
Katni	0.588	20	0.781	11	0.626	22
Jabalpur	0.639	2	0.802	2	0.732	3
Narsimhapur	0.597	16	0.763	20	0.628	21
Dindori	0.553	29	0.728	33	0.562	36
Mandla	0.613	8	0.787	7	0.636	18
Chhindwara	0.610	10	0.788	5	0.654	9
Seoni	0.633	4	0.788	6	0.652	11
Balaghat	0.639	1	0.774	15	0.659	8
Guna	0.493	47	0.696	45	0.545	40
Ashoknagar	0.507	41	0.684	49	0.540	45
Shahdol	0.599	15	0.786	8	0.636	17
Anuppur	0.619	5	0.783	10	0.664	6
Sidhi	0.519	38	0.713	40	0.535	46
Singrauli	0.493	46	0.745	26	0.542	43
Jhabua	0.371	49	0.739	28	0.405	49
Alirajpur	0.349	50	0.718	37	0.380	50
Khandwa	0.543	32	0.744	27	0.583	31
Burhanpur	0.495	45	0.688	48	0.562	37

Source: Author's calculations

Appendix Table 2
HDI in sub-districts of Madhya Pradesh, 2011

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
Sheopur	Vijaypur	0.463	313	0.663	235	0.486	314
	Beerpur	0.491	301	na	na	0.491	313
	Sheopur	0.536	232	0.686	204	0.579	195
	Badoda	0.550	205	0.638	266	0.567	219
	Karahal	0.430	323	na	na	0.430	325
Morena	Ambah	0.578	150	0.745	94	0.609	134
	Porsa	0.599	112	0.725	132	0.623	107
	Morena	0.556	191	0.718	147	0.627	95
	Joura	0.535	235	0.672	221	0.548	251
	Kailaras	0.542	219	0.725	131	0.568	218
	Sabalgarh	0.531	245	0.724	133	0.574	199
Bhind	Ater	0.605	99	na	na	0.605	146
	Bhind	0.605	98	0.758	74	0.673	41
	Mehgaon	0.564	174	0.675	217	0.577	197
	Gormi	0.593	121	0.639	265	0.600	157
	Gohad	0.572	162	0.645	262	0.592	175
	Ron	0.589	125	na	na	0.589	181
	Mihona	0.562	181	0.727	124	0.596	167
	Lahar	0.585	135	0.721	145	0.628	93
Gwalior	Gwalior	0.583	139	0.804	17	0.748	6
	Dabra	0.576	151	0.716	151	0.636	84
	Bhitarwar	0.549	207	0.662	239	0.569	213
	Chinour	0.586	133	0.692	193	0.596	168
Datia	Seondha	0.590	124	0.679	213	0.608	139
	Indergarh	0.615	80	0.721	143	0.632	88
	Datia	0.588	130	0.751	84	0.636	85
	Bhander	0.654	20	0.733	113	0.665	52
Shivpuri	Pohri	0.526	256	na	na	0.526	283
	Shivpuri	0.513	275	0.726	126	0.624	104
	Narwar	0.517	270	0.692	192	0.535	270
	Karera	0.571	163	0.760	70	0.598	165
	Kolaras	0.478	306	0.636	269	0.496	308
	Badarwas	0.499	289	0.663	236	0.511	298
	Pichhore	0.488	302	0.722	141	0.505	303
	Khaniyadhana	0.477	307	0.645	261	0.491	312

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
Tikamgarh	Niwari	0.603	108	0.715	154	0.623	105
	Orchha	0.569	169	0.702	179	0.606	144
	Prithvipur	0.543	215	0.651	260	0.563	227
	Jatara	0.532	243	0.665	231	0.551	245
	Mohangarh	0.527	254	na	na	0.527	281
	Palera	0.534	237	0.626	274	0.541	262
	Baldeogarh	0.495	296	0.659	243	0.506	301
	Khargapur	0.508	281	0.654	258	0.527	280
	Tikamgarh	0.540	222	0.751	86	0.608	138
Chhatarpur	Gaurihar	0.518	267	0.654	256	0.525	284
	Laundi	0.550	206	0.712	159	0.586	185
	Chandla	0.535	233	0.662	238	0.551	247
	Nowgong	0.610	90	0.793	25	0.668	47
	Maharajpur	0.578	149	0.704	171	0.622	108
	Chhatarpur	0.550	204	0.766	63	0.638	82
	Rajnagar	0.543	216	0.702	176	0.566	221
	Bada Malhera	0.512	276	0.681	209	0.538	268
	Ghuwara	0.494	297	0.616	278	0.510	299
	Bijawar	0.519	265	0.672	222	0.545	256
	Buxwaha	0.508	282	0.682	208	0.527	279
Panna	Ajaigarh	0.539	226	0.707	167	0.555	240
	Panna	0.531	248	0.788	33	0.626	98
	Devendranagar	0.562	180	0.666	228	0.586	186
	Gunnor	0.604	102	na	na	0.604	147
	Amanganj	0.534	240	0.696	188	0.552	242
	Pawai	0.552	198	0.697	186	0.564	225
	Shahnagar	0.514	273	na	na	0.514	295
	Raipura	0.557	190	na	na	0.557	237
Sagar	Bina	0.588	131	0.781	43	0.663	55
	Khurai	0.604	103	0.737	108	0.638	80
	Malthon	0.520	264	na	na	0.520	289
	Banda	0.514	274	0.685	205	0.539	266
	Shahgarh	0.518	268	0.721	144	0.542	259
	Rahatgarh	0.569	170	0.571	282	0.570	210
	Sagar	0.584	138	0.769	59	0.675	40
	Garhakota	0.538	228	0.705	170	0.583	191
	Rehli	0.554	194	0.724	134	0.590	178

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Kesli	0.504	287	na	na	0.504	304
	Deori	0.539	225	0.768	60	0.574	201
Damoh	Hatta	0.520	263	0.738	107	0.564	224
	Patera	0.539	224	na	na	0.539	265
	Batiyagarh	0.505	285	na	na	0.505	302
	Patharia	0.534	238	0.718	146	0.563	228
	Damoh	0.531	246	0.743	95	0.629	92
	Jabera	0.495	295	0.669	225	0.503	305
	Tendukheda	0.492	299	0.661	241	0.508	300
Satna	Raghurajnagar	0.648	27	0.797	24	0.733	10
	Majhgawan	0.537	230	0.642	263	0.559	235
	Birsinghpur	0.613	83	0.696	189	0.628	94
	Nagod	0.640	36	0.790	30	0.654	63
	Unchahara	0.624	64	0.703	173	0.632	89
	Rampur Baghelan	0.615	79	0.697	187	0.621	112
	Kotar	0.656	15	0.726	128	0.661	56
	Amarpatan	0.603	107	0.709	163	0.611	128
	Ramnagar	0.615	81	na	na	0.615	123
	Maihar	0.598	114	0.748	91	0.615	124
Rewa	Teonthar	0.584	137	0.663	237	0.593	173
	Jawa	0.572	161	na	na	0.572	203
	Sirmour	0.612	85	0.722	139	0.623	106
	Mangawan	0.611	87	0.700	182	0.616	120
	Semaria	0.605	97	0.698	185	0.612	127
	Hanumana	0.538	227	0.655	254	0.545	255
	Mauganj	0.592	122	0.658	247	0.601	156
	Naigarhi	0.603	106	0.655	252	0.606	143
	Huzur	0.651	24	0.813	8	0.733	9
	Raipur-Karchuliyan	0.620	72	na	na	0.620	117
	Gurh	0.581	144	0.690	194	0.593	172
Umaria	Bandhogarh	0.562	179	0.779	45	0.620	116
	Chandia	0.557	189	0.605	280	0.565	223
	Manpur	0.580	145	na	na	0.580	192
	Pali	0.619	73	0.780	44	0.672	42
	Nowrozabad	0.576	155	0.751	85	0.637	83
Neemuch	Jawad	0.634	45	0.759	72	0.661	57
	Singoli	0.616	76	0.723	138	0.634	86

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Neemuch	0.656	17	0.777	46	0.719	15
	Jiran	0.617	74	0.751	82	0.639	79
	Manasa	0.552	200	0.732	116	0.589	182
Mandsaur	Bhanpura	0.574	157	0.739	102	0.606	145
	Malhargarh	0.621	67	0.746	93	0.641	76
	Garoth	0.604	101	0.726	125	0.618	118
	Shamgarh	0.553	197	0.738	106	0.590	177
	Mandsaur	0.645	31	0.792	27	0.707	24
	Daloda	0.639	38	0.695	191	0.643	75
	Sitamau	0.589	127	0.742	97	0.601	155
	Suwasara	0.568	171	0.714	156	0.590	179
Ratlam	Piploda	0.616	78	0.706	169	0.622	110
	Jaora	0.605	100	0.716	149	0.641	77
	A lot	0.562	178	0.700	183	0.591	176
	Tal	0.595	120	0.684	206	0.607	142
	Sailana	0.371	331	0.821	6	0.410	329
	Bajna	0.294	341	na	na	0.294	341
	Rawti	0.399	326	na	na	0.399	330
	Ratlam	0.576	152	0.799	22	0.695	29
Ujjain	Khacharod	0.586	134	0.752	80	0.621	114
	Nagda	0.544	214	0.774	51	0.657	59
	Mahidpur	0.537	231	0.674	219	0.559	234
	Ghatiya	0.601	109	na	na	0.601	154
	Tarana	0.576	156	0.663	233	0.588	183
	Ujjain	0.628	54	0.792	26	0.755	5
	Badnagar	0.639	39	0.771	56	0.656	60
Shajapur	Susner	0.545	211	0.666	229	0.571	205
	Nalkheda	0.570	168	0.658	245	0.587	184
	Badod	0.520	262	0.670	223	0.535	269
	Agar	0.544	213	0.696	190	0.585	187
	Shajapur	0.596	118	0.748	90	0.650	71
	Gulana	0.609	91	na	na	0.609	136
	Moman Badodiya	0.548	209	na	na	0.548	250
	Shujalpur	0.625	62	0.727	123	0.658	58
	Kalapipal	0.621	70	0.711	160	0.626	97
Dewas	Tonk Khurd	0.637	43	0.681	210	0.640	78
	Sonkatch	0.606	96	0.679	212	0.622	109

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Dewas	0.633	49	0.783	38	0.720	14
	Kannod	0.523	258	0.709	164	0.552	244
	Satwas	0.518	266	0.629	272	0.544	257
	Bagli	0.525	257	0.660	242	0.540	263
	Hatpiplya	0.579	147	0.701	181	0.599	160
	Khategaon	0.579	148	0.727	122	0.599	161
Dhar	Badnawar	0.597	117	0.739	103	0.610	132
	Sardarpur	0.469	311	0.722	140	0.493	310
	Dhar	0.534	236	0.704	172	0.607	140
	Gandhwani	0.417	325	na	na	0.417	328
	Kukshi	0.452	317	0.703	174	0.482	315
	Dahi	0.444	320	0.636	270	0.460	322
	Manawar	0.532	244	0.684	207	0.547	252
	Dharampuri	0.520	261	0.703	175	0.568	216
Indore	Depalpur	0.635	44	0.723	136	0.654	64
	Hatod	0.634	46	0.699	184	0.652	67
	Sawer	0.645	29	0.702	177	0.653	66
	Indore	0.641	34	0.787	34	0.776	2
	Mhow	0.629	53	0.801	20	0.690	33
Khargone	Barwaha	0.570	166	0.765	65	0.613	125
	Maheshwar	0.544	212	0.739	104	0.575	198
	Kasrawad	0.566	172	0.652	259	0.574	200
	Segaon	0.512	277	na	na	0.512	297
	Bhikangaon	0.510	280	0.716	150	0.528	276
	Khargone	0.616	77	0.726	129	0.676	39
	Gogaon	0.495	294	0.572	281	0.502	306
	Bhagwanpura	0.342	336	na	na	0.342	339
	Jhiranya	0.372	330	na	na	0.372	337
Barwani	Barwani	0.422	324	0.760	71	0.515	294
	Pati	0.275	342	na	na	0.275	342
	Thikri	0.531	247	0.668	227	0.544	258
	Anjad	0.561	183	0.625	275	0.579	193
	Rajpur	0.434	322	0.658	246	0.467	319
	Pansemal	0.450	319	0.687	201	0.495	309
	Niwali	0.373	329	na	na	0.373	335
	Sendhwa	0.334	338	0.688	199	0.426	326
	Varla	0.324	339	na	na	0.324	340

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
Rajgarh	Jirapur	0.487	303	0.668	226	0.516	293
	Khilchipur	0.507	284	0.679	211	0.531	273
	Rajgarh	0.511	278	0.747	92	0.551	246
	Biaora	0.517	269	0.707	165	0.558	236
	Sarangpur	0.548	208	0.655	255	0.567	220
	Narsinghgarh	0.515	271	0.717	148	0.546	254
	Pachore	0.582	142	0.663	234	0.599	159
Vidisha	Lateri	0.439	321	0.637	268	0.464	320
	Sironj	0.481	304	0.635	271	0.516	292
	Kurwai	0.596	119	0.687	202	0.604	148
	Basoda	0.564	175	0.711	161	0.622	111
	Tyonda	0.526	255	na	na	0.526	282
	Nateran	0.534	239	na	na	0.534	271
	Shamshabad	0.452	318	0.641	264	0.473	316
	Gyaraspur	0.560	184	na	na	0.560	232
	Gulabganj	0.626	61	na	na	0.626	100
	Vidisha	0.607	94	0.753	78	0.678	38
Bhopal	Berasia	0.511	279	0.655	253	0.529	275
	Huzur	0.622	66	0.781	42	0.765	4
Sehore	Sehore	0.626	59	0.789	32	0.690	35
	Shyampur	0.608	92	na	na	0.608	137
	Ashta	0.652	23	0.712	158	0.667	49
	Jawar	0.633	48	0.688	200	0.638	81
	Ichhawar	0.554	195	0.723	137	0.570	211
	Nasrullaganj	0.559	187	0.742	98	0.585	188
	Budni	0.640	35	0.764	66	0.663	54
	Rehti	0.582	143	0.740	100	0.602	153
Raisen	Raisen	0.540	220	0.729	120	0.584	189
	Gairatganj	0.556	192	0.637	267	0.568	215
	Begamganj	0.522	259	0.687	203	0.562	230
	Goharganj	0.574	159	0.715	153	0.633	87
	Baraily	0.574	158	0.713	157	0.607	141
	Badi	0.551	203	0.664	232	0.570	208
	Silwani	0.497	291	0.662	240	0.517	291
	Udaipura	0.559	186	0.724	135	0.579	194
Betul	Bhainsdehi	0.529	249	0.738	105	0.539	267
	Athner	0.608	93	0.742	99	0.624	102

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Betul	0.652	21	0.812	9	0.719	17
	Chicholi	0.540	221	0.750	87	0.565	222
	Ghoda Dongri	0.640	37	0.826	5	0.719	18
	Shahpur	0.589	128	0.751	83	0.598	163
	Multai	0.669	9	0.798	23	0.683	36
	Amla	0.628	56	0.831	2	0.664	53
Harda	Khirkiya	0.576	154	0.732	117	0.615	122
	Sirali	0.533	241	na	na	0.533	272
	Harda	0.658	14	0.784	36	0.719	16
	Handiya	0.570	167	na	na	0.570	209
	Timarni	0.679	6	0.809	13	0.717	19
	Rehatgaon	0.542	218	na	na	0.542	260
Hoshangabad	Seoni-Malwa	0.630	52	0.782	40	0.654	62
	Itarsi	0.638	41	0.830	3	0.734	8
	Hoshangabad	0.667	10	0.810	12	0.770	3
	Dolariya	0.685	4	0.894	1	0.722	13
	Babai	0.576	153	0.707	166	0.593	171
	Sohagpur	0.621	69	0.769	57	0.646	72
	Pipariya	0.612	84	0.758	75	0.671	45
	Bankhedi	0.555	193	na	na	0.555	239
Katni	Murwara	0.628	55	0.789	31	0.725	12
	Rithi	0.598	115	na	na	0.598	164
	Barhi	0.527	253	0.673	220	0.546	253
	Badwara	0.560	185	na	na	0.560	233
	Vijayraghavgarh	0.570	165	0.767	61	0.597	166
	Bahoriband	0.604	104	na	na	0.604	149
	Dhimarkheda	0.584	136	na	na	0.584	190
Jabalpur	Sihora	0.648	26	0.734	111	0.668	48
	Majholi	0.649	25	0.665	230	0.651	68
	Patan	0.645	32	0.688	198	0.653	65
	Shahpura	0.601	110	0.771	55	0.613	126
	Jabalpur	0.634	47	0.812	10	0.790	1
	Panagar	0.678	7	0.783	39	0.725	11
	Kundam	0.589	126	0.733	112	0.596	169
Narsimhapur	Gotegaon	0.627	58	0.758	73	0.645	73
	Gadarwara	0.579	146	0.752	81	0.603	152
	Narsimhapur	0.588	129	0.807	16	0.655	61

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Kareli	0.623	65	0.740	101	0.650	70
	Tendukheda	0.582	140	0.657	249	0.592	174
Dindori	Shahpura	0.529	250	0.714	155	0.542	261
	Dindori	0.561	182	0.734	110	0.569	212
Mandla	Niwas	0.600	111	0.725	130	0.609	135
	Narayanganj	0.611	86	na	na	0.611	129
	Mandla	0.655	19	0.803	18	0.708	22
	Ghughari	0.552	199	na	na	0.552	243
	Bichhiya	0.610	89	0.730	118	0.616	121
	Nainpur	0.645	30	0.776	47	0.672	43
Chhindwara	Tamia	0.571	164	na	na	0.571	207
	Amarwara	0.604	105	0.758	76	0.618	119
	Harrai	0.538	229	0.734	109	0.556	238
	Chaurai	0.597	116	0.774	50	0.610	131
	Jamai	0.542	217	0.783	37	0.604	150
	Parasia	0.606	95	0.767	62	0.699	27
	Umreth	0.621	71	na	na	0.621	115
	Chhindwara	0.656	16	0.813	7	0.746	7
	Mohkhed	0.631	51	na	na	0.631	90
	Sausar	0.664	11	0.765	64	0.701	26
	Bichhua	0.621	68	na	na	0.621	113
	Pandhurna	0.624	63	0.800	21	0.669	46
Seoni	Lakhnadon	0.615	82	0.771	54	0.629	91
	Chhapara	0.592	123	0.726	127	0.610	133
	Ghansaur	0.504	286	0.760	69	0.518	290
	Dhanora	0.574	160	na	na	0.574	202
	Keolari	0.677	8	0.732	115	0.681	37
	Seoni	0.652	22	0.808	14	0.699	28
	Barghat	0.664	12	0.774	52	0.671	44
	Kurai	0.694	1	na	na	0.694	30
Balaghat	Katangi	0.646	28	0.775	49	0.667	50
	Tirodi	0.683	5	0.754	77	0.691	31
	Waraseoni	0.687	3	0.790	29	0.703	25
	Khairlanji	0.626	60	na	na	0.626	99
	Lalbarra	0.692	2	0.676	215	0.691	32
	Balaghat	0.638	40	0.811	11	0.710	21
	Kirnapur	0.661	13	0.808	15	0.666	51

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
	Baihar	0.551	202	0.706	168	0.579	196
	Paraswada	0.641	33	0.787	35	0.651	69
	Lanji	0.617	75	0.710	162	0.625	101
Guna	Guna	0.480	305	0.721	142	0.589	180
	Bamori	0.497	290	na	na	0.497	307
	Raghogarh	0.507	283	0.658	244	0.568	217
	Maksoodangarh	0.456	315	na	na	0.456	323
	Kumbhraj	0.493	298	0.657	250	0.521	287
	Aron	0.545	210	0.626	273	0.561	231
	Chachaura	0.469	312	0.716	152	0.514	296
Ashoknagar	Isagarh	0.520	260	0.656	251	0.530	274
	Chanderi	0.473	308	0.701	180	0.520	288
	Ashoknagar	0.501	288	0.675	218	0.569	214
	Shadhora	0.563	177	na	na	0.563	229
	Mungaoli	0.495	293	0.702	178	0.522	286
Shahdol	Beohari	0.532	242	0.732	114	0.564	226
	Jaisinghnagar	0.599	113	0.690	195	0.603	151
	Sohagpur	0.628	57	0.801	19	0.690	34
	Jaitpur	0.611	88	na	na	0.611	130
Anuppur	Kotma	0.638	42	0.776	48	0.707	23
	Anuppur	0.655	18	0.791	28	0.710	20
	Jaithari	0.633	50	0.752	79	0.644	74
	Pushparajgarh	0.565	173	0.728	121	0.572	204
Sidhi	Rampur Naikin	0.514	272	0.654	257	0.523	285
	Churhat	0.558	188	0.669	224	0.571	206
	Gopadbanas	0.496	292	0.763	68	0.548	248
	Sihawal	0.540	223	na	na	0.540	264
	Majhauli	0.457	314	0.605	279	0.468	318
	Kusmi	0.553	196	na	na	0.553	241
Singrauli	Chitrangi	0.455	316	0.828	4	0.463	321
	Deosar	0.527	252	na	na	0.527	278
	Singrauli	0.491	300	0.743	96	0.598	162
Jhabua	Thandla	0.350	334	0.750	88	0.387	331
	Petlawad	0.472	309	0.769	58	0.493	311
	Meghnagar	0.351	333	0.624	276	0.372	336
	Jhabua	0.322	340	0.782	41	0.373	334
	Ranapur	0.342	335	0.675	216	0.376	333

District	Sub-district	Rural		Urban		Total	
		HDI	Rank	HDI	Rank	HDI	Rank
Alirajpur	Bhavra	0.393	327	0.617	277	0.419	327
	Jobat	0.353	332	0.773	53	0.381	332
	Alirajpur	0.336	337	0.730	119	0.369	338
Khandwa	Harsud	0.582	141	0.688	197	0.600	158
	Khalwa	0.470	310	na	na	0.470	317
	Khandwa	0.551	201	0.763	67	0.627	96
	Punasa	0.586	132	0.657	248	0.593	170
	Pandhana	0.535	234	0.689	196	0.548	249
Burhanpur	Burhanpur	0.563	176	0.678	214	0.624	103
	Khaknar	0.528	251	na	na	0.528	277
	Nepanagar	0.374	328	0.749	89	0.437	324

Source: Author's calculations

Appendix Table 3
Decomposition of the urban-rural difference in HDI in Madhya Pradesh, 2011

State/District	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
Madhya Pradesh	0.198	0.048	0.057	0.093
Sheopur	0.178	0.042	0.056	0.079
Morena	0.164	0.028	0.025	0.111
Bhind	0.133	0.018	0.014	0.101
Gwalior	0.215	0.050	0.055	0.109
Datia	0.128	0.020	0.026	0.081
Shivpuri	0.204	0.051	0.053	0.100
Tikamgarh	0.163	0.033	0.050	0.080
Chhatarpur	0.191	0.046	0.060	0.085
Panna	0.185	0.054	0.051	0.080
Sagar	0.196	0.042	0.039	0.114
Damoh	0.214	0.040	0.050	0.125
Satna	0.149	0.043	0.040	0.066
Rewa	0.169	0.045	0.037	0.086
Umaria	0.170	0.066	0.051	0.052
Neemuch	0.153	0.020	0.051	0.081
Mandsaur	0.159	0.024	0.045	0.090
Ratlam	0.244	0.059	0.072	0.112
Ujjain	0.187	0.041	0.054	0.092
Shajapur	0.132	0.018	0.041	0.073
Dewas	0.166	0.035	0.053	0.079
Dhar	0.201	0.034	0.077	0.090
Indore	0.148	0.036	0.049	0.063
Khargone	0.221	0.050	0.067	0.103
Barwani	0.294	0.088	0.102	0.103
Rajgarh	0.170	0.016	0.060	0.095
Vidisha	0.175	0.045	0.040	0.090
Bhopal	0.212	0.057	0.049	0.107
Sehore	0.144	0.037	0.044	0.063
Raisen	0.157	0.025	0.031	0.102
Betul	0.197	0.046	0.070	0.081
Harda	0.191	0.044	0.055	0.092
Hoshangabad	0.184	0.040	0.051	0.093
Katni	0.193	0.054	0.050	0.089
Jabalpur	0.164	0.042	0.044	0.078
Narsimhapur	0.167	0.028	0.039	0.100

State/District	∇_{UIR}	∇H_{UIR}	∇E_{UIR}	∇S_{UIR}
Dindori	0.175	0.045	0.063	0.067
Mandla	0.174	0.053	0.072	0.049
Chhindwara	0.178	0.038	0.059	0.080
Seoni	0.155	0.034	0.057	0.064
Balaghat	0.135	0.027	0.030	0.078
Guna	0.203	0.045	0.055	0.103
Ashoknagar	0.177	0.036	0.040	0.101
Shahdol	0.186	0.060	0.067	0.059
Anuppur	0.163	0.050	0.056	0.057
Sidhi	0.194	0.051	0.045	0.098
Singrauli	0.252	0.078	0.059	0.115
Jhabua	0.368	0.106	0.135	0.126
Alirajpur	0.368	0.086	0.155	0.127
Khandwa	0.201	0.054	0.066	0.081
Burhanpur	0.193	0.058	0.069	0.066

Source: Author's calculations

Appendix Table 4
Decomposition of the urban-rural difference in HDI in sub-districts of Madhya Pradesh, 2011

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
Sheopur	Vijaypur	0.200	0.043	0.057	0.100
	Beerpur	na	na	na	na
	Sheopur	0.150	0.022	0.053	0.076
	Badoda	0.088	0.020	0.054	0.014
	Karahal	na	na	na	na
Morena	Ambah	0.145	0.015	0.013	0.117
	Porsa	0.126	0.016	0.011	0.098
	Morena	0.162	0.033	0.031	0.098
	Joura	0.138	0.016	0.018	0.104
	Kailaras	0.183	0.023	0.038	0.122
	Sabalgarh	0.193	0.025	0.033	0.135
Bhind	Ater	na	na	na	na
	Bhind	0.153	0.028	0.018	0.107
	Mehgaon	0.111	0.005	0.011	0.095
	Gormi	0.045	-0.008	-0.003	0.056
	Gohad	0.073	0.009	-0.003	0.067
	Ron	na	na	na	na
	Mihona	0.165	0.012	0.021	0.132
	Lahar	0.136	0.016	0.022	0.098
Gwalior	Gwalior	0.222	0.055	0.058	0.109
	Dabra	0.140	0.027	0.038	0.074
	Bhitarwar	0.113	0.020	0.025	0.069
	Chinour	0.106	0.025	0.021	0.061
Datia	Seondha	0.088	0.005	0.020	0.064
	Indergarh	0.106	0.007	0.029	0.069
	Datia	0.163	0.034	0.032	0.097
	Bhander	0.079	0.008	0.017	0.055
Shivpuri	Pohri	na	na	na	na
	Shivpuri	0.213	0.062	0.057	0.094
	Narwar	0.175	0.018	0.039	0.119
	Karera	0.190	0.051	0.061	0.078
	Kolaras	0.158	0.035	0.044	0.079
	Badarwas	0.164	0.023	0.043	0.098
	Pichhore	0.234	0.045	0.062	0.127
	Khaniyadhana	0.168	0.040	0.042	0.086

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
Tikamgarh	Niwari	0.112	0.023	0.032	0.057
	Orchha	0.132	0.021	0.029	0.082
	Prithvipur	0.107	0.011	0.024	0.072
	Jatara	0.133	0.015	0.047	0.071
	Mohangarh	na	na	na	na
	Palera	0.092	0.017	0.026	0.049
	Baldeogarh	0.165	0.016	0.057	0.091
	Khargapur	0.145	0.030	0.051	0.064
	Tikamgarh	0.211	0.061	0.067	0.083
Chhatarpur	Gaurihar	0.136	0.025	0.019	0.091
	Laundi	0.162	0.039	0.045	0.079
	Chandla	0.127	0.038	0.046	0.043
	Nowgong	0.183	0.048	0.077	0.059
	Maharajpur	0.126	0.041	0.043	0.042
	Chhatarpur	0.216	0.058	0.082	0.076
	Rajnagar	0.159	0.033	0.047	0.078
	Bada Malhera	0.169	0.043	0.060	0.066
	Ghuwara	0.122	0.016	0.034	0.071
	Bijawar	0.153	0.033	0.049	0.071
	Buxwaha	0.174	0.045	0.043	0.086
Panna	Ajaigarh	0.168	0.047	0.046	0.075
	Panna	0.257	0.080	0.063	0.114
	Devendranagar	0.104	0.024	0.036	0.045
	Gunnor	na	na	na	na
	Amanganj	0.163	0.026	0.047	0.089
	Pawai	0.145	0.040	0.046	0.059
	Shahnagar	na	na	na	na
	Raipura	na	na	na	na
Sagar	Bina	0.193	0.051	0.042	0.100
	Khurai	0.133	0.032	0.026	0.075
	Malthon	na	na	na	na
	Banda	0.172	0.029	0.037	0.105
	Shahgarh	0.203	0.048	0.050	0.105
	Rahatgarh	0.002	-0.033	-0.013	0.048
	Sagar	0.185	0.051	0.033	0.101
	Garhakota	0.167	0.021	0.036	0.109
	Rehli	0.170	0.023	0.039	0.108
	Kesli	na	na	na	na

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Deori	0.229	0.040	0.041	0.148
Damoh	Hatta	0.218	0.048	0.066	0.104
	Patera	na	na	na	na
	Batiyagarh	na	na	na	na
	Patharia	0.184	0.026	0.025	0.133
	Damoh	0.211	0.047	0.048	0.116
	Jabera	0.174	0.026	0.034	0.114
	Tendukheda	0.169	0.024	0.041	0.105
Satna	Raghurajnagar	0.149	0.036	0.041	0.072
	Majhgawan	0.105	0.041	0.032	0.032
	Birsinghpur	0.082	0.012	0.023	0.047
	Nagod	0.150	0.043	0.046	0.061
	Unchahara	0.080	0.028	0.033	0.019
	Rampur Baghelan	0.082	0.004	0.019	0.059
	Kotar	0.069	0.004	-0.004	0.070
	Amarpatan	0.106	0.021	0.032	0.054
	Ramnagar	na	na	na	na
	Maihar	0.149	0.049	0.039	0.061
Rewa	Teonthar	0.079	0.022	0.018	0.038
	Jawa	na	na	na	na
	Sirmour	0.111	0.021	0.020	0.069
	Mangawan	0.089	-0.004	0.015	0.078
	Semaria	0.093	0.017	0.022	0.054
	Hanumana	0.116	0.030	0.031	0.055
	Mauganj	0.065	0.007	0.011	0.048
	Naigarhi	0.052	0.009	0.002	0.042
	Huzur	0.163	0.046	0.037	0.080
	Raipur-Karchuliyan	na	na	na	na
	Gurh	0.109	0.020	0.027	0.062
Umaria	Bandhogarh	0.217	0.080	0.075	0.062
	Chandia	0.047	0.027	0.014	0.006
	Manpur	na	na	na	na
	Pali	0.161	0.058	0.072	0.031
	Nowrozabad	0.175	0.075	0.052	0.048
Neemuch	Jawad	0.125	0.027	0.036	0.062
	Singoli	0.107	0.022	0.063	0.022
	Neemuch	0.121	0.004	0.042	0.075
	Jiran	0.134	0.021	0.025	0.088

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Manasa	0.180	0.022	0.054	0.103
Mandsaur	Bhanpura	0.165	0.040	0.049	0.076
	Malhargarh	0.125	0.013	0.031	0.082
	Garoth	0.122	0.025	0.037	0.060
	Shamgarh	0.186	0.024	0.064	0.097
	Mandsaur	0.147	0.027	0.045	0.076
	Daloda	0.055	-0.007	0.005	0.058
	Sitamau	0.153	0.017	0.039	0.097
	Suwasara	0.146	0.020	0.056	0.069
Ratlam	Piploda	0.090	0.007	0.006	0.077
	Jaora	0.112	0.009	0.024	0.078
	A lot	0.138	0.016	0.056	0.066
	Tal	0.089	0.006	0.042	0.041
	Sailana	0.450	0.131	0.122	0.197
	Bajna	na	na	na	na
	Rawti	na	na	na	na
	Ratlam	0.223	0.056	0.067	0.101
Ujjain	Khacharod	0.167	0.035	0.045	0.087
	Nagda	0.230	0.050	0.064	0.117
	Mahidpur	0.137	0.008	0.060	0.069
	Ghatiya	na	na	na	na
	Tarana	0.087	0.016	0.035	0.037
	Ujjain	0.164	0.044	0.046	0.074
	Badnagar	0.132	0.029	0.037	0.066
Shajapur	Susner	0.121	0.009	0.053	0.058
	Nalkheda	0.088	-0.004	0.032	0.061
	Badod	0.150	0.007	0.063	0.079
	Agar	0.151	0.025	0.054	0.073
	Shajapur	0.153	0.018	0.044	0.091
	Gulana	na	na	na	na
	Moman Badodiya	na	na	na	na
	Shujalpur	0.102	0.023	0.021	0.058
	Kalapipal	0.090	0.035	0.034	0.021
Dewas	Tonk Khurd	0.044	-0.004	0.026	0.022
	Sonkatch	0.073	0.011	0.032	0.029
	Dewas	0.150	0.026	0.042	0.083
	Kannod	0.186	0.038	0.059	0.089
	Satwas	0.111	0.021	0.040	0.050

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Bagli	0.135	0.045	0.048	0.043
	Hatpiplya	0.122	0.007	0.036	0.079
	Khategaon	0.148	0.042	0.048	0.058
Dhar	Badnawar	0.142	0.027	0.051	0.064
	Sardarpur	0.253	0.056	0.084	0.113
	Dhar	0.170	0.037	0.065	0.068
	Gandhwani	na	na	na	na
	Kukshi	0.251	0.050	0.092	0.108
	Dahi	0.192	0.037	0.091	0.064
	Manawar	0.152	0.019	0.049	0.084
	Dharampuri	0.183	0.029	0.054	0.099
Indore	Depalpur	0.088	0.008	0.039	0.041
	Hatod	0.065	0.008	0.023	0.034
	Sawer	0.057	-0.002	0.031	0.028
	Indore	0.146	0.040	0.045	0.062
	Mhow	0.172	0.048	0.051	0.073
Khargone	Barwaha	0.194	0.033	0.057	0.105
	Maheshwar	0.195	0.018	0.048	0.128
	Kasrawad	0.086	0.026	0.021	0.038
	Segaon	na	na	na	na
	Bhikangaon	0.206	0.039	0.059	0.108
	Khargone	0.110	0.002	0.040	0.068
	Gogaon	0.077	-0.027	0.037	0.068
	Bhagwanpura	na	na	na	na
	Jhiranya	na	na	na	na
Barwani	Barwani	0.337	0.107	0.109	0.121
	Pati	na	na	na	na
	Thikri	0.137	0.003	0.046	0.088
	Anjad	0.064	0.002	0.029	0.033
	Rajpur	0.224	0.054	0.065	0.105
	Pansemal	0.238	0.072	0.075	0.090
	Niwali	na	na	na	na
	Sendhwa	0.354	0.107	0.135	0.111
	Varla	na	na	na	na
Rajgarh	Jirapur	0.181	0.003	0.058	0.120
	Khilchipur	0.172	0.011	0.081	0.081
	Rajgarh	0.236	0.037	0.101	0.098
	Biaora	0.189	0.014	0.064	0.111

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Sarangpur	0.106	0.004	0.030	0.072
	Narsinghgarh	0.202	0.034	0.045	0.123
	Pachore	0.081	0.000	0.032	0.049
Vidisha	Lateri	0.198	0.033	0.045	0.120
	Sironj	0.154	0.041	0.035	0.078
	Kurwai	0.092	0.020	0.015	0.057
	Basoda	0.147	0.040	0.036	0.071
	Tyonda	na	na	na	na
	Nateran	na	na	na	na
	Shamshabad	0.190	0.043	0.046	0.101
	Gyaraspur	na	na	na	na
	Gulabganj	na	na	na	na
	Vidisha	0.146	0.039	0.030	0.078
Bhopal	Berasia	0.144	0.026	0.034	0.083
	Huzur	0.159	0.048	0.042	0.069
Sehore	Sehore	0.163	0.047	0.048	0.068
	Shyampur	na	na	na	na
	Ashta	0.061	0.008	0.034	0.019
	Jawar	0.054	0.012	0.027	0.015
	Ichhawar	0.169	0.047	0.039	0.083
	Nasrullaganj	0.183	0.044	0.046	0.092
	Budni	0.124	0.016	0.036	0.072
	Rehti	0.158	0.040	0.033	0.085
Raisen	Raisen	0.188	0.047	0.033	0.109
	Gairatganj	0.081	0.014	0.003	0.064
	Begamganj	0.165	0.031	0.028	0.106
	Goharganj	0.142	0.022	0.039	0.080
	Baraily	0.139	0.018	0.034	0.087
	Badi	0.113	0.020	0.020	0.074
	Silwani	0.165	0.022	0.037	0.106
	Udaipura	0.164	0.020	0.035	0.110
Betul	Bhainsdehi	0.209	0.056	0.080	0.073
	Athner	0.134	0.014	0.064	0.056
	Betul	0.160	0.031	0.065	0.064
	Chicholi	0.210	0.046	0.093	0.072
	Ghoda Dongri	0.186	0.069	0.080	0.037
	Shahpur	0.162	0.043	0.078	0.042
	Multai	0.129	0.009	0.043	0.077

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Amla	0.203	0.044	0.064	0.095
Harda	Khirkiya	0.155	0.029	0.044	0.083
	Sirali	na	na	na	na
	Harda	0.126	0.022	0.042	0.062
	Handiya	na	na	na	na
	Timarni	0.130	0.028	0.033	0.069
	Rehatgaon	na	na	na	na
Hoshangabad	Seoni-Malwa	0.152	0.031	0.044	0.077
	Itarsi	0.192	0.049	0.051	0.092
	Hoshangabad	0.142	0.027	0.034	0.081
	Dolariya	0.209	0.050	0.042	0.117
	Babai	0.130	0.020	0.034	0.076
	Sohagpur	0.148	0.037	0.055	0.057
	Pipariya	0.146	0.035	0.057	0.055
	Bankhedi	na	na	na	na
Katni	Murwara	0.161	0.064	0.050	0.047
	Rithi	na	na	na	na
	Barhi	0.146	0.022	0.039	0.086
	Badwara	na	na	na	na
	Vijayraghavgarh	0.197	0.050	0.041	0.106
	Bahoriband	na	na	na	na
	Dhimarkheda	na	na	na	na
Jabalpur	Sihora	0.085	0.012	0.024	0.049
	Majholi	0.016	0.015	0.021	-0.020
	Patan	0.044	-0.002	0.015	0.031
	Shahpura	0.170	0.019	0.048	0.103
	Jabalpur	0.178	0.041	0.047	0.090
	Panagar	0.105	0.018	0.026	0.062
	Kundam	0.144	0.044	0.070	0.030
Narsimhapur	Gotegaon	0.132	0.018	0.031	0.083
	Gadarwara	0.173	0.027	0.040	0.105
	Narsimhapur	0.219	0.044	0.042	0.133
	Kareli	0.117	0.020	0.029	0.068
	Tendukheda	0.075	0.005	0.031	0.039
Dindori	Shahpura	0.185	0.039	0.073	0.073
	Dindori	0.173	0.047	0.059	0.067
Mandla	Niwas	0.126	0.036	0.056	0.034
	Narayanganj	na	na	na	na

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Mandla	0.148	0.044	0.056	0.048
	Ghughari	na	na	na	na
	Bichhiya	0.120	0.045	0.068	0.008
	Nainpur	0.131	0.043	0.056	0.033
Chhindwara	Tamia	na	na	na	na
	Amarwara	0.154	0.028	0.063	0.063
	Harrai	0.197	0.038	0.078	0.081
	Chaurai	0.177	0.017	0.046	0.115
	Jamai	0.241	0.089	0.096	0.056
	Parasia	0.161	0.027	0.045	0.088
	Umreth	na	na	na	na
	Chhindwara	0.157	0.030	0.051	0.077
	Mohkhed	na	na	na	na
	Sausar	0.100	0.004	0.022	0.075
	Bichhua	na	na	na	na
	Pandhurna	0.176	0.010	0.041	0.125
Seoni	Lakhnadon	0.157	0.042	0.064	0.051
	Chhapara	0.134	0.028	0.069	0.037
	Ghansaur	0.256	0.050	0.055	0.152
	Dhanora	na	na	na	na
	Keolari	0.054	0.009	0.033	0.012
	Seoni	0.156	0.035	0.057	0.064
	Barghat	0.109	0.013	0.034	0.062
	Kurai	na	na	na	na
Balaghat	Katangi	0.129	0.017	0.026	0.086
	Tirodi	0.071	0.020	0.014	0.036
	Waraseoni	0.103	0.019	0.028	0.056
	Khairlanji	na	na	na	na
	Lalbarra	-0.015	-0.014	0.000	-0.001
	Balaghat	0.173	0.035	0.036	0.102
	Kirnapur	0.147	0.029	0.030	0.088
	Baihar	0.155	0.039	0.038	0.079
	Paraswada	0.146	0.056	0.031	0.059
	Lanji	0.093	0.006	0.014	0.074
Guna	Guna	0.241	0.069	0.062	0.110
	Bamori	na	na	na	na
	Raghogarh	0.151	0.028	0.035	0.087
	Maksoodangarh	na	na	na	na

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
	Kumbhraj	0.164	0.008	0.046	0.110
	Aron	0.081	0.022	0.021	0.038
	Chachaura	0.246	0.024	0.069	0.153
Ashoknagar	Isagarh	0.135	0.009	0.038	0.088
	Chanderi	0.229	0.063	0.059	0.106
	Ashoknagar	0.174	0.029	0.039	0.105
	Shadhora	na	na	na	na
	Mungaoli	0.206	0.043	0.037	0.127
Shahdol	Beohari	0.200	0.052	0.046	0.102
	Jaisinghnagar	0.091	0.040	0.034	0.017
	Sohagpur	0.173	0.057	0.073	0.044
	Jaitpur	na	na	na	na
Anuppur	Kotma	0.138	0.045	0.048	0.045
	Anuppur	0.135	0.045	0.046	0.045
	Jaithari	0.119	0.026	0.056	0.038
	Pushparajgarh	0.163	0.067	0.062	0.034
Sidhi	Rampur Naikin	0.139	0.022	0.022	0.096
	Churhat	0.111	0.025	0.022	0.064
	Gopadbanas	0.267	0.072	0.058	0.137
	Sihawal	na	na	na	na
	Majhauli	0.148	0.035	0.021	0.092
	Kusmi	na	na	na	na
Singrauli	Chitrangi	0.373	0.121	0.085	0.168
	Deosar	na	na	na	na
	Singrauli	0.251	0.073	0.058	0.121
Jhabua	Thandla	0.399	0.106	0.150	0.143
	Petlawad	0.297	0.087	0.123	0.088
	Meghnagar	0.274	0.077	0.104	0.093
	Jhabua	0.460	0.146	0.152	0.162
	Ranapur	0.333	0.080	0.128	0.126
Alirajpur	Bhavra	0.224	0.059	0.099	0.066
	Jobat	0.419	0.107	0.165	0.147
	Alirajpur	0.394	0.087	0.168	0.140
Khandwa	Harsud	0.106	0.025	0.037	0.044
	Khalwa	na	na	na	na
	Khandwa	0.212	0.044	0.065	0.103
	Punasa	0.071	0.019	0.030	0.022
	Pandhana	0.154	0.044	0.054	0.056

District	Sub-district	∇_{UR}	∇H_{UR}	∇E_{UR}	∇S_{UR}
Burhanpur	Burhanpur	0.115	0.027	0.041	0.047
	Khaknar	na	na	na	na
	Nepanagar	0.375	0.123	0.115	0.138

Source: Author's calculations

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Dynamics of Population Growth and Development in Madhya Pradesh

A Regional Analysis

Binod Kumar Singh

Introduction

The state of Madhya Pradesh lies between 17^0 46' 55"N and 25^0 52' 52"N latitudes and 74^0 1' 55"E and 82^0 55'E longitudes. It is bounded by Uttar Pradesh in the north, Chhattisgarh in the east, Maharashtra in the south and Gujarat and Rajasthan in the west. The state first came into existence on 1st November, 1956 by merging the erstwhile states of Madhya Bharat, Vindhya Pradesh and Bhopal, Sironj region of Rajasthan and Mahakoshal area of the Central Province and Berar. On 1st November, 2000, the Chhattisgarh region was separated from the erstwhile Madhya Pradesh to constitute the Chhattisgarh state. At the 2001 population census, the state had 45 districts. During 2001-2011, five new districts were created so that the number of districts increased to 50 at the 2011 population census.

The state ranks 2nd in the country in terms of geographical area accounting for around 9.4 percent of the country's total area of 32,87,469 Km^2. Chhindwara district with an area of 11,815 Km^2 is the largest district of the state in terms of geographical area whereas Bhopal district with an area of 2,772 Km^2 is the smallest one. The geographical characteristics of Madhya Pradesh are manifold. The entire state falls into the Deccan Plateau region of the country composed of metamorphic rocks of pre-Cambrian age. Physiographically, the state is divided into three regions - Northern Madhya Pradesh Uplands, Central Madhya Pradesh Plateau, and Southern Madhya Pradesh Uplands. Northern Madhya Pradesh is typically a ravine and derelict land zone on account of erosion by the tributaries of the Chambal river system. The Central Madhya Pradesh Plateau inherits a complex geology. In general, gneisses-Vindhyans and Gondwana - are fairly represented here. Forest is deciduous and presents large varieties of Sal while the soil is primarily medium black to deep black in this part of the state. The Southern Madhya

Pradesh Uplands, on the other hand covers the Narmada region including flanks of Vindhya and Satpura mountains.

This paper presents an overview population and development transition in Madhya Pradesh with a view to highlight population concerns and development challenges that the state is currently facing. Madhya Pradesh is one of the least developed states of India. At the same time, population transition in the state remains slower than the national level. As such, the state offers a unique opportunity to study the dynamics of population growth and social and economic development and to explore the linkages between population transition and social and economic development. The paper follows a regional approach as the state can be divided into six natural divisions in terms of physiography - Northern Madhya Pradesh comprising 8 districts, Central region comprising 6 districts, Vindhya region comprising 10 districts, Malwa region comprising of 11 districts, South Western Madhya Pradesh comprising 7 districts and Southern Madhya Pradesh comprising of 8 districts.

The analysis presented in this paper is primarily based on the data available through the sample registration system and through the Annual Health Survey carried out by the Registrar General and Census Commissioner of India. In addition, evidence available through the National Family Health Survey has also been used in the analysis. The analysis has been carried out for the state as a whole and for each of its six physiological regions.

Socio-economic and Demographic Profile

According to the 2011 population census, the population of Madhya Pradesh was 72.6 million at 0.00 hours of 1st March 2011. More than 72 percent of the state population (52.6 million) lives in the rural areas whereas the urban population accounts for less than 28 percent (20.0 million) of the state population. Among different regions of the state, Vindhya region is the most populous with a population of 15.5 million (21.3 percent of the state population) while Central Madhya Pradesh accounts for only 11.8 percent of the state population. Among districts, Rewa has the largest rural population of 1.97 million (3.75 percent of the rural population of the state) whereas Indore has the highest urban population of 2.43 million (12.10 percent of the urban population of the state). Table 2 presents region-wise socio-economic and demographic characteristics of population of Madhya Pradesh as available through 2001 and 2011 population censuses.

During the ten years between 2001 and 2011, the population of the state increased by about 12.3 million which implies a decadal growth of 20.35 percent. Population growth has been more rapid in urban than in rural areas of the state. The urban population of the state increased by more than 25 percent during the ten years between 2001 and 2011 whereas the increase in the rural population has been just around 18 percent. The decadal population growth has been the highest in the Northern region (22.8 percent) of the state. The decadal growth in the rural population, on the other hand, has been the

highest in the Vindhya region (20.4 percent) whereas the decadal population growth in the urban population has been the highest in the Malwa region (30.4 percent).

As the result of the increase in population, the population density is increasing in the state, although it still remains substantially lower than the national average. During the period 2001 through 2011, the population density in the state increased by 40 absolute points. The South Western region of the state is the most densely populated region of the state with a population density of 296 inhabitants per km^2 followed by the Northern region (253 inhabitants per km^2). On the other hand, population density is found to be the lowest in the Malwa region (191 inhabitants per km^2). The trend in population density in different regions of the state is presented in table 6.

Males out number females in the state. At the 2011 population census, there were 931 females for every 1000 males in the state. Although the population sex ratio is increasing, yet the female deficit in the population persists. The female deficit is relatively the highest in the Northern region followed by Vindhya region whereas it is relatively the lowest in the Southern region of the state. In the Northern region, there were 869 females for every 1000 males compared to 967 females for every 1000 males in the Southern region. The increase in the sex ratio has relatively been the slowest in the Northern region but relatively the fastest in the Southern region. Increase in the sex ratio has also been more rapid in the urban as compared to the rural population of the state.

According to the 2011 population census, almost 11 million population of the state is below 7 years of age - 8.3 million rural and 2.5 million urban. There has been only a marginal increase in the population aged 0-6 years between 2001 and 2011 population census as the population aged 0-6 years decreased in the rural areas but increased in the urban areas. The proportion of population aged 0-6 years is relatively the highest in the Vindhya region (15.7 percent) followed by Northern region (15.2 percent) while this proportion is relatively the lowest in the Southern region (13.2 percent). During 2001-2011, the proportion of population aged 0-6 years decreased by 2.99 percentage points in the state. This decrease was relatively the most rapid in the Vindhya region (3.4 percentage points) but relatively the slowest in the Southern region (2.7 percentage points).

Madhya Pradesh has recorded a marked decrease in the child sex ratio (sex ratio of the population aged 0-6 years) from 932 girls per 1000 boys in 2001 to 918 girls per 1000 boys in 2011. The decrease in the child sex ratio has been more rapid in rural than in urban population. Relatively the most rapid decrease in the child sex ratio is observed in the Vindhya region whereas in Central and Southern regions, the decrease in the child sex ratio has been the slowest. The child sex ratio has decreased in rural and urban areas in all the six regions of the state, although the decrease has been marginal in the Southern region.

More than 35 percent population of the state is either Scheduled Castes or Scheduled Tribes. The proportion of Scheduled Castes population increased marginally from 15.2

percent in 2001 to 15.6 percent in 2011. Similarly, the proportion of Scheduled Tribes population increased from 20.3 percent in 2001 to 21.1 percent in 2011. The proportion of the Scheduled Castes population is the highest in the Northern region of the state (19.9 percent) and the lowest in the Southern region (10.7 percent). On the other hand, the proportion of the Scheduled Tribes population is the highest in the South Western region (39.1 percent) followed by the Southern region (30.4 percent) but the lowest in the Norther region (7.0 percent) and the Central region (8.7 percent). Growth of both Scheduled Castes and Scheduled Tribes population in different regions of the state has been different. The growth of the Scheduled Castes population has been the highest in the Malwa region (27.1percent) but the lowest in the Southern region (17.4 percent). The growth of the Scheduled Tribes population, on the other hand, has been the highest in the Northern region (35.0 percent) followed by South Western region (30.2 percent) but the lowest in the Central region (17.4 percent) preceded by the Southern region (20.1 percent).

The sex ratio in both Scheduled Castes and Scheduled Tribes is higher than the state average. Moreover, the sex ratio in Scheduled Castes increased markedly from 905 females per 1000 males in 2001 to 920 females per 1000 males in 2011. The sex ratio in Scheduled Castes is relatively the highest in Malwa and Southern regions (954 females per 1000 males) but the lowest in the Northern region (866 females per 1000 males). However, the increase in the sex ratio of Scheduled Castes during 2001-2011 has been the most rapid in the Northern region whereas this increase has been relatively the slowest in the Vindhya region.

Although, the sex ratio of the Scheduled Tribes population is higher than that of the Scheduled Castes population, yet the increase in the Scheduled Tribes sex ratio has been slower than that in Scheduled Castes. The sex ratio in Scheduled Tribes increased from 975 females per 1000 males to 984 females per 1000 males during 2001-2011. In the Southern region of the state, there are more Scheduled Tribes females than Scheduled Tribes male whereas there are only 940 Scheduled Tribes females for every 1000 Scheduled Tribes males in the Northern region. The increase in the Scheduled Tribes sex ratio has however been relatively the highest in Malwa and South Western regions but the slowest in the Southern region.

The number of literates in the state has increased from 31.6 million at the 2001 population census to 42.9 million in the 2011 population census. This means that the effective literacy rate (number of literates aged 7 years and above per 100 population aged 7 years and above) in the state increased from 63.7 percent in 2001 to 69.3 percent in 2011. The increase in the effective literacy rate has been more marked in females than in males. The females effective literacy rate increased from 50.3 percent in 2001 to 59.2 percent in 2011 whereas the male effective literacy rate increased from 76.1percent to 78.7 percent during the same period. As the result, the gender gap in effective literacy rate in the state decreased sharply during the decade.

The effective literacy rate is the highest in the Central region of the state (74.4 percent) followed by the Southern region (73.9 percent) but the lowest in the South Western region (65.0 percent) followed by Vindhya (66.7 percent) and Malwa (67.2 percent) regions. In all regions of the state, the increase in effective female literacy rate has been relatively faster than the effective male literacy rate so that the gender gap in the effective literacy rate has decreased over time. The reduction in the gender gap has been the largest in the Vindhya region but the smallest in the Malwa region.

Total number of workers in the state has increased from 25.8 million in 2001 to 31.6 million in 2011. However, the work participation rate increased only marginally from 42.7 percent in 2001 to 43.5 percent in 2011. Notably, the male work participation rate increased from 51.5 percent to 53.6 percent during 2001-2011 but the female work participation rate decreased from 33.2 percent to 32.6 percent during this period.

Among different regions of the state, the work participation rate decreased in the Northern region from 39.4 percent to 37.0 percent during the decade 2001-2011 because of a very substantial decrease in the female work participation rate in the region. The female work participation rate has also decreased in the Vindhya region. In other regions of the state, however, the female work participation rate has increased.

Another discerning feature of Madhya Pradesh is that the proportion of main workers to total workers decreased from 74.1 percent in 2001 to 71.9 percent in 2011 which indicates towards the marginalisation of the workforce in the state. The decrease in this proportion has been confined to only three regions of the state - Central region, Vindhya region and the Southern region. In the other regions, the proportion of main workers to total workers has increased over time but the increase has at best been marginal.

The workforce in the state is constituted largely by the workers engaged in agriculture - cultivators and agricultural labourers other than those engaged in plantation activities - but the proportion of workers engaged in agriculture has decreased marginally from 71.5 percent in 2001 to 70.0 percent in 2011. However, the proportion of cultivators to total workers decreased while the proportion of agricultural labourers to total workers increased during 2001-2011. This trend again indicates towards casualisation of the labour force in the state. There has also been a marginal decrease in the proportion of workers engaged in household industries whereas the proportion of other workers to total workers has shown an increasing trend.

The pattern of the change in the labour force has been different in different regions of the state. For example, the decrease in the proportion of cultivators to total workers has been very pronounced in the Vindhya region of the state but less pronounced in the South Western region. Similarly, there has been an increase in the proportion of workers engaged in household industries in four regions of the state - the Northern region, the Vindhya region, the Malwa region and the South Western region. However, the proportion of cultivators to total workers decreased during this period in Central and Southern regions of the state.

Growth Trends and Regional disparities

During the 60 years between 1951 through 2011, the population of the state increased from 18.6 million in 1951 to 72.6 million in 2011 recording almost three times increase since 1951. The net addition to the population also increased in every decade. During 1951-61, only 4.6 million people were added to the state population. This number increased to 6.8 million during 1961-1971; 8.2 million during 1971-81; 10.4 million during 1981-91; 11.8 million during 1991-2001; and 12.3 million during 2001-2011. The decadal population growth was however the highest during 1961-71 when the state population increased by 29.3 percent. Since 1971, the decadal population growth has shown a decreasing trend so that during 2001-2011, the state population increases by only 20.3percent.

The increase in population has been different in different regions. In the Southern region, population increased by more than 3.7 times between 1951 and 2011 and this proportion is the highest among all the six regions of the state. By contrast, population increased by less than 2.6 times in the Malwa region during this period. However, the decadal population growth decreased in all regions of the state during the period 2001-2011. This decrease has been very sharp in Central and Southern regions but marginal in South Western, Northern and Malwa regions.

Regional Growth Trends. The state population increased at an average annual growth rate of 1.85 percent per year during the period 2001-2011 which is higher than the national average of 1.63 percent per year. Within the state, the average annual population growth rate has been the slowest in the Vindhya region (1.68 percent per year) but the most rapid in the South Western region of the state where the population increased at an average annual rate of 2.19 percent per year during the ten years between 2001 through 2011. In addition to the Vindhya Region, the rate of population growth has also been slower than the state average in Central and Malwa regions but higher than the state average in other regions of the state.

The growth in population has slowed down considerably in all regions of the state during the period 2001-11 compared to the period 1991-2001. However, the decrease in the average annual population growth rate has been the fastest in the Central region followed by the Southern region. By contrast, the decrease in the average annual population growth rate has been the slowest in the South Western region of the state.

In order to analyse the disparity in population growth across the regions of the state, we have calculated the coefficient of variation in the average annual population growth rate which shows the disparity in population growth across regions was very high during 1960s and 1970s but decreased after 1970. This indicates that the population growth across the regions of the state is converging over time.

Regional Distribution. As the result of differing pace of population growth in different regions of the state, the regional distribution of population has also undergone

change over time. In 1951, Vindhya region accounted for 22.5 percent of the state population while Malwa region accounted for 21.7 percent of the state population. The corresponding proportion was 16.5 percent for the Northern region; 13.6 percent for the Southern region; 13.1 percent for the South Western region; and 12.5 percent for the Central region. By 2011, the share of the Southern region increased to 16.5 percent while that of the South Western region increased to 14.8 percent but the share of Malwa region decreased to 19.9 percent; the share of the Vindhya region decreased to 21.3 percent; the share of the Northern region decreased to 15.7 percent and the share of the Central region decreased to 11.8 percent.

Fertility Trends and Patterns. Population growth is determined primarily by the natural population growth rate which, in turn, is determined by the prevailing levels of birth rate and death rate and the prevailing levels of fertility and mortality. Data available through the sample registration system suggest that the birth rate in the state decreased from 30.8 live births per 1000 population in 2001 to 26.9 live births per 1000 population in 2011 while the total fertility rate decreased from 3.9 live births per woman of reproductive age in 2001 to 3.1 live births per woman of reproductive age in 2011. The state is however yet to achieve the replacement fertility.

Estimates of fertility indicators for the regions of the state are available through the Annual Health Survey 2010-11. According to this survey, the birth rate is the highest in Vindhya region (27.9) followed by the Central region (27.1). On the other hand, the birth rate is the lowest in the Malwa region (23.5). The Annual Health Survey also suggests that the Malwa region is the only region in the state where the total fertility rate is below 3.0 live births per woman of reproductive age. Besides the Malwa region, the total fertility rate in the Southern region is equal to the state average of 3.1 live births per woman of reproductive age. In the remaining four regions, total fertility rate is estimated to be higher than the state average with the highest total fertility rate estimated for the Vindhya region (3.6 live births per woman of reproductive age).

In all regions of the state both birth rate and the total fertility rate has decreased over time. The decrease in the birth rate has however been the fastest in Southern and Central regions of the state but the slowest in the Vindhya region. Similarly, the decrease in the total fertility rate has been the fastest in the Northern and Central regions of the state but the slowest in the South Western region.

Mortality Trends and Patterns. Like fertility, mortality has also decreased in the state but the decrease has not been the same in all the six regions of the state. The crude death rate in the state decreased from 10.0 deaths per 1000 population to 8.2 deaths per 1000 population in 2011. Among different regions, the death rate varies from a maximum of 8.9 deaths per 1000 population in Vindhya region to a minimum of 6.4 in the Malwa region according to the Annual Health Survey 2012-13. The death rate has decreased in all regions of the state. The decrease has been the most rapid in the Southern region but the slowest in the Northern region. Similarly, the infant mortality rate varies from a

maximum of 70 infant deaths per 1000 live births in the Vindhya region to a minimum of 56 infant deaths per 1000 live births in the Malwa region. The infant mortality rate has also decreased in all regions but the decrease has been the most rapid in the Vindhya region but the slowest in the Northern region.

Conclusions

The present analysis highlights regional disparities in demographic situation in Madhya Pradesh. Fertility in the state is high and is well above the replacement level. Moreover, there are notable spatial variations. Fertility is comparatively low in the Malwa region; moderately high in Southern and Northern regions and very high in Vindhya, Central and South Western regions of the state. There is a need to examine the factors that are responsible for the observed regional variation in fertility in the state. It will be interesting to explore whether regional variation in population dynamics in the state is the result of the regional variation in the level of social and economic development. It is well known that a certain threshold of social and economic development is necessary for hastening the pace of population transition. The prevailing population scenario suggests that such a threshold of social and economic development is still missing in most of the regions of the state.

Table 1
Physiographical regions of Madhya Pradesh

Region	Districts
Northern	Sheopur, Morena, Bhind, Gwalior, Datia, Shivpuri, Guna, Ashoknagar.
Central	Sagar, Damoh, Vidisha, Bhopal, Sehore, Raisen.
Vindhya	Tikamgarh, Chhatarpur, Panna, Satna, Rewa, Umaria, Shahdol, Anuppur, Sidhi, Singrauli.
Malwa	Neemuch, Mandsaur, Ratlam, Ujjain, Shajapur, Dewas, Dhar, Indore, Rajgarh, Jhabua, Alirajpur.
South Western	Khargone (West Nimar), Barwani, Betul, Harda, Hoshangabad, Khandwa (East Nimar), Burhanpur.
Southern	Katni, Jabalpur, Narsimhapur, Dindori, Mandla, Chhindwara, Seoni, Balaghat.

Source: Classified by the author on the basis of natural divisions identified in the National Sample Survey.

Table 2

Socio-economic and demographic characteristics in different regions of Madhya Pradesh, 2001-2011

Variables	India		Madhya Pradesh		NSS Natural Divisions of Madhya Pradesh											
					Northern		Central		Vindhya		Malwa		South Western		Southern	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Sex ratio (Females per 1000 males)																
Overall	933	943	919	931	852	869	890	906	921	926	942	955	942	955	957	967
Rural	946	949	927	936	849	865	888	901	930	931	954	966	948	959	971	977
Urban	900	929	898	918	862	878	894	914	882	906	914	932	920	940	912	937
SC	936	945	905	920	844	866	882	900	912	921	941	954	929	940	944	954
ST	978	990	975	984	932	940	936	944	961	972	976	987	974	985	1003	1010
Child	927	919	932	918	877	867	933	924	937	911	940	926	953	938	956	947
Mean household size																
Total	5.3	4.9	5.5	4.8	6.2	5.2	5.4	4.7	5.4	4.6	5.7	5.0	5.7	5.1	5.0	4.4
Population composition (Percent)																
Urban	27.8	31.2	26.5	27.6	27.8	29.4	35.1	37.2	18.5	18.4	30.9	32.9	21.3	21.1	24.5	25.3
Child	15.9	13.6	17.9	14.9	18.3	15.2	18.0	14.8	19.1	15.7	17.7	14.9	18.4	15.6	15.9	13.2
SC	16.2	16.6	15.2	15.6	19.7	19.9	18.3	18.7	15.8	16.6	15.2	15.8	11.4	11.2	10.6	10.7
ST	8.2	8.6	20.3	21.1	6.4	7.0	8.9	8.7	19.8	20.4	21.6	22.4	35.9	39.1	29.3	30.4

Variables	India		Madhya Pradesh		NSS Natural Divisions of Madhya Pradesh											
					Northern		Central		Vindhya		Malwa		South Western		Southern	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Literacy Rate (Percent)																
Persons	64.8	73.0	63.7	69.3	64.0	69.5	67.7	74.4	58.4	66.7	63.3	67.2	61.6	65.0	68.0	73.9
Males	75.3	80.9	76.1	78.7	77.8	80.3	78.6	82.4	71.6	76.4	76.1	77.5	72.8	73.4	79.4	82.3
Females	53.7	64.7	50.3	59.2	47.8	57.1	55.2	65.6	44.1	56.3	49.7	56.5	49.8	56.2	56.1	65.3
Rural	58.7	67.8	57.8	63.9	58.9	65.0	60.7	68.8	54.5	63.6	55.4	59.1	56.2	59.7	62.8	69.5
Urban	79.9	84.1	79.4	82.8	76.7	79.9	79.8	83.6	74.8	79.9	80.1	83.1	80.4	83.7	83.3	86.6
Work participation rate (Percent																
Persons	39.1	39.8	42.7	43.5	39.4	37.0	38.6	40.6	42.5	42.9	45.5	46.3	43.9	45.7	44.7	46.8
Males	51.7	53.3	51.5	53.6	49.9	50.8	50.1	53.3	49.9	51.5	53.6	55.2	51.9	54.3	52.8	55.9
Females	25.6	25.5	33.2	32.6	27.0	21.2	25.7	26.4	34.4	33.7	36.8	36.9	35.5	36.7	36.3	37.4
Rural	41.7	41.8	47.1	47.0	43.6	39.8	42.9	43.9	45.2	45.2	51.4	51.4	47.8	49.1	49.2	50.5
Urban	32.3	35.3	30.6	34.2	28.4	30.3	30.7	35.0	30.5	33.0	32.2	35.8	29.6	33.3	30.8	35.8
Workers by type of work (Percent)																
Main	77.8	75.2	74.1	71.9	75.8	76.6	75.8	73.5	70.4	64.7	75.2	75.7	77.3	77.4	71.4	65.2
Marginal	22.2	24.8	25.9	28.1	24.2	23.4	24.2	26.5	29.6	35.3	24.8	24.3	22.7	22.6	28.6	34.8

Variables	India		Madhya Pradesh		NSS Natural Divisions of Madhya Pradesh											
					Northern		Central		Vindhya		Malwa		South Western		Southern	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Workers by occupation (Percent)																
Cultivators	31.7	24.6	42.8	31.2	52.2	40.3	29.1	21.9	46.5	30.1	46.8	36.2	42.2	32.1	36.0	24.4
Agriculture labourers	26.5	30.0	28.7	38.6	18.6	28.4	28.2	34.6	29.8	43.2	25.4	34.3	35.7	45.1	35.5	46.0
Household industry workers	4.2	3.8	4.0	3.0	2.2	2.3	11.3	6.6	4.3	3.5	1.9	1.8	1.8	1.6	4.5	3.2
Other workers	37.6	41.6	24.5	27.2	27	29.0	31.4	36.9	19.3	23.1	26.0	27.7	20.3	21.2	24.0	26.4

Source: Author's calculations.

Table 3
Population growth trend in Madhya Pradesh: 1951-2011

Census Year	Decadal population growth (Percent)		Proportion of India's population (Percent)
	Madhya Pradesh	India	
1951			5.16
1961	24.73	21.51	5.29
1971	29.28	24.80	5.48
1981	27.16	24.66	5.59
1991	27.24	23.87	5.74
2001	24.26	21.54	5.87
2011	20.35	17.7	6

Source: Author's calculations.

Table 4
Decadal population growth and average annual exponential growth rate in regions of Madhya Pradesh: 1951-2011

	1951-61	1961-71	1971-81	1981-91	1991-01	2001-11
	Decadal population growth (Percent)					
Madhya Pradesh	24.73	29.28	27.16	27.24	24.26	20.35
Northern	21.01	26.21	27.30	27.62	23.45	21.24
Central	22.93	26.92	25.23	26.60	25.42	18.84
Vindhya	23.12	28.96	26.44	25.90	23.48	18.27
Malwa	23.87	29.03	23.66	25.88	21.11	18.66
South Western	27.75	30.86	30.57	28.24	25.98	24.48
Southern	32.01	34.11	31.55	30.20	27.85	21.82
Coefficient of variation	16.35	9.78	11.28	6.09	9.73	11.88
	Average annual population growth rate (Percent)					
Madhya Pradesh	2.21	2.57	2.40	2.41	2.17	1.85
Northern	1.91	2.33	2.41	2.44	2.11	1.93
Central	2.06	2.38	2.25	2.36	2.26	1.73
Vindhya	2.08	2.54	2.35	2.30	2.11	1.68
Malwa	2.14	2.55	2.12	2.30	1.92	1.71
South Western	2.45	2.69	2.67	2.49	2.31	2.19
Southern	2.78	2.94	2.74	2.64	2.46	1.97
Coefficient of variation	14.45	8.57	9.98	5.39	8.73	10.77

Source: Author's calculations.

Table 5
Share of population in different regions of Madhya Pradesh 1951-2015

State and Regions	Regional Share of Population (%)						
	1951	1961	1971	1981	1991	2001	2011
Madhya Pradesh	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Northern	16.5	16.0	15.7	15.7	15.7	15.6	15.7
Central	12.5	12.3	12.1	11.9	11.8	11.9	11.8
Vindhya	22.5	22.2	22.2	22.0	21.8	21.7	21.3
Malwa	21.7	21.6	21.5	20.9	20.7	20.2	19.9
South Western	13.1	13.4	13.6	14.0	14.1	14.3	14.8
Southern	13.6	14.4	15.0	15.5	15.8	16.3	16.5
Coefficient of variation	26.7	25.5	25.2	24.0	23.2	22.0	20.9

Source: Author's calculations.

Table 6
Population density in regions of Madhya Pradesh

State and Regions	Share of population (Percent)						
	1951	1961	1971	1981	1991	2001	2011
Madhya Pradesh	60	75	97	124	158	196	236
Northern	68	82	104	132	169	209	253
Central	62	76	97	121	153	192	228
Vindhya	68	83	107	136	171	211	250
Malwa	53	66	85	106	133	161	191
South Western	67	86	113	147	189	238	296
Southern	49	65	87	114	149	190	232
Coefficient of variation	13.55	12.12	11.44	12.31	12.46	13.13	14.68

Source: Author's calculations.

Table 7
Vital satatistics in regions of Madhya Pradesh

State and regions	CDR (Crude death rate)	IMR (Infant mortality rate)	CBR (Crude birth rate)	NR (Natural Growth Rate)	TFR (Total Fertility Rate)
			2010-11		
Madhya Pradesh	8.0	67	25.0	17.1	3.1
Northern	7.5	67	24.0	16.5	3.2
Central	8.5	70	27.1	18.6	3.5
Vindhya	9.3	76	27.9	18.6	3.6
Malwa	6.7	60	23.5	16.8	2.9
South Western	9.2	66	25.6	16.4	3.3
Southern	8.8	68	25.8	16.9	3.1
			2012-13		
Madhya Pradesh	7.7	62	24.5	16.8	3
Northern	7.4	64	23.4	16.0	2.9
Central	8.2	65	26.3	18.1	3.3
Vindhya	8.9	70	27.5	18.6	3.5
Malwa	6.4	56	22.9	16.4	2.7
South Western	8.8	62	25.0	16.1	3.2
Southern	8.4	63	25.0	16.6	2.9

Source: Author's calculations.

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Agricultural Production and Food Security in District Bankura, West Bengal, India

Subhasis Nandi

Introduction

Concerns about food security have afflicted the mankind throughout the recorded history. India is currently at a peculiar crossroad where the country is confronted with a painful disjuncture. At the one hand, the country has the highest ever food production but, at the other, the country has the largest number of people who are food insecure and many of them even die of starvation (Dev, 1998). Food security is one of the seven pillars of the concept of human security, along with economic, health, environmental, personal, community, and political security that was originally mooted by United Nations Development Programme. Technically speaking, food security is defined as the physical, economic and social access to balanced diet and safe drinking water so as to enable every individual to lead a productive and healthy life in perpetuity.

The concept of feed security has however undergone significant changes in the course of the time. Roots of the concern about food security can be traced back to the Universal Declaration of Human Rights by the United Nations which recognizes that "everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food" way back in 1940 (United Nations,). Later, in the 1970s, the operational concept of right to food was introduced by the Food and Agricultural Organization (FAO). The World Food Conference, 1974 defined food security as the availability at all times of adequate supplies of basic foodstuff to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (Kadekodi, 2007). According to this definition, unavailability of the food is the only reason behind food insecurity. However, in reality, nations have enough food in terms of availability, yet there are countries in the world, regions within countries, villages within regions, households within villages and individuals within household that are not able to meet their food needs.

West Bengal is one of those states of India which are performing well the food grain production but major concerns in terms of future sustainability of the food grain

production remain. The state is the most densely populated state of India. According to the 2011 population census, the state had a population of 91.3 million. During the period 2001-2011, about 11 million people were added to the state population. Although, the state appears to have achieved the replacement fertility, yet the population of the state will continue to increase at least in the near future because of the population momentum. In order to ensure food security to its increasing population, it is therefore imperative for the state to increase the food grain production.

It is in the above context that the present paper examines the temporal and spatial variation in population growth and food production in West Bengal. More specifically, the paper examines: 1) the situation of agriculture in West Bengal; 2) the gap in food demand and food availability; and 3) food consumption patterns in the state.

Data Source and Methodology

The paper is based on data available from a number of sources. The data available through the population census have been used to examine spatial and temporal patterns of population growth in the state. Data pertaining to food grain production and land use pattern, on the other hand, have been derived from the Statistical Abstract of West Bengal. Based on these data, per capita food availability and optimum carrying capacity of the state has been analysed and the gap between the demand and supply of food in the state has been worked out.

In addition, data available through a household survey carried out in district Bankura of the state have also been used to supplement the macro level analysis. District Bankura was selected for the survey as the per capita food grain production in the district is low. The district has 22 development blocks out of which three blocks were selected for the household survey on the basis of the cropping intensity. Within each selected block, villages were ranked on the basis of cropping intensity and three villages from each block were selected where both cropping intensity and population density was high. Data available through the household survey was analysed to assess the level of food security and the period of food insecurity at the household level.

Results and Findings

Food Grain Production. West Bengal is situated in the most fertile land of lower Gangetic Plain and hence agriculture plays a pivotal role in the state economy. Nearly three out of every four persons in the state, on average, are directly or indirectly involved in agriculture. The agro-climatic conditions in the state are also favourable to intensive agricultural activity. The state is considered as the food bowl of India. The total food grain production in the state has increased from 11270 thousand tonnes to 160610 thousand tonnes during the last twenty years with very substantial increase in rice and wheat production (Table 1).

Although, West Bengal is an agriculture-dependent state, yet it depended upon the central government to meet the domestic food demands till the 1980s. Since then, there has been a significant increase in the food grain production and now the state is a food surplus state. The total food grain production in the state is increased by 42 percent in the last thirty years with the increase in production being the most rapid in rice. Introduction of Boro or summer rice cultivation has been one of the responsible factors for the drastic increase in the rice production in the state. There has also been a significant increase in the non food grain crops with the maximum increase recorded in the production of potato. However, there has been a decrease in the production of pulses by around 22 percent during the last thirty years.

Population Dynamics. West Bengal occupies 4 percent of the landmass of the country but 10 percent of its population. As the result, the population density in the state is amongst the highest in the country. According to the 2011 population census, the population density of the state was 1029 persons per square kilometre which is the second highest in the country. Since 1901, the population of the state has increased by more than five times - from 16.9 million in 1901 to 91.3 million in 2011. This means that in a period of 110 years, 74.4 million people have been added to the state population. Population growth has not been the same in all districts of the state. Population growth has been comparatively more rapid in Maldah, Murhidabad, Uttar Dinazpur and North Twenty Four Paragnas districts. All these districts are located on the border of Bangladesh and in-migration from Bangladesh is widely attributed as the reason for rapid population growth in these districts.

Food Security. Food security indicators are derived from the country level household income and expenditure surveys to estimate per capita calorie availability. In general, the objective of food security indicators is to capture some or all of the main components of food security in terms of 1) food availability; 2) access to available food; and 3) utilisation or adequacy of the food. Among the three components of food security, it is relatively easy to estimate food availability (production and supply) and food utilisation or adequacy (nutritional status) but assessment of the access to the available food is difficult.

In order to measure the spatial-temporal patterns of food security, two approaches have been employed in the present paper. The first approach is to estimate food grain availability while the second one is to calculate standard nutrition unit. The food grain availability is measured in terms of food grain availability per capita per day which is calculated with the help of the following formula:

$$\text{Food availability (per capita/day)} = \frac{\text{Total food grain production}}{\text{(Total population x 365)}}$$

In West Bengal, food availability is estimated to have increased from 485 grams per capita per day in 1991 to 507 grams per capita per day in 2008. However, there exists huge spatial-temporal variation in food availability within the state. There are at least six

districts in the state - Maldah, Uttar Dinazpur, Nadia, Darjeeling, South 24 Parganas and Howrah - where the food availability has decreased over time. In district Bankura, on the other hand, food availability increased from 848 grams per person per day in 1991 to 903 grams per person per day in 2008. District Bankura had the second highest food availability in the state in 2008, next to district Birbhum.

In an attempt to analyse food availability at the household level, we used the data available through a household survey carried out in district Bankura of the state. For the purpose of comparison, food availability at the household level has been categorised into five categories - very low, low, medium, high and very high. Household food security is categorised as very low if the per capita per day availability of food in the household is less than 500 grams. On the other hand, food availability is categorised as low if it ranges between500-1000 grams; medium if it ranges between1000-1500 grams; high if it ranges between 1500-2000 grams; and very high if it is at least 2000 grams per capita per day**.** It may be seen from table 2 that in less than five percent of the households surveyed**,** the food availability is estimated to be high or very high in district Bankura whereas in almost three-fourth of the households surveyed, the food availability is estimated to be very low. Food availability has been estimated to be very low in nearly all households belonging to other backward classes and in most of the households with marginal land holdings.

In order to further explore the nature of food availability at the household level, the respondents during the survey were asked how many months did they depend on household food grain production. It was found that only one third of the households depended on their own food grain production for the whole year while in more than one fifth of the households, food grain produced by the household was sufficient to meet the household food demand for at the most four months in the year. There was however not much difference in this dimension of food availability across different social classes and across households with different size of land holdings.

Standard Nutrition Unit. Standard nutrition unit (SNU) is an approach suggested by Stamp (1958) to convert the food grain production into calories and to establish the relationship between food grain production and the adequacy of food or the nutrition component of food security. One SNU is estimated to be sufficient for a person. The adequacy of food is usually measured in terms of calories. One calorie is the amount of energy required to raise the temperature of one kilogram of water by one degree centigrade. According to the British Medical Association, caloric intake among adults ranges from 2100 calories a day for a woman living in a sedentary occupation to 4250 calories a day for a man engaged in active manual work. For infants, caloric requirement is estimated to be 800 calories a day and for teenage boys 3400 calories a day. Taking into consideration the age structure of the population, the range of occupation, body weight and height of the people living under the climatic conditions of north Western Europe, the average calorie intake is estimated to be 2460 calories a day or 963600 calories per year. Based on these calculations, Stamp suggested that 1000000 calories should be taken as

SNU. Sukhatme (1961), on the other hand, estimated that the requirement of an average Indian is 2300 calories per day which amounts to SNU of 839500 calories. A Nutrition Expert Group constituted by the Indian Council of Medical Research has estimated that normal calorie requirement in Indian adults' ranges from 1,900 calorie a day for a woman engaged in sedentary work to 3,900 calories a day for a man engaged in heavy manual work. For infants, the calorie requirement is estimated to be 10 calories per kg weight of the body per day and 3000 calories a day for teenage boys.

For the state of West Bengal, the SNU is estimated to be 772774 or approximately 800000 calories. This estimate is the same as obtained by Shafi (1960) for Uttar Pradesh. This value of SNU reflects the adequacy of the food grain production to meet the nutritional requirement of the people living in the given area. If the SNU estimated for the area is less than 800000 per person than the food grain availability may be termed as inadequate which is an indicator of food insecurity.

We have estimated SNU for all districts of West Bengal. First the total production of different food grain crops in each district was converted into calories on the basis of the calorie value of each food grain. Next the total estimated calories were divided by 800000 to obtain SNUs for the entire population. In other words,

$$\text{Standard Nutrition Unit (SNU)} = \frac{\text{Total calorie availability}}{800000}$$

Finally SNUs so estimated were divided by the total population to obtain average SNU per person. The food grain crops covered in the estimation of SNU per person included rice, wheat, sugar cane and pulses as these crops covered more than 80 percent of the gross cropped area in the state.

Estimates of SNU per person for the districts of the state are presented in table 3 which reflect the variation in the adequacy dimension of the food security. It may be seen from the table that food adequacy varies widely across the districts of the state. The adequacy of local food production is found to be the lowest in district South 24 Parganas of the state but the highest in the Maldah district.

Conclusions

In this paper we have attempted to analyse food security in West Bengal. The analysis suggests that despite a significant increase in the food grain production in the state, a very substantial proportion of households in the state, particularly in district Bankura of the state, remain food insecure. The analysis also shows that food security varies widely across the districts of the state. Since, food grain production or the high agricultural productivity is one of the important determinants of food security, districts with high agricultural productivity are no doubt are food secure districts. However, at the household level, food security cannot be ensure by just household production of food grains as in majority of the

households surveyed in district Bankura, household food gran production is not sufficient to meet the household food grain demand for the whole year. In such a situation the public distribution system can play a pivotal role in building food security at the household level. This, however, requires increasing the purchasing power of the average household.

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Table 1
Crop production (thousand tones) in West Bengal

District	Rice		Wheat		Maize		Sugarcane		Pulses	
	1990	2008	1990	2008	1990	2008	1990	2008	1990	2008
Burdwan	1420.4	1858.6	5.7	6.0	0.0	0.9	52.5	56.1	1.4	0.8
Birbhum	813.1	1220.7	25.1	94.9	0.1	0.6	82.2	117.8	5.4	18.2
Bankura	843.8	1173.6	12.3	7.7	9.0	0.7	11.5	1.1	1.4	0.3
Midnapore East	1529.3	821.8	8.8	1.4	1.5	0.0	0.0	15.5	19.1	8.5
Midnapore West	0.0	1798.9	0.0	16.6	0.0	1.0	318.8	243.5	0.0	4.3
Howrah	232.5	259.2	0.2	1.1	0.0	0.1	0.0	4.4	2.2	0.4
Hooghly	610.7	845.1	1.5	0.8	0.0	0.7	7.2	46.9	0.5	0.2
24 Parganas North	646.9	744.6	18.7	17.9	0.0	0.2	39.2	49.4	8.6	6.5
24 Parganas South	509.7	796.8	1.0	4.8	0.0	0.6	0.1	6.2	3.2	10.6
Nadia	695.1	683.0	81.5	110.6	2.9	7.2	58.5	270.0	49.7	28.8
Murshidabad	785.3	1142.4	174.9	313.4	0.1	19.5	79.1	621.2	29.6	41.7
Dinazpur North	768.4	683.5	0.0	98.2	0.0	60.5	0.0	0.0	10.9	1.5
Dinazpur South	0.0	492.0	67.2	29.9	0.0	1.4	0.0	0.0	0.0	0.4
Maldah	498.3	480.4	88.5	137.9	6.6	22.8	157.3	284.6	38.5	24.2
Jalpaiguri	249.7	372.4	16.4	39.2	5.9	25.4	0.0	10.5	2.9	2.2
Darjeeling	64.6	59.5	3.8	3.8	41.3	38.2	0.0	2.3	0.6	0.7
Cooch Behar	401.9	518.8	22.5	29.3	0.0	57.7	0.1	0.0	5.7	3.7

District	Rice		Wheat		Maize		Sugarcane		Pulses	
	1990	2008	1990	2008	1990	2008	1990	2008	1990	2008
Purulia	372.8	768.2	2.1	3.8	14.2	7.0	52.3	42.5	13.7	4.9
West Bengal	10442.5	14719.5	530.2	917.3	81.6	244.5	858.8	1772.0	193.4	157.9

Source: Statistical abstract of West Bengal, 2010.

Table 2

Per capita food grain availability in district Bankura

Types	Number of households					Total	Percentage distribution					Total
	Very low	Low	Medium	High	Very high		Very low	Low	Medium	High	Very high	
						Samples						
Sample 1	20	2	0	0	0	22	91	9	0	0	0	100
Sample 2	18	1	0	0	0	19	95	5	0	0	0	100
Sample 3	11	0	0	0	0	11	100	0	0	0	0	100
Sample 4	17	4	1	0	0	22	77	18	5	0	0	100
Sample 5	5	11	8	3	3	30	17	37	27	10	10	100
Sample 6	2	8	5	1	1	17	12	47	29	6	6	100
Sample 7	19	4	0	0	0	23	83	17	0	0	0	100
Sample 8	27	0	0	0	0	27	100	0	0	0	0	100
Sample 9	21	3	0	0	0	24	88	13	0	0	0	100
						Social class						
General	63	18	7	4	2	94	67	19	7	4	2	100
SC	27	9	6	0	2	44	61	20	14	0	5	100
ST	28	5	1	0	0	34	82	15	3	0	0	100
OBC	22	1	0	0	0	23	96	4	0	0	0	100

Types	Number of households					Total	Percentage distribution					Total
	Very low	Low	Medium	High	Very high		Very low	Low	Medium	High	Very high	
						Size of land holding						
Marginal	97	17	4	0	0	118	82	14	3	0	0	100
Small	39	12	8	4	2	65	60	18	12	6	3	100
Semi Medium	3	4	1	0	1	9	33	44	11	0	11	100
Medium	1	0	1	0	1	3	33	0	33	0	33	100
						Profession						
Cultivation	86	21	8	0	2	117	74	18	7	0	2	100
Service	16	5	2	1	2	26	62	19	8	4	8	100
Business	26	6	4	2	0	38	68	16	11	5	0	100
Others	12	1	0	1	0	14	86	7	0	7	0	100
All	140	33	14	4	4	195	72	17	7	2	2	100

Source: Household Survey in district Bankura.

Table 3
Average SNU per person in districts of West Bengal

District	Average SNU per person	
	1990	2008
Burdwan	1079	1222
Birbhum	874	1241
Bankura	808	1161
Midnapore East	602	779
Midnapore West	0	1295
Howrah	691	968
Hooghly	1146	1474
24 Parganas North	852	1083
24 Parganas South	445	746
Nadia	815	1227
Murshidabad	799	1342
Uttar Dinazpur	548	991
Dakshin Dinazpur	0	955
Malda	784	1495
Jalpaiguri	358	865
Darjeeling	460	860
Cooch Behar	495	808
Purulia	521	909
West Bengal	739	1120

Source: Author's calculations.

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Contemporary Issues of Population Poverty Nexus in Madhya Pradesh

Pritika Pariyar

Introduction

Historically, the definition of poverty was limited to income and living standard but currently its scope has been expanded to include lack of opportunities, deprivation regarding access to education and health, gender disparity, environmental degradation, etc. Population has the ability to influence all facets of poverty (Mogelgaard, 2011). The relationship between population growth and poverty dates back to 1798 with the Malthusian philosophy pioneered by a church parish Thomas Robert Malthus. Malthusians argued that high rates of population growth ruin the societies to the state of under-progress and the relationship of high fertility and poverty can only be improved by increasing the standard of living. However, Marx argued that high fertility is the indication and not a cause of poverty (Sinding, 2009). Nevertheless, many efforts have been made to understand the population-poverty nexus looking at the current situation. Population growth due to high fertility contributes to the household poverty through a number of ways like reduction in household savings, spending on health and education needs of large number of children, decrease in benefits of production due to low household savings, decrease in the participation of female labor force due to high fertility leading to low income of the household, etc. High fertility tends to reduce natural resources leaving lives of the resource dependent population at stake (MEA, 2005). Growing population strains social conditions by creating hurdles in better schooling, public order and supply of information to the people (Harte, 2007). Poverty also plays a role in the high fertility (Birdsall, 2001). Poor households are likely to have higher infant mortality which compel them to have more births to maintain the size of their family (Palloni, 1999). Moreover, women in poor households may have little access and knowledge about how to avoid unwanted pregnancies (Dreze, 2001). Women from poor household tend to have early marriage and less education which, in most of the situation, leads to high fertility (Davis,

1963). However, the population-poverty nexus is neither clear nor well recognised (McNicoll, 1999).

This paper discusses population-poverty nexus in Madhya Pradesh, one of the under-developed states of India. The population and development situation in Madhya Pradesh is amongst the poorest in the country. It is argued that poor development situation and low living standard of the people of the state are prime contributors to high fertility and high mortality in the state. At the same time, it is argued that unacceptable demographic situation in the state is a hindrance towards rapid economic progress. An analysis of population-poverty nexus is expected to provide some insight into the persistent backwardness of the state.

Population and Poverty in Madhya Pradesh

Madhya Pradesh was formed in 1956 by merging a number of former separate political bodies. As a result, no state in India is so internally diverse as Madhya Pradesh (Manor, 2002). In 2000, the erstwhile Madhya Pradesh was divided into existing Madhya Pradesh and Chhattisgarh. Madhya Pradesh, as it exists today, is the second largest state of India after Rajasthan and had 45 districts in 2001 which have increased to 50 by 2011 with Bhopal as the capital city. In 2001, the state had a population of about 60.4 million which increased to 72.6 million in 2011 with a population density of 196 persons per sq. km. Population growth in the state has always been above the national average. The vital rates namely birth rate and death rate for Madhya Pradesh have also been well above the national average currently as well as historically (Lakshmana, 2007).

Gender Disparity. Poverty has always been a stigma in India where there is a deep rooted social condition with gender discrimination as a predominant example. The situation of poverty endures because of the suppression of women and girls even though many studies have shown that when women are empowered all of the society gets benefitted but women are still being held back and are disadvantaged. Contrary to all odds and in the face of centuries of suppression, it is important to empower women to be key change agents in the process of ending poverty in the society. The women go on to make changes in their communities addressing issues such as literacy, education, water and sanitation and health. They are true ground breakers creating lasting change and promoting self-sufficiency in their communities (The Hunger Project, 2008). However it is equally true that the regions with higher gender biasedness do not necessarily overlap with regions of high poverty. The two factors may intersect but do not overlap (Agarwal, 1997). Several studies in India have shown that there is an independent relationship of poverty and deprivation with the risk for common mental disorder in women and further sources reveal that the stress associated with womanhood is the primary cause of mental disorders in women (Government of India, 2005; Kumari, 2013). As far as Madhya Pradesh is concerned, the status of women in the state is far from satisfactory but the state government is taking several initiatives to improve their standards. The female population

of the state is around 48 percent of the total population of the state. The sex ratio in the state has increased from 919 females per 1000 males in 2001 to 930 females per 1000 males in 2011. The female literacy rate in the state was 50.3 percent in 2001 which increased to 60 percent in 2011 (Tyagi et al, 2010).

Access to Education and Health. Madhya Pradesh has a complicated social structure, primarily agrarian economy and a difficult geographical landscape. These factors create several alarming obstructions to the health care service delivery system. The state government has started several initiatives to deliver health care services to the people but the health care infrastructure is lagging behind. According to the third round of the National Family Health Survey 2005-06 (NFHS-3), Madhya Pradesh is one of the poorest performing states of India in terms of nutritional status of its under five children in the urban areas. The NFHS-3 data also show that at least 51 percent of the urban women aged 15-49 years were anaemic (Mirza, 2010). It has also been observed that government run hospitals in the state face many problems like lack of basic facilities, lack of adequate staff, distant location of the hospital, etc. (Times of India, 2014). In the year 2012, more than 1,000 people died from tuberculosis in the state with 24 children dying in the Chaupai village of Sidhi district alone. The health situation is very poor in several tribal districts as several people die from malaria and tuberculosis. In Hoshangabad district, several people died due to leprosy, malaria and tuberculosis primarily because of the paucity of staff, specialists and doctors. On top of it, corruption in the health sector has plagued the health care system and its accessibility (IBN7, 2013). In the absence of sufficient insurance coverage, expenditure to treat illness can lead to economic disaster, pushing individuals or households into poverty or deepens their existing poverty (van Doorslaer et al, 2006; Wagstaff and van Doorslaer, 2003; Xu et al, 2003; Ghosh, 2011).

The role of education in reducing poverty is widely accepted but the poverty is rarely mentioned directly in policy documents on education. There are two basic similarities where poverty can be treated as a factor in education. There is a crucial demand of long term scope in education whereas poverty forces people to remain fixed in immediate or short term fears. It is difficult for children belonging to the poor families to cope up with the promptness that school demands as hunger, illness and uncertainty disturb their life back at home most of the time. Education alone cannot deal with poverty but it holds an important place among the several policies that a welfare state must adopt to loosen the grip that chronic poverty has on its victims (Kumar, 2013). The quality of education also matters a lot. Although, the state has taken a major initiative to expand the education system, yet the quality of education has not improved. The enrolment of girls is sinking as the level of education is going up. The pupil teacher ratio (PTR) and the class room-teacher ratio (SCR) are also not encouraging. Private schools are mushrooming throughout the state but there is a need to focus on higher education as the enrolment in higher and technical education is quite low. There is a need to provide better infrastructure and facilities for which the state has to increase its spending towards these sectors of education (Ray et al, 2009).

The educational development index (EDI) 2012-13 prepared by the National University of Education Planning and Administration (NUEPA) reveals that the rank of Madhya Pradesh has slipped from 26 to 28 across the states and Union Territories of the country with an EDI of 0.552. The EDI takes into account four dimensions of the elementary education system: access, infrastructure, teachers and outcomes (Josh, 2013).

Employment. About 30 percent of the state population is in the age group of 15-30 years and the employment rate in the state has declined from 39.5 percent in 2009-10 to about 36.3 percent in 2011-2012 which demands the creation of more employment in the state. A major chunk of the work force in the state is engaged in the agriculture and allied activities (73 percent) and the work force engaged in the industrial sector is just about 18 percent while the remaining work force is engaged in the service sector. Madhya Pradesh ranks ninth with just four percent share of the workforce in the industry sector in India. According to the Assocham Economic Research Bureau (AERB) there is scope to create 11 lakh new jobs in both organised and unorganised sectors in the state. The report has recommended the state government to promote non crop activities (TNN, 2014).

According to the National Sample Survey, Madhya Pradesh ranks 3rd in terms of unemployment rate (36 percent). According to the State Economic Survey 2014-15, there were over 16 lakh educated unemployed in the state. The Survey also states that by the end of 2013, over 17.5 lakh educated unemployed youth were registered in the Employment Exchanges of the state. This number decreased to 16.5 lakh in November 2014 (Santoshi, 2015)

Environmental Degradation. The link between poverty and environment is complex. Traditional environmental analysts are of the opinion that poverty is one of the primary causes of environmental degradation. They, therefore, are of the opinion that there is a negative relationship between poverty and sustainable development (Udofia, 2011) However, since the poor depend more critically on natural resources based productive activities then the non-poor, they are often seen as the cause as well as the victim of environmental degradation (Shah, 2003). Environmental degradation caused either by the poor or by the rich has both direct and indirect impact not only on the cost of production but also on the income of the poor (Nayak, 2005). The relationship between poverty and environment has led to a situation where the poor are both the victim and the cause of environmental degradation (Hope, 2007). The water pollution load in Madhya Pradesh is increasing steadily because of poor water management. The state is also reported to have faced significant decline in the forest cover. About 54 percent of the area of the state is under cultivation of which about 22 percent is under double cropping while 32 percent of the land area of the state is under forests and the rest 14 percent is barren uncultivable and cultivable wasteland. The state has 14,095 thousand hectare of degraded forests and wastelands which is about 23 percent of geographical area of the state. Districts having large areas of degraded land are Khargone (785 thousand hectare), Chhindwara (648 thousand hectare), Dhar (643 thousand hectare), Khandwa (581 thousand hectare),

Mandsaur (525 thousand hectare) and Shahdol (508 thousand hectare). The total area affected by water erosion (including open forest areas) accounts for 13,465 thousand hectare or 44 percent of total geographical area. Worst affected districts are Khargone (779 thousand hectare), Dhar (638 thousand hectare), Chhindwara (588 thousand hectare) and Shivpuri (488 thousand hectare). Some districts have areas ranging from 200 to 400 thousand hectare as degraded land. Ujjain, Balaghat, Bhind, Bhopal, Damoh, Datia, Gwalior and Tikamgarh districts have less than 200 thousand hectare of soil erosion affected areas. Soil acidity is localized, and affected districts are Mandla (216 thousand hectare), Balaghat (83 thousand hectare), Chhindwara (58 thousand hectare), Sagar (15 thousand hectare) Vidisha (13 thousand hectare). Sodic soils are found in Vidisha (28 thousand hectare), Bhind (12 thousand hectare), Morena (11 thousand hectare), and Datia (4 thousand hectare) (Indian Council of Agricultural Research, 2010).

Policy Initiatives for Poverty Reduction in Madhya Pradesh

There are a number of poverty reduction initiatives taken up by the state under the Madhya Pradesh District Poverty Initiatives Project (MPDPIP). The project was launched in 2001 and covers 2932 villages spreading over 53 development blocks of 14 districts of the state. MPDPIP aims at improving the economic well being of the people by sensitising them about the economic opportunities and by constituting community groups on the basis of common problems and interests. Funds are made available to these groups. A Project Facilitation Team (PFT) in a cluster of 25-30 villages guides the villagers and supports them with such services like technical skills, credits, etc. MPDPIP involves Panchayat Raj Institutions for budgeting and monitoring, and for contribution either in the Gram Kosh or in the maintenance fund or in the CIG fund. MPDPIP ensures that these funds are used properly.

MPDPIP is managed by the Madhya Pradesh Society for Poverty Alleviation Initiatives (MPSPAI) at the state level. MPSPAI is chaired by the Chief Minister of the state while the Minister Rural Development and Panchayat Raj is the Vice Chairperson. Members of MPSPAI include Chief Secretary, Secretaries of different departments and eminent individuals. MPSPAI guides and reviews the project periodically. MPSPAI is supported by the State Project Unit (SPU) which is headed by a senior government officer as the project coordinator (PEO, 2005). MPSPAI is the primary agency responsible for the implementation of MPDPIP.

MPDPIP has three tier organizational structure corresponding to state, district and cluster level. The State Project Unit (SPU) is responsible for the management and implementation of the project activities at the state level. There is a District Project Support Unit (DPSU) in all the 14 districts which is responsible for coordinating, managing, supervising and supporting project activities at the district level. DPSU is headed by the District Project Manager (DPM). There are about 160 PFTs spread over 14 districts. A PFT consists of five team members, each having a specialized function. One

of the experts of the PFT acts as PFT Coordinator and bears the responsibility of overall management and coordination (MPPRD, 2010)

At the district level, the Zila Panchayat District Poverty Initiatives Sub-Committee (ZPSC) has been constituted which is headed by Zila Adhyakash. Public representatives, CEO of the Zila Panchayat and representatives of PFTs, CIG members, NGOs and village PRIs are members of ZPSC. ZPSC is responsible for monitoring, distribution and use of MPDPIP funds at the district level.

At the village level, Village Development Committee (VDC) has been constituted involving CIG members and members of the village panchayat to approve projects and sub projects and to fund them. The VDC also monitors maintenance of the village level fund called Gram Kosh. One third (up to a maximum of Rs 12 lakh) of the budget under the MPDPIP is for the community infrastructure development.

Reducing Poverty and Improving Human Development

Countries where the level of poverty is relatively high are likely to reveal low values of human development thus lowering the mean values of development measures. However, the widely accepted indicators of poverty do not necessarily reflect deprivation in human development. As such, UNDP introduced the human development index (HDI) which is a composite index reflecting: 1) state of health; 2) level of knowledge; and 3) standard of living. Although there are many criticisms of HDI, yet it provides a reasonable picture of how well different countries are performing beyond mere increase in income. Countries that rank at the bottom in terms of HDI also have high Human Poverty Index (HPI). If a country has low HDI despite high per capita income then this means that economic growth is not being translated into human development. If both HDI and HPI are high then this means that human development achievements are not being satisfactorily shared by those at the bottom. Preferably, HDI should be high while HPI should be low (Fosu, 2007).

Madhya Pradesh is the sixth most populous state of India and accounts for about six percent of India's population. Nearly 48.6 percent of the population of the state is estimated to be living below the poverty line - 53.6 percent in the rural areas and 35.1 percent in the urban areas. In terms of the Multidimensional Poverty Index (MPI), about 68.1 percent of the state population is poor. The situation of the poor is further compromised by insignificant and low productivity land holdings, regular droughts, insecure land possession and dependence on seasonal agricultural and forest labour. Poverty, in such environment, manifests in many ways. Madhya Pradesh is among the most food insecure states of the country. In terms of the Hunger Index, Madhya Pradesh falls in the "extremely alarming" category. According to NFHS-3, the state has one of the lowest nutrition and health indicators in the country. More than 40 percent of the women of the state has a Body Mass Index (BMI) less than 18.5. The state has the highest

percentage of underweight children below five years of age (60 percent) and the second highest infant mortality rate (62 infant deaths per 1000 live births) in the country. The population sex ratio has increased in the state since the 2001 population census, yet it is still below the national average. On the other hand, the child sex ratio has declined by 20 points during the decade 2001-2011. The effective literacy rate in the state was 70.6 percent at the 2011 population census which was less than the national average of 74.0 percent. The HDI in the state (0.375) is also well below the national average of 0.467 (UNDP, 2011).

Conclusions

Neo-classical economists have argued that the process of development involves changes in the individual income over time. However, income measures cannot satisfactorily reveal development as per-capita income does not satisfactorily compares with measures of human development such as life expectancy, child/infant mortality and literacy. To address this challenging situation, government involvement is needed at the right time in the right place. The prevailing situation in Madhya Pradesh demands precise government interventions and associated responsibilities. This is possible only if the people at large are made aware adequately of how they can reduce the poverty which in turn raises the socio-economic standards of the public. If the people en-mass become sensible, then it is possible to make them responsible to a significant extent. Government actions can only be lucid if the people - the receiver - are aware and knowledgeable of their rights and how they can upgrade their life in a decent way.

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Table 1
Key indicators of reproductive health in madhya Pradesh and India

SN	Indicator	Madhya Pradesh	India
1	Place of delivery (Percent)		
	1. Public hospital	38.4	26.4
	2. Private hospital	8.5	20.5
	3. Home but attended by SBA	3.1	5.6
	4. Home but not assisted by trained health person	50.1	47.5
2	Mean out of pocket expenditure on delivery (US$)	30	44
3	SDPP (US$)	385	671
4	Registered allopathic doctors per one lakh population	47	89
5	Per capita Public expenditure in health 2004-05 (US$)	3	5
6	Women who experienced pregnancy complications (Percent)	46.3	45.6

Source: (Mohanti and Srivastava, 2013).

Table 2
Selected demographic indicators, 2013 - Madhya Pradesh and India

SN	Indicator	Madhya Pradesh	India
1	Crude birth rate	26	21
2	Total fertility rate	2.9	2.3
3	Crude death rate	8	7
4	Infant mortality rate	54	40
5	Neonatal mortality rate	36	28
6	Post neonatal mortality rate	27	13
7	Under-five mortality rate	69	49

Source: Sample Registration System

Table 3
Education development index (EDI) in Madhya Pradesh, 2013-14

Year	EDI	Access	Infrastructure	Teachers	Outcomes
			Primary		
Index	0.559	0.239	0.779	0.433	0.735
Rank across states	24	15	16	30	15
			Upper Primary		
Index	0.479	0.321	0.750	0.237	0.707
Rank across states	34	22	16	34	19
			Elementary (Primary+Upper Primary)		
Index	0.519				
Rank across states	31				

Source: Government of India (2014).

Table 4
Poverty in Madhya Pradesh

SN	Particulars	2004-05	2009-10	2011-12
			Rural population	
1	Number of poor	25440	21690	19095
2	Percentage poor	53.60	42.00	35.74
3	Poverty line	408.41	631.90	771.00
			Urban population	
1	Number of poor	6130	4490	4310
2	Percentage poor	35.10	22.90	21.00
3	Poverty line	532.26	771.70	897.00
			Combined population	
1	Number of poor	31570	21680	23406
2	Percentage poor	48.60	36.70	31.65

Source: Planning Commission.

Table 5
Prevalence of poverty in regions of Madhya Pradesh

Region	Rural		Urban	
	2004-05	2009-10	2004-05	2009-10
Vindhya	59.7	61.5	28.3	37.7
Central	64.5	43.2	36.6	28.2
Malwa	42.1	17.3	28.6	4.6
South	64.5	56.7	39.6	32.7
South-western	53.2	58.2	39.0	27.5
Northern	40.1	21.7	44.5	27

Source: Mishra (2014)

Table 6
Human development in Madhya Pradesh and India

Human Development Indicators	Madhya Pradesh	India
Human Development Index (HDI), 2007-08	0.375	0.467
HDI Rank (out of 23)	20	
Gender Related Development Index (GDI) 2006	0.516	0.59
GDI Rank (out of 35)	33	22
Gender Empowerment Measure (GEM) 2006	0.463	0.497
GEM Rank (out of 35)	21	
Inequality Adjusted Human Development Index (IHDI) 2006	0.29	0.343
IHDI Rank (out of 19)	19	
Loss in HDI due to Inequality (Percent)	35.74	32
Literacy Rate (Percent)	70.63	74.04
Male Literacy Rate (Percent)	80.53	82.14
Female Literacy Rate (Percent)	60.02	65.46

Source: UNDP (2011).

Table 7
Multidimensional poverty in Madhya Pradesh and India

SN	Indicator	Madhya Pradesh	India
1	Percentage of population	6.5	100
2	Multidimensional poverty index	0.374	0.283
3	Incidence of poverty	68.1	53.7
4	Average intensity across the poor	54.9	52.7
5	Population vulnerable to poverty	14.2	16.4
6	Population in severe poverty	40.5	28.6
7	Destitutes	42.7	28.5
8	Inequality among MPI poor	0.249	0.234

Source: Alkaire et al, (2015).

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Levels and Socio-economic Determinants of Caesarean Section Delivery in Northeast and EAG States of India

Evidence from National Family Health Survey

Ajay Gupta

Introduction

The increase in caesarean section (C-section) delivery rates in recent years has made it the most performed surgical procedure in hospitals throughout the world. A C-section is medically indicated when there is a significant risk of adverse outcome for the mother or the child if the operation is not performed at the given time and for unknown medical indications such as 'failure to progress' in labour, breech presentation, multiple births, etc. (Penna and Arulkumaran, 2003). However use of C-section for non-medical and unknown medical reasons is increasing throughout the world, and concerns are growing for the alarming increase in unnecessary C-section deliveries (Potter et al, 2001; Matthews et al, 2003; Sufang et al 2007; Laws et al, 2007; MacDorman et al, 2008; Gibbons et al, 2012). According to Villar et al (2007). Unnecessary C-section can increase the risk of maternal morbidity, neonatal death and neonatal admission to an intensive care unit. World Health Organization has suggested that C-section rate should be at the most 10-15 percent of all deliveries (WHO, 1985). Although, the optimum level of C-section rate is a matter of debate, yet C-section rate in many developed and developing countries is already well above the threshold proposed by WHO. Obstructured labour is one of the major pregnancy complications (WHO, 2005; Kvale et al, 2005) and it is accepted that if obstruction is not overcome by manipulation then C-section is needed (Abouzahr, 2003). However, poportion of C-section rate of more than 10 percent may not be helpful in reducing maternal mortality. On the other hand, a C-section rate of more than 15 percent may be associated with additional mortality and morbidity (Althabe et al, 2006, Betran et al, 2007). A C-section rate of at least 5 percent is thought to be necessary to save the life of many mothers and neonates (WHO, 2009) while C-section rate less than 1-2 percent is thought to reflect a real inadequacy in the provision and hence access to

obstetric care (De Brouwere et al, 2002) specially among the poorer regions of the world such as Sub-Saharan Africa where many women die during childbirth (Rosmans et al, 2006).

The situation in India is not different from other developing countries. A study by Kabra and others (1994), in a leading private hospital in the city of Jaipur, found that C-section rate increased from 5 percent in 1972 to 19.7 during 1980-85. Mishra and Ramanathan (2002) using data from India's National Family Health Survey, 1992-93, found the C-section rate to be more than 15 percent in Goa and Kerala. In Chennai city, C-section rate was reported to be 45 percent of all live birth, based on reporting by mothers of 210 children aged 12-36 months, a level which is extremely difficult to justify (Pai et al.,1999). In a retrospective study over a period of five years in a postgraduate institute in West Bengal, Pahari and Ghosh (1997) found that half of the deliveries were C-section deliveries, out of which about 58 percent were elective and only 41 percent were emergencies. Kambo and others (2002) analysed data from 30 medical/teaching hospitals in the country over a period of five years. They found that C-section rate increased from 21.8 percent in 1993-94 to 25.4 percent in 1998-99. Sreevidya and others (2003) found that the C-section rate in the Madras city (Chennai) was as high as 32.6 percent. In a maternity hospital in Mumbai, C-section rate rose ten-fold during 1957-1998 and no improvement in perinatal outcome could be observed beyond a C-section rate of 10 percent (Mehta et al, 2001).

Although C-section rate is increasing throughout the world, yet reasons for the increasing trend in these rates are not clear. Many studies give medical explanations for the increase (Nassar et al, 2006) while others suggest demographic, socio-economic, institutional and physicians' factors. High C-section rates are found to be associated with the availibility of facilities and trained obsetricians (Kabra et al, 1994). Increase in institutional deliveries is one of the main factors behind the increase in C-section rate. C-section rate is reported to be higher in private health institutions as compared to public health institutions because of the profit earning orientation of the private sector (Chacham and Perpetuo, 1998; Padmadas et al, 2000). The physicians' factors affecting C-section include physician's practice style, fear of litigation and physician's convience (Belizan et al, 1991, Gomes et al, 1999). Request of elective C-section has recently emerged as an important reason behind the increase in the C-section rate in the world (MacDorman et al, 2008). Demographic factors such as mother's age at the time of delivery, parity, size of the child and body mass index also influence C-section rate (Padmadas et al, 2000; Schiff and Rogers, 1999). On the other hand socio-econimic factors such as place of residence, woman's educational level and standard of living are found to be related to C-section rate (Chachan and Perpetuo, 1998). More number of visits for ANC are also found to be associated with the higher level of C-section rate (Bahugue et al, 2002). In India, another factor which influences the C-section rate is the patient demand for C-section to give the birth according to the astronomical calender at the predetermined time (Kabra et al, 1994).

The aim of the present paper is to examine the level and the trend in the C-section rate in the north-eastern (NE) states and in Empowered Action Group (EAG) states of India where maternal mortality ratio continues to be well above the national average and where obstetric care facilities remain far from satisfactory. Another objective of the paper is to explore different demographic and socio-economic determinants of C-section in this part of the country.

Data

The paper is based on the data available from the three rounds of the National Family Health Survey (NFHS): NFHS-1 (1992-93), NFHS-2 (1998-99) and NFHS-3 (2005-06). C-section delivery has been listed in these surveys as one of the several self-reported delivery/pregnancy related complications associated with the most recent live or still birth that occurred during the four years preceding the survey. There exists no systematic bias in retrospective reports from mothers regarding the C-section deliveries in NFHS as it is very unlikely that a vaginal delivery will be misreported as C-section delivery or vice-versa (Padmadas et al, 2000). The study covers seven north eastern states - Assam, Manipur, Megahalaya, Mizoram, Nagaland, Arunachal Pradesh and Tripura and five EAG states - Bihar, Madhya Pradesh, Uttar Pradesh, Orissa and Rajasthan. Data pertaining to Uttranchal, Jharkhand and Chhatisgarh from NFHS-3 has been merged respectively with Uttar Pradesh, Bihar and Madhya Pradesh so that NFHS-3 data are comparable with the data available through NFHS-2 and NFHS-1.

Methodology

The study variable used in the present analysis is a dichotomous variable which is equal to "zero" in case a delivery is not a C-section delivery and "one" in case of a delivery is a C-section delivery. In order to analyse demographic, socio-economic and institutional correlates of C-section delivery, a number of variables were selected as explanatory variables. Demographic variables included woman's age at the time of birth, parity, size of the child and body mass index (BMI). Socio-economic variables, on the other hand included place of residence, educational level of the woman, standard of living, woman's working status, religion and caste. Finally, institutional factors included place of delivery and antenatal care (ANC) visits. All the explanatory variables were tested for association with the dependent variable on the basis of bivariate correlation coefficient and only those variables were retained for further analysis which were found to be statistically significant

The second stage of analysis comprised of regressing the dependent variable on the explanatory variables using the logistic regression model. The analysis was carried out for the country as a whole and separately for the North Eastern (NE) states and EAG states of the country. The influence of factors such as religion, working status and caste was also controlled during the analysis.

Results

Table 1 shows the distribution of women by their background characteristics. About 40 percent women surveyed were less than 21 years and more than 34 years of age. This proportion was respectively 46 and 40 percent for NE States and EAG states. Women with parity one in India, NE and EAG states were 32, 30 and 27 percent respectively. More than half of the newborn were of normal size in India and in EAG states but 48 percent in NE states. The proportion of women who were overweight was about 18 percent in India; 17 percent in NE States but only 12 percent in EAG states. In India as well as in NE and EAG states, more than 60 percent women were residing in the rural areas. Almost 50 percent women in India had either no education or primary education whereas this proportion was 63 percent in EAG states. In India, the standard of living was low in 24 percent women but high in 38 percent women. In NE states, 26 percent women had low standard of living while the standard of living was high in 29 percent women. Similar proportions were found in EAG states also. More than 70 percent women were not working in India and EAG states while this proportion was about 63 percent in NE states. Majority of women were Hindus (69 percent) compared to Muslims (17 percent) and others (14 percent) in India. In EAG states, almost 82 percent women were Hindus whereas in NE states, about 55 percent women belonged to other religions. Majority of women in India and in EAG states were non Scheduled Castes/Tribes but more than half of the women in NE states were Scheduled Tribes. More than 46 percent women had not visited any antenatal care facility during their most recent birth in India. This proportion was 50 percent in both EAG and NE states.

Table 2 represents the level and the trend in C-section rate in India and in NE and EAG states. According to NFHS-3, the C-section rate in India was about 10 percent of all deliveries but only 6 percent in north eastern and central part of India. The C-section rate was quite high in southern (21.5 percent) and western part (15 percent) of India whereas the North and the East region of the country had a C-section rate of 9.6 percent and 7.9 percent respectively. Among the NE states, Tripura had the highest (12.3 percent) of C-section rate while Arunachal Pradesh has the lowest (2.7 percent). The proportion of women who have undergone caesarean in EAG states was about 5.4 percent - highest in Uttar Pradesh and Madhya Pradesh (6 percent) but only 4.1 percent in Bihar and Rajasthan.

In India, C-section rate has increased from 2.8 percent in 1992-93 to 6.7 percent in 1998-99 and 10 percent in 2005-06 – an increase of about 7.2 percent points in 13 years. Among the NE states, the increase in C-section rate has been the highest in Manipur and Tripura where it increased by almost 9 percent points between 1992-93 and 2005-06 but decreased in Arunachal Pradesh and Mizoram primarily between 1998-99 and 2005-06. In EAG states, C-section rate increased from 0.8 percent in 1992-93 to 5.4 percent in 2005-06. In Madhya Pradesh and Uttar Pradesh, there has been ten-fold increase in the C-section rate but the increase in Bihar and Rajasthan has been relatively slow.

Table 3 shows C-section rate by selected background characteristics of women. C-section rate is high in women aged 21-34 years compared to women aged less than 21 years and women aged more than 34 years. C-section rate is high in primipara women compared to multipara and grand multipara women. C-section rate does not appear to be associated with the size of the new born. C-section rate is higher in overweight women compared to normal weight women. Rural-urban difference in C-section rate is very wide in India and in NE and EAG states. Similarly, C-section rate is high in highly educated women compared to illiterate women or women having less than five years of education. C-section rate does not appear to be related to religion of the woman but it is high in other castes compared to Scheduled Castes and Scheduled Tribes. The prevalence of C-section is very high in the private sector compared to the public sector. Moreover, the higher is the number of visits for antenatal checkup, the higher is the probability of a C-section delivery.

Results of the logistic regression analysis are presented in tables 4, 5 and 6 separately for India, NE states and EAG states. In India, multiparous and grand multiparous women are less likely to have a C-section delivery as compared to primiparous women. On the other hand, educated women and women living in the urban areas have a higher probability of having a C-section delivery as compared to illiterate women and women living in the rural areas. In both NE and EAG states, the probability of a C-section delivery is statistically significantly less in multi and grand multi-parous women compared to primi-parous women. Similarly, the probability of C-section delivery is statistically significantly higher in over-weight women compared to under-weight women in both groups of states. The table also confirms that the probability of a C-section delivery is higher when the place of delivery is a private health institution as compared to when the place of delivery is a public health institution. On the other hand, the effect of residence has not been found to be statistically significant in NE states but found to be statistically significant in EAG states. The chance of a C-section delivery in urban areas of EAG states is more than 40 percent higher than the probability of C-section delivery in the rural areas. Similarly, the chance of a C-section delivery in NE states is at least 70 percent higher in women having at least high school education than women having less than five years of education. In EAG states, education of women does not appear to have any impact on the probability of a C-section delivery.

Summary and Conclusions

The analysis reveals that C-section rate in both NE and EAG states is well below the WHO threshold and lower than the national average, although the rate has shown an increasing trend over time. The C-section rate of less than five percent still prevails in Bihar and Rajasthan among EAG states and Nagaland and Arunachal Pradesh in NE states. It appears that these states suffer from the lack of necessary health facilities to meet the surgical obstetrics needs of pregnant women.

The analysis also reveals that C-section rate is significantly higher in private sector as compared to the public sector. Similar results have been obtained in other studies conducted in India (Padmadas et al, 2000; Mishra and Ramanathan, 2002). Similarly, the fact that C-section rate is higher in urban than in rural areas is also supported by other studies (Sreevidya et al (2003), Ghosh and James (2010)).

C-section rate is found to be higher in women aged more than 34 years and less than 21 years in NE states and in India as a whole. This finding is consistent with earlier studies (Rosenthal and Paterson-Brown, 1998; Padmadas et al, 2000). It is because as the age at birth increases, pregnancy related complications also increase. On the other hand, women below 21 years of age are more vulnerable to C-section due to fear and possibly due to familial pressure. Women with at least 10 years of schooling have higher probability of C-section in NE states and in India. This finding is also consistent with earlier studies as well (Chacham and Perpetuo, 1998). The frequency of antenatal care visit is significantly associated with the level of the C-section rate. This result confirms the findings reported by Leone et al (2008) and Mishra and Ramanathan (2002) that more are the antenatal care visits the higher is the probability of a C-section delivery.

Although, C-section rate in India appears to be low in comparison to other developing countries, yet total number of C-section deliveries in India may be very large because India is the second most populous country of the world. The very fact that C-section rate is very high in the private sector needs further investigation as there may be a possibility that this life saving procedure is being misused for earning profits. On the other hand, low C-section rates in some NE and EAG states reflect a real inadequacy in access to obstetric care.

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Table 1
Distribution of sampled women by background characteristics, NFHS-3

Background characteristics	India		North East		EAG States	
	Percent	N	Percent	N	Percent	N
Mothers age at birth						
<21 &>34 years	39.9	21764	46.4	4518	40.5	8784
21-34 years	60.1	32802	53.6	5215	59.5	12926
Parity						
1	32.3	17619	30.0	2922	27.0	5853
2+	67.7	36947	70.0	6811	73.0	15857
Child Size						
Large	21.1	11533	22.2	2157	17.2	3739
Average	52.7	28733	48.6	4734	57.1	12393
Small	19	10380	18.2	1772	20.2	4385
Body Mass Index						
Thin	37.7	20582	27.1	2638	45.2	9819
Normal	40.5	22096	53.0	5158	39.0	8468
Over Weight	17.8	9686	17.3	1684	12	2597
Residence						
Rural	62.3	33979	66.6	6482	68.4	14855
Urban	37.7	20587	33.4	3251	31.6	6855
Education						
<5 years	48.6	26520	43.8	4266	63.2	13713
5-9 years	29.4	16042	37.1	3607	22.3	4838
10+	22.0	12003	19.1	1859	14.6	3159
Standard of living						
Low	23.7	12951	26.4	2565	30.7	6664
Medium	31.7	17313	39.5	3842	31.0	6731
High	35.7	19458	28.8	2806	28.5	6194
Mother Working						
No	70.4	38422	62.8	6117	70.9	15382
Yes	29.4	16026	37.0	3599	29.0	6292

Background characteristics	India		North East		EAG States	
	Percent	N	Percent	N	Percent	N
Religion						
Hindu	68.7	37448	33.0	3204	81.9	17764
Muslim	16.7	9079	12.5	1214	15.7	3406
Other	14.6	7983	54.5	5299	2.4	510
Caste						
Schedule Castes	18.3	9633	8.0	728	20.6	4472
Schedule Tribes	17.0	8977	54.1	4939	11.7	2536
Others	64.7	34055	38.0	3466	67.7	14698
Place of delivery						
Public	22.1	12064	23.9	2324	11.7	2535
Private	20.2	11029	8.4	817	15.4	3354
Other	52.0	28391	60.1	5847	68.0	14755
Ante natal care visits						
No	45.7	24935	51.6	5025	53.7	11668
Some	14.0	7641	13.5	1312	19.2	4161
Full	40.3	21990	34.9	3396	27.1	5881

Source: Author's calculations

Table 2
Levels and trends in C-section rates in India, Northeast and EAG states

State/Region/Country	C-section delivery rate		
	1992-93	1998-99	2005-06
India	2.8	6.7	10.0
Regions			
North	2.7	6.0	9.6
Central	0.6	2.7	6.0
North East	1.8	4.4	5.9
East	1.7	5.6	7.9
West	5.2	9.7	14.9
South	6.7	15.3	21.5
North East States	1.8	4.4	5.9
Assam	2.2	4.5	6.3
Manipur	0.2	4.4	9.2
Meghalaya	2.3	2.4	5.1
Mizoram	2.6	9.6	5.5
Nagaland	1.1	1.5	2.8
Arunachal Pradesh	0.9	4.3	2.7
Tripura	3.0	4.3	12.3
EAG States	0.8	3.0	5.4
Bihar	1.0	2.8	4.1
Madhya Pradesh	0.8	2.9	6.0
Orissa	1.4	4.7	5.8
Rajasthan	0.6	3.0	4.1
Uttar Pradesh	0.6	2.6	6.0

Source: Author's calculations

Table 3
C-section rates (Percent) by background characteristics
India, North East and EAG states, 2005-06

Background characteristics	India	North East states	EAG states
Mothers age at birth			
<21 &>34yrs	9.1	6.6	4.6
21-34 years	10.7	5.3	6
Parity			
1	16.5	10.4	10.8
2+	7.0	4	3.4
Child Size			
Large	12.9	8.4	7.1
Average	10.3	5.8	5.4
Small	9.5	6.7	5.5
Body Mass Index			
Underweight	5.4	3.4	2.9
Normal	8.5	4.5	4.8
Over Weight	22.6	13.7	16.2
Residence			
Rural	5.9	3.6	2.4
Urban	16.9	10.7	12
Education			
<5 years	3.3	1.8	2
5-9 years	10.5	4.9	6.8
10+	24.2	17.6	18.4
Standard of living			
Low	2.6	1.2	1.3
Medium	5.9	3.7	2.9
High	18.2	13.4	12.4
Mother Working			
No	11.2	6.1	6.4
Yes	7.3	5.7	3

Background characteristics	India	North East states	EAG states
Religion			
Hindu	10.6	10.9	5.4
Muslim	9	3.3	5.1
Other	8.8	3.6	7.1
Caste			
Scheduled Castes	7.6	6.3	3.5
Scheduled Tribes	3.7	3.9	1.3
Others	12.2	9.0	6.7
Place of Delivery			
Public	18.1	15.8	12.8
Private	29.9	25.9	25.5
Ante natal care visits			
No visit	4.6	2	2.6
Some	3.8	2.5	3.1
Full	18.4	13.0	12.7
Total	10.0	5.9	5.4
N	54566	9733	21710

Source: Author's calculations

Table 4
Result of the logistic regression analysis for India, 2005-06

Background characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Mother's age at birth			
<21 & >34 yrs®			
21-34years	1.269** (1.191,1.351)	0.970 (0.905,1.039)	0.925** (0.861,0.994)
Parity			
1®			
2+	0.365** (0.343,0.387)	0.523** (0.489,0.559)	0.636** (0.593,0.683)
Child Size			
Large®			
Average	0.796** (0.742,0.855)	0.780** (0.722,0.843)	0.852** (0.786,0.924)
Small	0.788** (0.719,0.863)	0.939 (0.850,1.037)	0.963 (0.869,1.068)
Body Mass Index			
Thin®			
Normal	1.623** (1.501,1.754)	1.289** (1.184,1.403)	1.218** (1.114,1.332)
Over Weight	4.161** (3.768,4.587)	2.635** (2.409,2.882)	2.050** (1.866,2.251)
Residence			
Rural®			
Urban		1.692** (1.577,1.816)	1.104** (1.026,1.189)
Education			
<5 years®			
5-9 years		1.992** (1.805,2.198)	1.145** (1.032,1.271)
10+		3.380** (3.046,3.751)	1.447** (1.297,1.615)

Background characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Standard of living			
Low®			
Medium		1.458** (1.274,1.668)	1.019 (0.883,1.176)
High		2.316** (2.023,2.652)	1.181 (1.023,1.363)
Place of Delivery			
Public®			
Private			1.544** (1.438,1.659)
Ante natal care Visits			
No Visits®			
Some			1.072 (0.914,1.257)
Full			1.553** (1.427,1.691)

** p<0.05. ® reference category of independent variables.
Source: Author's calculations

Table 5
Results of the logistic regression analysis for North East states, 2005-06

Background characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Mother's age at birth			
<21 & >34 yrs®			
21-34years	0.824** (.690,0.985)	0.722** (0.596,0.871)	0.720** (0.590,0.880)
Parity			
1®			
2+	0.349** (0.292,0.418)	0.462** (0.382,0.560)	0.615** (0.502,0.755)
Child Size			
Large®			
Average	0.720** (0.586,0.883)	0.823 (0.661,1.024)	0.924 (0.736,1.160)
Small	0.866 (0.671,1.119)	1.132 (0.853, 1.489)	1.160 (0.870,1.547)
Body Mass Index			
Thin®			
Normal	1.395** (1.086,1.793)	1.110 (0.853,1.444)	1.068 (0.811,1.406)
Over Weight	3.792** (2.701,5.023)	2.342** (1.768,3.103)	2.010** (1.491,2.709)
Residence			
Rural®			
Urban		1.440** (1.177,1.760)	0.924 (0.752,1.135)
Education			
<5 years®			
5-9 years		1.524** (1.127,2.061)	0.975 (0.711,1.338)
10+		3.653** (2.669,4.998)	1.701** (1.227,2.358)

Background characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Standard of living			
Low®			
Medium		2.170** (1.429,3.294)	1.283 (0.828,2.430)
High		4.045** (2.638,6.201)	1.544 (0.994,2.430)
Place of Delivery			
Public®			
Private			1.277** (1.025,1.592)
Ante natal care visits			
No Visit®			
Some			1.174 (0.757,1.819)
Full			1.721** (1.331,2.226)

** p<0.05. ® reference category of independent variables.
Source: Author's calculations

Table 6
Results of the logistic regression analysis for EAG states, 2005-06

Back Ground Characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Mothers age at birth			
<21 & >34 years®			
21-34 years	1.570** (1.372,1.796)	1.073 (0.924,1.245)	1.040 (0.889,1.217)
Parity			
1®			
2+	0.267** (0.235,0.304)	0.402** (0.348,0.464)	0.537** (0.462,0.624)
Child Size			
Large®			
Average	0.746** (0.637,0.874)	0.691** (0.581,0.821)	0.767** (0.639,0.921)
Small	0.835 (0.688,1.012)	0.927 (0.750,1.146)	0.920 (0.736,1.150)
Body Mass Index			
Thin®			
Normal	1.649** (1.410,1.929)	1.306** (1.101,1.548)	1.160** (0.969,1.388)
Over Weight	5.268** (4.325,6.377)	2.619** (2.170,3.162)	2.088** (1.710,2.549)
Residence			
Rural®			
Urban		2.609** (2.223,3.061)	1.407** (1.184,1.672)
Education			
<5 years®			
5-9 years		1.915** (1.574,2.330)	1.181 (0.958,1.458)
10+		2.995** (2.430,3.691)	1.131 (0.909,1.427)

Back Ground Characteristics	Odds Ratio		
	Model 1	Model 2	Model 3
Standard of living			
Low®			
Medium		1.401** (1.068,1.837)	0.950 (0.710,1.273)
High		2.388** (1.819,3.135)	0.986 (0.736,1.321)
Place of Delivery			
Public®			
Private			1.838** (1.566,2.158)
Ante natal care visits			
No Visits®			
Some			1.306** (1.010,2.158)
Full			1.565** (1.315,1.861)

** $p<0.05$; ® reference category.

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Heavy Burden of Diarrhoea Among Children Under Five Years of Age in Bihar

Rajiv Ranjan

Introduction

About 2.1 million children below five years of age die every year in India. This number is the highest for a single country worldwide (UNICEF, 2004). The under-five mortality rate in India is estimated to be is around 49 deaths per 1000 live births during 2013 (Government of India, 2014). There is however significant variation in the risk of death in the first five years of life within the country. The under-five mortality rate in the rural areas of the country is almost twice the under-five mortality rate in the urban areas. There is also wide variation across states with the under-five mortality rate ranging from 12 per 1,000 births in Kerala to 73 per 1000 live births in Assam. Attaining the Millennium Development Goal - Reduce Child Mortality - for India would imply a reduction in the under-five mortality rate to 41 deaths per 1000 live births by the year 2015. The latest country report on Millennium Development Goals, however suggest that India will be missing this target (Government of India, 2015).

There has however been a substantial decrease in child mortality in India in the past. The reduction in child mortality was more marked during the 1980's than during the 1990's (Claeson et al, 2000) but appears to have picked up again during the first decade of the current century (Government of India, 2015). Despite these impressive gains, India compares poorly in terms of the rate of the decrease in child mortality with several other countries in south and south-east Asia including Bangladesh. An accelerated reduction in child mortality continues to be a major development challenge for India as under-five mortality rate is regarded as perhaps the most sensitive indicator of social and economic progress.

Pneumonia and diarrhoea are the leading killers of the world's youngest children, accounting for 29 percent or more than 2 million deaths of children below five years of age worldwide every year. These premature deaths are concentrated heavily in the poorest regions and countries of the world and among the most disadvantaged children within these societies. Nearly 90 percent of deaths due to pneumonia and diarrhoea occur in sub-Saharan Africa and South Asia (UNICEF, 2012). Diarrhoea is a major cause of illness and death among young children in India (Government of India, 1998). It is estimated that at

least 257,000 children below five years of age die every year from diarrhoea in India with approximately half of these deaths occurring in the EAG states (Chow et al, 2007). India is one of the 10 countries of the world where mortality due to diarrhoea is very high (Lie et al, 2012).

Both pneumonia and diarrhoea have long been regarded as diseases of poverty and are closely associated with such factors as poor home environment, under-nutrition and lack of access to essential services. Deaths due to these diseases are largely preventable through such simple approaches as optimal breastfeeding practices and adequate nutrition, vaccination, hand washing with soap, safe drinking water, basic sanitation, etc. The main immediate cause of death during diarrhoea is dehydration. Most of the diarrhoeal deaths among children can be prevented through continued feeding and increasing the fluid intake (WHO, 1995).

In order to reduce mortality from pneumonia and diarrhoea, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) had launched the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) in 2013. This action plan outlines key interventions that should be universally adopted, with the goal of ending preventable pneumonia and diarrhea mortality in children by the year 2025. GAPPD sets forth coverage targets of 90 percent for vaccination, 90 percent for access to treatment of pneumonia and diarrhoea, and 50 percent for exclusive breast feeding of children during their first six months of life (WHO, 2013). India and Nigeria - the two countries with the highest and the second highest burden of child mortality from pneumonia and diarrhoea - continue to have low overall GAPPD intervention scores - 33 percent and 22 percent respectively.

It is estimated that deaths from diarrhoea account for approximately 13 percent of total deaths of children below five years of age ( ). Use of low osmolarity ORS and zinc for treatment of childhood diarrhoea has been recognized as the global strategy to prevent deaths from diarrhoea by WHO and UNICEF. The Government of India has issued guidelines on the use of Zinc for the treatment of childhood diarrhoea way back in 2007 on the basis of the recommendations of the Indian Academy of Pediatrics in 2003. In recent years, Zinc has been included in the 'National List of Essential Medicines' and in Indian Pharmacopeia. Zinc has also been given the status of over-the-counter (OTC) drug.

Zinc supplementation in the oral rehydration therapy for the treatment of diarrhea has been proved to be safe and effective in numerous studies in children 6 to 59 months of age (The Zinc Investigators' Collaborative Group, 1999; 2000). Zinc has been found to decrease the duration of the episode in both acute and persistent diarrhoea (Black et al, 2003). Zinc treatment has also been found to decrease the severity of diarrhoea episode in terms of reducing the number of stools per day,(Sazawal, 1995; Sachdev, 1990; Al-Sonboli, 2003), the volume of stools (Dutta et al, 2000; Khatun et al,2001; Bhatnagar et al, 2004) and the number of episodes of diarrhoea lasting beyond 7 days (Faruque et al, 1999; Sazawal et al, 1995).

Estimates of the prevalence of diarrhoea among children in India are available through national surveys like the National Family Health Survey (IIPS,), the District Level Health and Facility Survey (IIPS,)and the Annual Health Survey (Government of India,). In addition, cases of diarrhoea treated at the public health institution are reported through the Health Management Information System (HMIS) of the Government of India. However, reporting of diarrhoea cases treated in the public health institutions through HMIS is only a small proportion of the estimated diarrhoea cases in the country and the extent of reporting varies across states and Union Territories.

This paper has two objectives. The first objective of the paper is to assess the extent of reporting of diarrhoea cases treated at the public health institutions in India and to measure the gap between the estimated and reported cases of diarrhoea treated in the public health institutions in India and states on the basis of HMIS. The second objective, on the other hand, is to present achievements of the Childhood Diarrhoea Management Programme of launched by the Government of Bihar. Bihar is the only state in the country where the reporting of diarrhoea cases treated in the public health institutions is found to be more than 80 percent and this signal achievement may be attributed to the success of the Childhood Diarrhoea Management Programme which has focussed on building the capacity of the field level workers (FLWs) in assessing, treating and referring cases of diarrhoea through a comprehensive training programme.

Data and Method

The paper is based on the data available through HMIS. HMIS is the routine reporting system of India's public health care delivery system. It captures data pertaining to services delivered and reporting of cases through progress reports of different public health care delivery institutions - district hospital, other hospital, community health centre, primary health centre, health sub centre. HMIS is essentially a reporting system which is based on the reports provided by the grass roots level health services providers. The reference period for the present analysis is November 2013 through October 2014.

The methodology adopted in the present paper involves application of the ratio method and uni-variate analysis. The ratio method has been used to estimate expected number of diarrhoea episodes in one year. The National Commission on Macroeconomics and Health (NCMH) constituted by the Government of India has estimated average diarrhoeal episodes of 1.71 per year per child below five years of age (Government of India, 2005). Using this ratio as the norm, estimated number of diarrhoeal episodes in a year has been estimated for the country and for its constituent states. The estimated number of diarrhoea episodes so obtained has then been compared with the number of diarrhoea cases being reported in HMIS to estimate the gap between the estimated number of diarrhoea cases and the number of cases reported through HMIS to measure the reach of HMIS in reporting the cases of diarrhoea can be ascertained as far as the treatment of diarrhoea is concerned.

Results and Discussion

Table 1 depicts the number of diarrhoeal cases in children below five years of age captured in HMIS during the period November 2013 to October 2014 along with the estimated number of diarrhoea episodes in one year. These estimates have been derived on the basis of the diarrhoea episode rate of 1.71 episodes per year per child as worked out by the National Commission on Macroeconomics and Health (NCMH). The total number of diarrhoea cases reported under HMIS in India during the period under reference was around 4.8 million against the estimated number of diarrhoeal episodes of around 199 million according to the norms laid down by NCMH. This means that HMIS could capture only about 2.4 percent of estimated diarrhoea episodes in India during the period under reference. Reporting under HMIS has however not been uniform across all states and Union territories of the country, although reporting has never been more than 15 percent of the estimated diarrhoea episodes in any state or Union Territory of the country. Reporting of diarrhoeal episodes under HMIS is found to be relatively the highest in Meghalaya where almost 13 percent of the estimated diarrhoea episodes were reported in HMIS to Punjab where less than 0.4 percent of the estimated diarrhoea episodes could be reported in HMIS. Besides Meghalaya, Sikkim and Daman and Diu are the only other states and Union Territories of the country where at least 10 percent of the estimated diarrhoea episodes have been reported under HMIS. By contrast, in seven states and Union Territories, number of diarrhoea cases reported in HMIS is found to be less than one percent of the estimated diarrhoea episodes. One reason for this variation in the number of diarrhoea cases reported in HMIS may be the inter-state variation in diarrhoea episodes rate as compared to the national average estimated by NCMH. However, state level estimates of diarrhoea episodes rate are not available to examine this variation and to analyse how this variation has influenced reporting of diarrhoea cases under HMIS.

It may however be pointed out that only a proportion of total children with diarrhoea opt for diarrhoea treatment and even a proportion of those children who opt for treatment go to a public health facility to seek the treatment. According to DLHS 3, at the national level, around 71 percent of children who had diarrhoea during the two weeks prior to the survey opted for the treatment of diarrhoea and this proportion varied from 90 percent in the Union Territory of Daman and Diu to around 18 percent in Nagaland. Similarly, out of those children with diarrhoea who sought treatment, around 28 percent sought treatment in a public health facility at the national level. This proportion also varied from 92 percent in Arunachal Pradesh to 9 percent in Haryana. If these proportions are taken into account then around 12 percent of the estimated cases of diarrhoea in India who went for treatment at a public health facility could be reported under HMIS. This proportion is estimated to be the highest in Bihar (82 percent) but the lowest in Rajasthan (1 percent). Punjab, Maharashtra, Goa and Kerala are the other states of the country where this proportion is estimated to be very low - less than 3 percent. On the other hand, Bihar stands out of all states and Union Territories of the country in terms of capturing of

diarrhoea cases seeking treatment in a public health facility in HMIS. There is no state or Union Territory in the country where more than 35 percent of the estimated diarrhoea cases seeking treatment in a public health facility could be captured under HMIS.

Deaths due to diarrhoea is a major contributor to post-neonatal mortality and the major cause of diarrhoeal deaths is the dehydration following diarrhoea. It is also well known that nearly all diarrhoeal deaths can be prevented through rehydration therapy. This is why the oral rehydration therapy is the universally recognised and accepted as low cost, highly effective appropriate technology to prevent deaths from diarrhoea and to reduce post-neonatal mortality. The success of the oral rehydration therapy, however depends upon correct assessment, appropriate treatment and timely referral of diarrhoea cases. This requires building the capacity of the community and the grassroots level service providers so that they can correctly assess the degree of dehydration in diarrhoea cases for appropriate teatment and referral.

In the above context, the Micronutrient Initiative, a development organisation, in collaboration with the Government of Bihar, launched the 'Childhood Diarrhoea Management Programme' in 15 districts of Bihar in 2011 on a pilot basis to promote use of oral rehydration therapy to prevent deaths from dehydration during diarrhoea. Based on the learnings and the experiences gained from this pilot initiative, the programme was scaled-up by the state government to cover all districts of the state in 2013. Under this programme, front line workers (FLWs) - ANM, ASHA and AWW - and medical officers and programme managers at block and district level were trained in aspects of diarrhoea management including the assessment, management, treatment and referral of diarrhoea cases and reporting and uploading of diarrhoea cases treated at public health facilities on the HMIS portal. In addition, 9 of the 13 basic indicators related to diarrhoea have also been integrated in the state specific District Health Information System (DHIS-2) portal. The training imparted to FLWs under this initiative has been found to be robust in the project districts, but relatively low in the scale-up districts. Under this capacity building initiative, FLWs have been trained in the assessment and classification of diarrhoea and treatment and referral of cases as per the classification. ASHA and AWW were trained for the treatment of diarrhoea cases with 'no' or 'mild' dehydration and for referring diarrhoea cases with 'some' and 'severe' dehydration to Health Sub Centre (SC) or to other public health care facility. On the other hand, ANMs have been trained in treating diarrhoea cases with 'no' and 'some' dehydration but referring cases with 'severe' dehydration. As the result of this capacity building initiative, large number of diarrhoea cases could be correctly assessed, properly treated and timely referred by FLWs as per approved diarrhoea management protocol (Table 2). About 71 percent of diarrhoea cases reported by FLWs in Bihar had 'no' dehydration while 26 percent assessed by FLWs had 'some' dehydration while 27 percent had 'severe' dehydration. In other words, only a small proportion of diarrhoea cases had 'severe' dehydration. As such, more than three-fourth of the diarrhoea cases could be treated at either the community level or the health sub-centre level (Table 3).

The impact of the Childhood Diarrhoea Management Programme in the pilot o4 demonstration districts versus scale-up districts of Bihar has however been different (Table 4). During the period under reference, around 0.67 million cases of diarrhoea were reported in the state. Out of these cases, 0.56 million (___ percent) cases were reported from the demonstration districts while only 0.12 million (___ percent) cases were reported from scale-up districts. If reporting of diarrhoea cases in scale-up districts would have been the same as in demonstration districts, total number of reported diarrhoea cases in the state would have crossed the 1 million mark during the period under reference.

Conclusions

Bihar was probably and so obviously the first state in India to initiate an ambitious programme of reducing deaths from diarrhoea through the universal adoption of ortal rehydration therapy way back in 2011 and scaling up the programme to the entire state in 2013. As recommended by the Government of India, the use of low osmolarity ORS and zinc for the treatment of childhood diarrhoea was introduced under the programme. A large number of field level workers, public health managers and medical officers were oriented and trained in the management of diarrhoea at the community level. Critical indicators related to the assessment, treatment and referral of diarrhoea cases were customized in the routine reporting system of the Department of Health of the state government. The programme appears to have resulted in a significant increase in the reported diarrhoea cases in HMIS which shows the improvement in the monitoring of diarrhoea cases. The programme has also resulted in the correct assessment and proper treatment of diarrhoea at the community level leading to a reduction in the severity of diarrhoea. As a result, a large number of deaths due to diarrhoea could be averted in Bihar as the result of this innovative programme. The trend in the under-five mortality rate indicates that prevention of diarrhoeal deaths as the result of Childhood Diarrhoea Management Programme appears to have contributed to the reduction in the under-five mortality in the state.

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Table 1

Diarrhoea cases reported under HMIS and proportionate cases against episode of diarrhoea, treatment seeking behaviour and utilisation of public health services

India/States/ Union Territories	Child population	Estimated annual episodes of diarrhoea	Diarrhoea cases reported in HMIS	Diarrhoea cases reported in HMIS who sought treatment	Diarrhoea cases seeking treatment who attended public health facilities	Reporting in HMIS as proportion to estimated diarrhoea episodes	Reporting in HMIS as proportion to diarrhoea cases who sought treatment	Reporting in HMIS as proportion to estimated cases treated in public health facilities
				(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
India	116568190	199331605	4843614	70.6	28.4	2.4	3.4	12.1
Jammu & Kashmir	1477051	2525757	51815	68.7	62.9	2.1	3.0	4.7
Himachal Pradesh	558333	954750	35208	62.8	76	3.7	5.9	7.7
Punjab	2189728	3744435	13836	88	20.7	0.4	0.4	2
Chandigarh	84499	144493	9542	64.4	na	6.6	10.3	na
Uttarakhand	958191	1638506	44948	60.8	48.2	2.7	4.5	9.4
Haryana	2450589	4190507	41635	81.7	8.9	1.0	1.2	13.7
Delhi	1435270	2454311	138170	77	27.1	5.6	7.3	27
Rajasthan	7594100	12985910	54980	59.6	64.3	0.4	0.7	1.1
Uttar Pradesh	21144726	36157482	273738	73.8	10.4	0.8	1.0	9.9
Bihar	13355247	22837472	540041	73.6	3.9	2.4	3.2	82.4
Sikkim	43338	74109	7944	40	85.6	10.7	26.8	31.3

India/States/ Union Territories	Child population	Estimated annual episodes of diarrhoea	Diarrhoea cases reported in HMIS	Diarrhoea cases reported in HMIS who sought treatment	Diarrhoea cases seeking treatment who attended public health facilities	Reporting in HMIS as proportion to estimated diarrhoea episodes	Reporting in HMIS as proportion to diarrhoea cases who sought treatment	Reporting in HMIS as proportion to estimated cases treated in public health facilities
				(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
Arunachal Pradesh	149695	255978	18860	57.9	91.7	7.4	12.7	13.9
Nagaland	197065	336981	5467	17.6	na	1.6	9.2	na
Manipur	265665	454288	13901	52.8	55.6	3.1	5.8	10.4
Mizoram	126357	216071	8647	46.1	76.8	4.0	8.7	11.3
Tripura	331659	567137	30288	57.3	67.3	5.3	9.3	13.8
Meghalaya	426893	729986	92058	65.3	65.2	12.6	19.3	29.6
Assam	3315980	5670325	137692	57.8	46	2.4	4.2	9.1
West Bengal	7527810	12872556	571527	81.5	24.9	4.4	5.4	21.9
Jharkhand	3800226	6498386	33024	52.2	21	0.5	1.0	4.6
Odisha	3750753	6413788	223582	60.4	64.9	3.5	5.8	8.9
Chhattisgarh	2647943	4527983	102098	66.9	48	2.3	3.4	7
Madhya Pradesh	7756003	13262765	299697	64	38.4	2.3	3.5	9.2
Gujarat	5657090	9673624	778856	65.6	43.8	8.1	12.3	28
Daman & Diu	20912	35759	3575	89.6	na	10.0	11.2	Na
Dadra & N H	40012	68421	3035	70.1	na	4.4	6.3	na

India/States/ Union Territories	Child population	Estimated annual episodes of diarrhoea	Diarrhoea cases reported in HMIS	Diarrhoea cases reported in HMIS who sought treatment	Diarrhoea cases seeking treatment who attended public health facilities	Reporting in HMIS as proportion to estimated diarrhoea episodes	Reporting in HMIS as proportion to diarrhoea cases who sought treatment	Reporting in HMIS as proportion to estimated cases treated in public health facilities
				(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
Maharashtra	9645213	16493314	73334	77.9	31.2	0.4	0.6	1.8
Andhra Pradesh	6419424	10977216	129608	69.2	37.1	1.2	1.7	4.6
Karnataka	5197295	8887375	232361	76.6	32.2	2.6	3.4	10.6
Goa	102815	175813	1766	69.2	66.5	1.0	1.5	2.2
Lakshadweep	5114	8745	826	84.4	na	9.4	11.2	na
Kerala	2476755	4235251	36193	78.8	38.4	0.9	1.1	2.8
Tamil Nadu	5435112	9294041	819020	73.3	40.5	8.8	12.0	29.7
Puducherry	98726	168822	13151	58	na	7.8	13.4	na
A & N Islands	29130	49813	3191	60.2	na	6.4	10.6	na

Source: Author's calculations

Table 2
Reported diarrhoea cases with degree of dehydration in Bihar

Month	Degree of dehydration			Total	Proportionate distribution			Total
	No	Some	Severe		No	Some	Severe	
November 2014	37603	17535	1603	56741	0.66	0.31	0.03	1.00
December 2014	37128	15055	1765	53948	0.69	0.28	0.03	1.00
January 2015	44192	16019	1630	61841	0.71	0.26	0.03	1.00
February 2015	52222	17802	1348	71372	0.73	0.25	0.02	1.00
March 2015	49302	16891	1757	67950	0.73	0.25	0.03	1.01
April 2015	21386	9208	940	31534	0.68	0.29	0.03	1.00
May 2015	23982	11172	1104	36258	0.66	0.31	0.03	1.00
June 2015	31534	14101	1482	47117	0.67	0.30	0.03	1.00
July 2015	47281	15167	1948	64396	0.73	0.24	0.03	1.00
August 2015	55741	21028	1995	78764	0.70	0.27	0.03	1.00
September 2015	42083	13618	1290	56991	0.74	0.24	0.02	1.00
October 2015	34785	11817	1204	47806	0.72	0.25	0.03	1.00
Total	477239	179413	18066	674718	0.70	0.27	0.03	1.00

Source: Author's calculations.

Table 3
Diarrhoea cases treated and referred at the community level in Bihar, February 2014

Place of treatment	Diarrhoea cases with degree of dehydration			
	No	Some	Severe	Total
OPDs	3140	1602	107	4849
APHS	3721	1464	88	5273
Health Sub-centre and below	45112	14423	1064	60599
Other facilities	249	313	89	651
Total cases	52222	17802	1348	71372
Treated at Health Sub-centre and below Health Sub-centre	86.4	81	78.9	84.9

Source: Author's calculations.

Table 4
Estimates of diarrhoea cases in Bihar

Particulars	Demonstration area 15 districts	Scale-up area 23 districts	Total
Projected child population under age 5, 2014	4852116	8503131	13355247
Estimated annual episodes of diarrhoea	8297118	14540354	22837472
Number of diarrhoea cases who sought treatment	6106679	10701700	16808379
Number of diarrhoea cases who sought treatment in public health facilities	238160	4173663	4411824
Diarrhoea cases reported under HMIS	558350	116368	674718
Proportionate cases reported in HMIS	2.34	0.03	0.15
Estimated diarrhoea cases treated in public health institutions based on reporting in the demonstration area	558350	9784851	10343201

Source: Author's calculations.

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Status of Basic Vaccinations of Children before their First Birthday in Uttar Pradesh

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Introduction

Universal immunisation of children against six vaccine-preventable diseases - tuberculosis, diphtheria, whooping cough, tetanus, poliomyelitis and measles - is crucial to reducing infant and child mortality. Vaccination, therefore, is one of the most cost-effective health interventions worldwide through which a number of serious childhood diseases have been either prevented or eradicated successfully. The immunisation campaign carried out by the World Health Organization (WHO) during 1967 through 1977 has contributed to the eradication of Small Pox from the world. Variation in the immunisation coverage rate across different subgroups of the population is also an important indicaor of the inequality in the delivery of health care services and, therefore, is useful for planning for the delivery of health care services and for targeting resources. Immunisation coverage rate is also the most commonly used indicator for monitoring and evaluating programmes directed towards improving maternal and child health such as as Expanded Programmes on Immunisation (EPI), Universal Immunisation Programme (UIP) and Reproductive and Child Health Programme (RCH). However, despite the known effectiveness of immunisation in reducing morbidity and mortality in children from a number of diseases and despite efforts made towards the universal immunisation of children against six vaccine preventable diseases, approximately 27 million infants in the world could not be vaccinated against measles or tetanus in the year 2007 (Angela et al, 2010). It has also been estimated that 2-3 million children below five years of age die annually in the world from diseases that can easily be prevented through immunisation and many more fall ill.

In India, universal immunisation of children against the six vaccine preventable diseases has been an important component of the maternal and child health care system. However, coverage rates of different vaccines vary widely across different states of the country. A review of the estimates of vaccines coverage rates available through the recently carried out Rapid Survey of Children conducted by the Government of India, Ministry of Women and Child Development in collaboration with the United Nations Children's Fund has revealed that only 47 percent children aged 12-23 months in Uttar Pradesh were fully immunised and this proportion was second lowest in the country next only to Meghalaya (Chaurasia, 2015). Uttar Pradesh is the most populous state of India having a population of almost 200 million at the 2011 population census accounting for more than 16 percent population of the country. This means that the level of immunisation coverage in Uttar Pradesh has a very significant impact on the level of immunisation coverage in India as a whole.

It is in the above context that the present paper analyses immunisation coverage in Uttar Pradesh and factors that influence the level of immunisation coverage in the state. The analysis, presented in the following pages, reflects that fully vaccinated children in the state are largely confined to the urban areas of the state. The analysis also suggests that the proportion of fully vaccinated children is high in children belonging to educated and working mothers.

Data and Methods

The analysis is based on the data available through the National Family Health Survey, 2005-06 (NFHS-3)). NFHS-3 collected information on the vaccinations received by all living children born during five years preceding the survey. However, the present analysis is limited to only those children who were born during the two years precedig the survey to unerstand the recent dynamics of immunisation in the society. The NFHS-3 identified 1162 children in Uttar Pradesh who were born during the two years preceding the survey so that the present analysis is confined to these 1162 children only.

According to the guidelines laid down by the World Health Organization, a child aged 12-23 months is classified as fully immunised if she or he is received: 1) one dose of BCG vaccine; 2) three doses of the diphtheria, pertusis (whooping cough), and tetanus (DPT) vaccine; 3) three doses of the oral poliomyelitis (OPV) vaccine; and 4) one dose of the measles vaccine during the first year of life according to the prescribed immunisation schedule. Information about the vaccination status of the child during NFHS-3 was collected in two ways. First, the mother of the child or other responsible member of the family was asked about the vaccination card of the child. If the card was available, information related to different vaccinations received by the child was recorded from the vaccination card. On the other hand, if the vaccination card was not available, then the mother of the child was asked about the vaccinations received by the child with probe and without probe and the response of the mother was recorded. Based on the information

about the vaccination status of each child surveyed, the immunisation coverage rate of different vaccines was calculated.

Univeriate Binary logistic regression was used to determine the factors associated with full immunisation coverage among children aged 12-23 months.The dependent variable in the regression analysis was a dichotomous variable with value 1 if the child was fully immunised and 0 otherwise. Independent variables included in the analysis were socio-demographic characteristics of the mother of the child such as her age and education, gender of the child and such factors as residence, religion, place of delivery and prenatal care.

Results

Out of the 1162 children aged 12-23 months covered in the present analysis, the vaccination card was available in case of 23.8 percent children only so that data pertaining to vaccine was culled out of the vaccination card for these children. For rest of the children, information about the vaccination status of the child was collected from the mother of the child. The coverage of OPV was found to be the highest among the children covered in the present study. More than 95 percent children received first dose of OPV whereas almost 93 percent children received the second dose and almost 90 percent children received the third dose of OPV in the state. The coverage of first, second and third doses of DPT vaccine, on the other hand, was 57.7 percent, 46.0 percent and 32.8 percent respectively. This shows that the drop out rate in successive doses of DPT is substantially higher than the drop out rate in successive doses of OPV.

Coverage rate of the measles vaccine was found to be the lowest across all vaccines among the children analysed. Less than 40 percent of the children covered in the present analysis received measles vaccine. Very low coverage of mesles vaccine appears to be the primary reason behind the low coverage of immunisation children in the state. Only about 25 percent of the children aged 12-23 months of age analysed in the present study were found to be fully immunised (Table 1).

The proportion of fully immunised children is found to increase with the increase in the education of the mother. The proportion of children fully immunised was more than 70 percent in those children whose mothers had at least higher secondary level education. By contrast, the proportion of children fully immunised was just around 13 percent in children whose mother was illiterate. Similarly, proportion of children fully immunised was substantially higher in children of working women as comprared to children of non-working women.

The place of delivery had a direct relationship with the immunisation coverage rate. The proportion of children fully immunised was relatively high among those children who were born in a hospital - public or private - as compared to children who were born at home. The proportion of children fully immunised has been found to be higher in children

living in the urban areas as compared to children living in rural areas. Table 1 also reveals that the proportion of children fully immunised was very low in children whose mother received prenatal care from either a Dai or some person other than a health personal.

Results of the bivariate logistic regression analysis are presented in table 2. It may be seen from the table that the level of education of the mother of the child, religion of the family of the child, place of residence, place of delivery of the child and the personal who provided prenatal care at the time of delivery are significantly associated with the full immunisation status of the child. The table also reveals that children belonging to women in the middle of the reproductive age significantly more likely to be fully immunised than children belonging to younger and older women. Hindu children are found to be 55 percent more likely to be fully immunised compared to non-Hindu children. Children living in the urban areas are almost 2.5 time more likely to be fully immunised than children living in the rural areas. Children of working women are almost nine times more likely to be fully immunised than children of non-working women. Similarly, children born in a hospital are almost five times more likely to be fully immunised than children born at home. Table 2 also indicates that the gender of the child is a major influencing factor in deciding the immunisation status of the child even after controling all other confounding variables. Male children are found to be more than 1.8 times more likely to to be fully immunised as compared to female children.

Table 2 highlights the importance of the education of the mother in realising the goal of universal immunisation of children. Children of women having at least higher secondary level education are more than17 times more likely to be fully immunised than children belonging to illiterate women. Some of the possible reasons why education of the mother of the child is crtical in achieving the goal of universal immunisation of children include: i) education gives the basic ideas about the path of wellbeing and also equips and encourages women in increasing knowledge on healthy living; ii) education equips women with the knowledge about appropriate health related behaviour within the family, especially related to preventive and curative measures related to the health of family members including children.

Conclusions

Low ro very low immunisation coverage rate in Uttar Pradesh reveales the poor utilisation of immunisation services in Uttar Pradesh and there is substantial scope for improvement. At the same time, it appears that the awareness of the people about the availability of immunisation services being offered at the health facilities is poor and people do not appear to realise the importance of immunisation in preventing certain diseases and deaths in preventing dealths during infance and early childhood. The present analysis shows that the immunisation programme in the state has been effective only in the urban areas of the state. The analysis also shows that there exists a direct relationship between the education of the mother and the immunisation status of the child. This observation

highlights the need of strengthening communication, education and information skills of front line health care services providers to that they can effectively impart health education to even illiterate women. At the same time, there is a need to improve the efficiency of immunisation services delivery. The surveillance and referral system related to child immunisation also needs to be reinforced so as to identify defaulters of immunisation and reduce the drop-out rate between successive doses of OPV and DPT vaccines.

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Table 1
Immunisation coverage by different socio-demographic characteristics of the mother

Background Characteristics	Distribution		Full immunisation coverage rate Percent
	Frequency	Percent	
Maternal age at Birth			
15-20	182	15.7	19.2
20-25	451	38.8	27.7
25-30	304	26.2	27.9
30-35	151	13.0	25.2
35+	74	6.4	17.6
Residence			
Urban	383	33.0	37.1
Rural	779	67.0	19.8
Religion			
Hindu	861	74.1	28.2
Non-Hindu	301	25.9	17.6
Respondent's Education			
Illiterate	706	60.8	13.2
Primary	118	10.2	28.0
Secondary	244	21.0	41.8
Higher Secondary	94	8.1	72.3
Respondent's Occupation			
Not working	1068	92.0	21.5
Service	94	8.0	70.2
Has Health Card			
No	483	41.6	0.4
Yes	276	23.8	41.6
Yes but not seen	400	34.4	14.8
Sex of the child			
Male	637	54.8	27.2
Female	525	45.2	23.4
Place of Delivery			
Home	845	72.7	16.7
Hospital	317	27.3	48.9
Prenatal Care			
Doctor	272	23.4	41.2
Other health personnel	539	46.4	29.9
Dai /Other	351	30.2	6.6
Total	1162	100.0	25.5

Source: Author's calculations.

Table 2

Likelihood of full immunisation among children aged 12–23 months in Uttar Pradesh

Background Characteristics	Odds Ratio	95 percent Confidence interval	p
Maternal Age at Birth			
15-20*			
20-25	1.610	1.056-2.457	0.001
25-30	1.630	1.044-2.546	0.000
30-35	1.412	0.839-2.377	0.004
35+	0.895	0.443-1.808	0.002
Residence			
Urban	2.415	1.345-3.867	0.000
Rural*			
Religion			
Hindu	1.554	0.986-2.005	0.000
Non-Hindu*			
Respondent's Education			
Illiterate*			-
Primary	2.559	1.620-4.404	0.000
Secondary	4.735	3.387-6.619	0.000
Higher Secondary	17.239	10.437-28.474	0.000
Respondent's Occupation			
Not working*	-	-	-
Working	8.588	5.649-11.613	0.000
Sex of Child			
Male	1.821	0.628-2.072	0.000
Female*			
Place of delivery			
Home*	-	-	-
Hospital	4.777	3.593-6.352	0.000
Prenatal care			
Doctor	4.900	1.234-5.560	0.001
Other health personnel	2.789	0.987-4.678	0.000
Dai/Other*			

* Reference category

Source: Authors' calculations.

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Child Bearing Pattern of Young Females under Bivariate Settings

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Introduction

Several investigations concerned with the formulation of a model for the number of births in a specified period have been carried out by Henry (1956) and Dandekar (1955) in the context of the study of human fertility. Brass (1958) extended Dandekar's modified distribution and used its zero truncated distribution to describe the distribution of fecund women aged 45-49 years by the number of children born to them. Singh (1961; 1963; 1968) extended the discrete and continuous time models of Dandekar assuming that only a fraction of women is susceptible to the risk of conception throughout the period of observation and rest of the women are incapable of being pregnant during this period. Singh and Pathak (1968) and Pathak (1966) modified the discrete and continuous time models proposed by singh.

Family size distribution plays an important role in anthropological and genetical because it allows formal analysis of extinction of lineages (Lotka, 1931). Family size distribution provides estimates of the number of individuals carrying recessive alleles in a growing population (Li, 1975). In examining consequences of certain social practices and individual preferencs on human fertility, it is sometimes necessary to study the distribution of numbers of boys and the number of girls in families with variable family size. In particular, past work of Hill (1972; 1979), Emigh and Pollak (1979), and Pollak (1980) suggests that for estimating the variance of effective family size, it is important to consider the covariance term of the bivariate distribution of the numbers of boys and the number of girls is quite critical. This covariance term explains the relationship between boys and girls in the family. Such joint distributions have also been found to be important in the study of female infanticide which is often inferred by studying the distribution of boys and girls in the family (Pakrasi, 1966; Pakrasi and Malaker, 1979).

The objective of the present study is to construct a model of the number of girls and the number of boys in the family in Uttar Pradesh, India and to examine the correlation between the number of male births and the number of females births according to different socio characteristics of the family. Bivariate geometric distribution (Pathak and Sreehari, 1981) has been applied to model the number of boys and the number of the number of girls in the family. Based on the model so constructed, we also attempts to analyse the son preference in younger women in the state.

Construction of the Model

Let X and Y represents the number of boys and girls to women aged 15-25 years. Let p_0 represents the proportion of childless women, p_1 represents the probability of a male birth and p_2 represents the probability of a female birth. We consider (X, Y) as a random variable which follows bivariate geometric distribution (Krishna and Pundir, 2009) with the product moment function (pmf):

$$P[X = x, Y = y] = \frac{(x+y)!}{x!\,y!} p_1^x p_2^y p_0$$

where

$$x, y = 0,1,2,\ldots; 0 < p_1, p_2 < 1; p_0 = 1 - p_1 - p_2$$

The moment generating ffunction (mgf) of the bivariate geometric distribution (BGD) (p_1, p_2) is

$$p_0(1 - p_1 e^{t_2} - p_1 e^{t_1})^{-1}; t_1, t_2 > 0$$

This gives

$$E(x) = \frac{p_1}{p_0}; E(y) = \frac{p_2}{p_0}$$

$$V(x) = \frac{p_1}{p_o}\{1 + \frac{p_1}{p_0})$$

$$V(y) = \frac{p_2}{p_o}\{1 + \frac{p_2}{p_0})$$

$$Corr(x,y) = \rho_{xy} = \sqrt{\frac{p_2 p_1}{(1-p_2)(1-p_1)}}; 0 < \sqrt{p_2 p_1} < \rho_{xy}$$

Estimation Procedure

Let n women are observed and x_i and y_i, $i=1,2,\ldots n$ are the number of boys and the numebr of girls respectively to the i^{th} woman. Then the likelihood of the above mentioned pmf of BGD is

$$L = \prod_{i=1}^{n} \frac{(x_i + y_i)!}{x_i!\, y_i!} p_0 p_1^{n\bar{x}} p_2^{n\bar{y}}$$

$$n\bar{x} = \sum_{i=1}^{n} x_i$$

$$n\bar{y} = \sum_{i=1}^{n} y_i$$

Taking log and differentiating w.r.t. p_j ($j=1,2,3,\ldots$), the maximum likelihood estimates (MLE) of p_0, p_1 and p_2 are obtained as

$$\hat{p}_0 = \frac{1}{1+\bar{x}+\bar{y}};$$

$$\hat{p}_1 = \frac{\bar{x}}{1+\bar{x}+\bar{y}};$$

$$\hat{p}_2 = \frac{\bar{y}}{1+\bar{x}+\bar{y}}$$

Data and Application of the Model

For the application of the model, we use two data sets. The first data set is related to the immigrant Indian community in Houston, Texas, USA while the second data set is related to the data for Uttar Pradesh available through the National Family Health Survey, 2005-06 (NFHS-3) (IIPS, 2007). We extract the joint distribution of the numbers of boys and the number of girls born to women aged 15-25 years in Uttar Pradesh during the seven years prior to the survey. Chakraborty and Schwartz (1989) have analysed the survey data on family size distribution by sum of parents to demonstrate the selective neutrality of the surname distribution and random loss of surnames in a single generation in 353 immigrant Indian families in Houston, Texas where both parents were at least 50 years of age. These families migrated from the north-eastern part of India. We tested the goodness of fit of the model through the conventional χ^2 test and by the Freeman-Tukey (F-T) statistic which is more accurate than the traditional χ^2 test as it has no effect of small frequencies (Freeman and Tukey, 1950). The F-T statistic is further simplified by Ayinde

and Abidoye (2007). The simplified version has some advantages as it is easier and faster to calculate the test statistic because calculating the expected cell frequencies is not necessary. Moreover, the problem of approximation is also reduced considerably so that the risk of committing either type I or type II error is considerably minimised.

The F-T statistic is given by

$$T^2 = 4\sum_{i=1}^{r}\sum_{j=1}^{c}(\sqrt{O_{ij}} - \sqrt{E_{ij}})^2$$

Here r and c are the number of rows and columns respectively, O_{ij} and E_{ij} are respectively observed and expected frequencies, respectively. The F-T statistic, T^2 follows the χ^2 distribution with (rc-1) degrees of freedom. Further, the degrees of freedom will reduce by the number of parameters estimated.

Results and Discussion

Estimates of the parameters of the model for the Indian immigrant community of Houston, Texas and for total, rural and urban populations of Uttar Pradesh are presented in table 1. In the Indian immigrant community of Houston, Texas, the chance of a male birth was 33 percent while that of a female birth was 32 percent so that around 35 percent women aged 15-25 years were childless in this community. The correlation coefficient between the number of boys and the number of girls for this community is estimated to be 0.49 which is significant at 5 percent level of significance while the sex ratio was 961 female births per 1000 male births.

In Uttar Pradesh, on the other hand, the chance of a male births is estimated to be around15 percent while the chance of a female birth is estimated to be 14 percent. About 71 percent of the women aged 15-25 years in Uttar Pradesh are estimated to be childless during the exposure period - 7 years prior to the survey. In urban area of Uttar Pradesh, the probability of a male birth is estimated to be 11 percent while the probability of a female birth is estimated to be 10 percent. However, in the rural areas of the state, the probability of a male birth is estimated to be 19 percent but the probability of a female birth is estimated to be only about 17 percent. Because of the relatively higher probability of a male birth as compared to that of a female birth in the rural areas of the state, the sex ratio at birth is more favourable to males as compared to that in the urban areas of the state. It is estimated that there are about 884 female births for every 1000 males births in the rural areas of the state as comapred to around 960 female births for every 1000 male births in the urban areas. For the state as a whole, the sex ratio at birth is estimated to be 911 female birth for every 1000 male births. The correlation coefficient is also found to be relatively high in the rural areas as compared to that in the urban areas because the proportion of the childless women was comparatively more in the urban areas.

Tables 2 to 5 show the observed and expected frequencies for different data sets used in the present study. For the Houston data set, χ^2= 19.788 which suggests that it is reasonable to assume that the model provides a good fit to the observed data (p=0.101, df=13). Similarly, the F-T statistic T^2=19.714 which also confirms that the model provides a reasonably good fit to the observed data (p=0.1026, df=13). This means that the proposed distribution is fairly suitable to estimate the number of boys and the number of girls in the family.

The model also performed well with the Uttar Pradesh data. For the total population, T^2=7.920 (p=0.244, df= 6) while χ^2=7.929 (p=0.019). For the urban areas of the state T^2=0.4975 (p=0.919, df=6) and χ^2=0.543 (p=0.762, df=2) pulling cells with frequency less than 5. However, in the rural area of the state, the model does not provide a good fit as T^2=12.312 (p=0.055, df=6) and χ^2=11.185 (p=0.004, df=2) after pulling cells with frequency less than 5.

The mean number of male births in Uttar Pradesh is estimated to be 0.211 whereas the mean number of female births is estimated to be 0.193. In the rural areas of the state, the mean number of male birth is estimated to be 0.292 whereas the mean number of the female birth is estimated to be 0.258.

It is well known that India is a traditional society, so son preference is prevalence due to the result of traditional religious beliefs, social customs (dowry system, lineage, familial and kinship ties etc.), economic benefits and including support of ageing parents is widespread in India. Regional variable has significant role the main reason that urban dwelling women are educated so they promotes modern values including gender equality. Pande and Astone (2007) particularly in rural India where few women go beyond primary schooling, and they are not able to understand the value of female child, usually they have strong belief in son.

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Table 1
Parameter estimates of the model for for four populations

Data set	p_0	p_1	p_2	Sex Ratio (Females per 1000 males)	Correlation		
					Simple zero order correlation coefficient	95 percent confidence interval	
						Upper	Lower
Houston	0.3454	0.3337	0.3209	961	0.4887	0.648	0.3272
UP(total)	0.7122	0.1506	0.1372	911	0.1679	0.5097	0.1437
UP(Rural)	0.6455	0.1882	0.1663	884	0.215	0.5284	0.1769
UP(Urban)	0.7837	0.1104	0.1059	960	0.1212	0.4918	0.1081

Source: Authors' calculations

Table 2
Observed and Expected of the numbers of boys and girls in the immigrant Indian community of Houston, Texas, USA

Number of boys (x)	Number of girls (y)					
	0	1	2	3	4	Total
0	122 (122)	36 (39)	7 (13)	5 (4)	4 (1)	174 (179)
1	38 (41)	34 (26)	13 (13)	3 (5)	1 (2)	89 (87)
2	9 (14)	15 (13)	9 (8)	6 (4)	5 (2)	44 (41)
3	3 (5)	7 (6)	5 (5)	7 (3)	4 (2)	26 (21)
4	1 (2)	3 (2)	5 (2)	4 (2)	1 (1)	14 (9)
5	0 (1)	0 (1)	1 (1)	2 (1)	3 (12)	6 (16)
Total	173 (185)	95 (87)	40 (42)	27 (19)	18 (20)	353 (353)

Remarks: Figures in the bracket are expected frequencies.
Source: Authors' calculations.

Table 3
Observed and Expected numbers of boys and girls born to women aged 15-25 years in Uttar Pradesh - total population

Number of boys (x)	Number of girls (y)					
	0	1	2	3	4	Total
0	958 (943)	122 (129)	21 (18)	1 (2)	1 (0)	1103 (1092)
1	137 (142)	28 (39)	9 (8)	3 (1)	0 (0)	177 (190)
2	17 (21)	11 (9)	4 (2)	1 (1)	0 (0)	33 (33)
3	2 (3)	4 (2)	1 (1)	0 (0)	0 (0)	7 (6)
4	3 (0)	1 (0)	0 (0)	0 (0)	0 (3)	4 (3)
Total	1117 (1109)	166 (179)	35 (29)	5 (4)	1(3)	1324 (1324)

Remarks: Figures in the bracket are expected frequencies.
Source: Authors' calculations.

Table 4
Observed and Expected numbers of boys and girls born to women aged 15-25 years in Uttar Pradesh - rural population

Number of boys (x)	Number of girls (y)					
	0	1	2	3	4	Total
0	407 (401)	65 (67)	13 (11)	1 (2)	1 (0)	487 (481)
1	75 (75)	17 (25)	6 (6)	3 (1)	0 (0)	101 (107)
2	11 (14)	7 (7)	4 (2)	1 (1)	0 (0)	23 (24)
3	2 (3)	3 (2)	1 (1)	0 (0)	0 (0)	6 (6)
4	3 (1)	1 (0)	0 (0)	0 (0)	0 (2)	4 (3)
Total	498 (494)	93 (101)	24 (20)	5 (4)	1 (2)	621 (621)

Remarks: Figures in the bracket are expected frequencies.
Source: Authors' calculations.

Table 5
Observed and Expected number of boys and girls born to women aged 15-25 years in Uttar Pradesh - urban population

Number of boys (x)	Number of girls (y)				
	0	1	2		Total
0	551 (553)	57 (58)	8 (4)	0 (1)	616 (616)
1	62 (61)	11 (13)	3 (2)	0 (0)	76 (76)
2	9 (7)	5 (2)	0 (1)	0 (0)	14 (10)
3	0 (1)	0 (0)	0 (2)	0 (1)	0 (4)
Total	622 (622)	73(73)	11 (9)	0 (2)	706 (706)

Remarks: Figures in the bracket are expected frequencies.
Source: Authors' calculations.

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Tobacco Use Among Youth and Parents' Tobacco Consumption Behaviour

Nidhi Jain

Introduction

Adolescence and youth are commonly regarded as a relatively healthy period of the life. During this period, an individual is possibly less vulnerable to infections as compared to younger ages. However, there is a strong tendency to experiment with risk behaviour during this period which make adolescents and young adults engage in a range of behaviours that can affect the quality of their health and the probability of their survival in the short term and affect their health and survival for the rest of the life. Lifestyle patterns and health behaviours that people follow in adulthood are frequently experimented and/or adopted during adolescence. According to an estimate prepared by the World Health Organization (WHO), nearly two-third of the premature deaths and one-third of the total disease burden in adults are associated with conditions or behaviours during their adolescence such as tobacco use, a lack of physical activity and exposure to violence. Moreover, four of the most prominent non-communicable diseases (NCDs) which are the leading cause of adult mortality – cardiovascular diseases, neoplasms, chronic respiratory diseases and diabetes – are associated with major behavioural risk factors - unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol - which have their origin during adolescence and young age.

Smoking and smokeless tobacco use have been argued to be the leading preventable causes of disease and death in the world. Tobacco causes several diseases such as cancer, heart disease, chronic obstructive pulmonary disease, peripheral vascular disease, osteoporosis, hyperthyroidism and hypothyroidism, diabetes, etc. Many of these diseases are fatal or disabling. Smoking is responsible for over 90 percent of all cases of lung cancer, 75 percent of chronic bronchitis and emphysema cases and nearly 25 percent cases of ischemic heart disease. Chewing tobacco causes a significant proportion of oral cancer

(WHO, 2011). Francis et al in their study of cigarette smoking among Greek adolescents reported that adolescents who smoke were at higher risk of psychopathology than those who were non-smokers. (Francis et al, 2007). About 50 percent of the adolescents who continue to smoke during adulthood die from diseases associated with smoking (MacKey and Ericksen, 2002). It is estimated that around 250 million of today's children are expected to die from tobacco-related diseases (Peto and Lopez, 2004).

Considering the enormous health complications associated with tobacco use, it is of utmost importance to understand the factors leading to its use and to plan strategies to reduce its intake. This is especially relevant for developing countries like India where tobacco use continues to be common notwithstanding the recognition of harmful consequences of its use. India is the second most populous country in the world and is also the second largest consumer and the third largest producer of tobacco products in the world. Prevalence of tobacco use among school students in different states of Indiahas been reported to vary from 1.9 percent in Delhi to 75.3 percent in Mizoram (Kumar et al, 2006; Bhojani et al, 2009; Sinha et al, 2003; Singh et al, 2007; Kapil et al, 2005; Pednekar and Gupta, 2004; Gajalakshmi et al, 2004; Kapoor et al, 1995).

It has been argued that an important determining factor in tobacco use behaviour of adolescents and youths is the parental tobacco consumption and parental attitude towards tobacco use. Children are often introduced to tobacco products at the very early stage of their life as they are in contact with the members in the family who use tobacco products. This paper attempts to test this hypothesis in the India context. More specifically, this paper attempts to study the prevalence of tobacco consumption among youths in India and analyses its association with parental tobacco consumption.

Data and Methodology

The paper is based on the data available through the study Youth in India: Situation and Needs which was carried out during 2006-08 in six states - Bihar, Jharkhand, Maharashtra, Rajasthan, Andhra Pradesh, and Tamil Nadu - of India. These six states, have geographic and socio-cultural background and account for 39 percent of country's population. The objectives of the study were to identify key transitions experienced by youth, including those pertaining to education, work force participation, sexual activity, marriage, health and civic participation; provide state-level evidence on the magnitude and patterns of young people's sexual and reproductive practices in and outside marriage and related knowledge, decision-making and attitudes; and, finally, identify key factors underlying young people's sexual and reproductive health knowledge, attitudes and life choices. The study focussed on married and unmarried young women and unmarried young men aged 15–24 years and, because of the paucity of married young men in the younger ages, married men aged 15–29 years in both rural and urban settings. The study was based on statistically representative sample in each state. During the study, 50,848 married and unmarried young women and men were successfully interviewed. Informed

consent was obtained from all respondents as well as parents of unmarried minor youths. Details of the study are available elsewhere. (IIPS & Population Council, 2010). Both descriptive and multivariate analyses have been used to analyse the association between parental and adolescent's tobacco consumption behaviour. Logistic regression was applied to investigate the effect of parental tobacco consumption on tobacco consumption among youths aged 15-24 years. Normalised sampling weights were used to take into account clustering, unequal probabilities of selection and non-response.

Results

Table 1 presents the prevalence of tobacco consumption among youth aged 15-24 years by different socio-demographic characteristics. Overall 11 percent of youths aged 15-24 years consumed tobacco products. This proportion was higher in males (30 percent) and older youths (14.6 percent) as compared to females (2 percent) and youths aged 15-19 years (7.7 percent). Tobacco consumption was marginally higher in rural than in urban areas. Similarly, tobacco use was higher in youths belonging to Scheduled Castes/Scheduled Tribes compared to youths belonging to other backward classes. Tobacco use was more or less similar among youths of different religion. Similarly, tobacco use among youths did not vary much by family type. However, tobacco use was found to be higher among youths belonging to the poorest wealth quintile as compared to youths belonging to the richest wealth quintile. On the other hand, more than two third of youths using alcohol reported using tobacco. Tobacco use was lower in youths whose parents where having at least school level education compared to youths whose parents were illiterate. Tobacco use in youths whose parents were using tobacco was substantially higher than the tobacco use in youths whose parents did not consume tobacco.

Table 2 presents odd ratios of tobacco consumption among youths aged 15-24 years by different characteristics of youths. Older youths were more than 2 times more likely to consume tobacco than youths aged 15-19 years. On the other hand, females were less likely to consume tobacco than their male counterparts. Years of schooling was found to be a significant predictor of tobacco consumption. As the number of years in school increases the likelihood of consuming tobacco decreases. Muslim youths were 1.5 times more likely to consume tobacco than their Hindu counterparts. Within Hindus, youths belonging to Scheduled Castes/Tribes are more likely to consume tobacco than youths from other backward classes and other classes. Youths living in non-nuclear families were more likely to use tobacco. Wealth seems to be an important predictor of tobacco consumption. Tobacco use is significantly lower in youths belonging to the richest wealth quintile as compared to youths belonging to the poorest wealth quintile group. Use of alcohol was found to be the strongest predictor of tobacco consumption. Youths consuming alcohol were 9 times more likely to consume tobacco that youths who did not consume alcohol. Youths with mother having at least 12 years of schooling were 36 percent less likely to consume tobacco than mothers with less than 12 years of schooling.

Parents' tobacco consumption status affects significantly the likelihood of tobacco consumption. Youths with fathers who consumed tobacco were 1.8 times more likely to consume tobacco than youths whose parents did not consume tobacco. This relationship gets stronger when the mother also use tobacco. When both the parents consume tobacco, things gets worse. The likelihood of use of tobacco by youths is 3.5 times if both parents use tobacco.

Discussions and Conclusions

The analysis confirms that parents' tobacco consumption affects the tobacco consumption behaviour of youths. Tobacco use by family members is likely to influence adolescents. They are more likely to perceive tobacco use as a positive and acceptable behaviour and contribute to developing favourable personal beliefs and subjective norms related to tobacco use. This has been reflected in a number of other studies throughout the world (Farkas et al, 2000; WHO, 2002; Sargent and Di Franza, 2003; Holm et al, 2003; De Vries et al, 2003; Markham et al, 2004). Another finding that goes with the existing literature is that alcohol consumption increases the risk of tobacco consumption among youths. Education is negatively related to the tobacco consumption among youths.

Considering the enormous adverse health consequences of tobacco use, it is very important to develop preventive strategies to reduce tobacco consumption. Such strategies should especially be focused towards children and adolescents. Policies and programmes focusing on adolescents' tobacco use must take into account the parents' history of tobacco use. Parents should also be counselled about the impact of their smoking and tobacco use on their children as it can be a powerful tool for helping them change their behaviour. Often "doing it for the children" is a stronger motivation than taking care of oneself.

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Table 1
Prevalence of tobacco consumption among youths aged 15-24 years
India, 2006-07

Background characteristics	Percentage of youth consuming tobacco	N
Age		
15-19	7.7	23970
20-24	14.6	21734
Sex		
Male	30.4	14433
Female	2.0	31270
Place of Residence		
Urban	9.1	13584
Rural	11.8	32120
Education		
No education	11.2	9113
1-4 yrs	16.7	3126
5-7 yrs	14.4	7814
8-9 yrs	10.9	10263
10-11 yrs	7.8	8126
12 yrs & above	8.3	7261
Caste		
SC/ST	14.6	12870
OBC	10.1	22760
Others	8.1	9698
Religion		
Hindu	10.8	38387
Muslim	12.9	4566
Others	10.2	2752
Family type		
Nuclear	10.1	21986
Non-nuclear	11.7	23718
Wealth quintile		
Poorest	14.7	7015
Poorer	13.7	8417
Middle	11.1	9504
Richer	9.7	10575
Richest	7.2	10192
Alcohol Consumption		
Yes	67.8	2740
No	7.3	42962

Background characteristics	Percentage of youth consuming tobacco	N
Father's education		
No education	13.2	17751
1-4 yrs	14.2	3703
5-7 yrs	10.0	7241
8-9 yrs	10.4	4450
10-11 yrs	7.5	6255
12 yrs & above	6.1	4506
Mother's education		
No education	12.5	30782
1-4 yrs	10.3	2766
5-7 yrs	8.3	5641
8-9 yrs	6.3	2417
10-11 yrs	6.0	2344
12 yrs & above	3.1	1275
Parents consuming tobacco		
None of the parents	6.7	30282
Father only	18.8	13204
Mother only	22.0	771
Both parents	22.3	1447
All	11.0	45704

Source: Author's calculations.

Table 2
Binary logistic regression model showing odds ratio of youth consuming tobacco

Independent variables	Exp(B)
Age	
15-19 ®	
20-24	2.203**
Sex	
Male®	
Female	.054**
Residence	
Urban	
Rural	0.939
Education	
No education ®	
1-4 years	.743**
5-7 years	.542**
8-9 years	.365**
10-11 years	.238**
12 years and above	.208**
Religion	
Hindu ®	
Muslim	1.499**
Others	0.861
Caste	
SC/ST ®	
OBC	.774**
Others	.770**
Type of Family	
Nuclear®	
Non-nuclear	1.349*
Wealth Quintile	
Poorest ®	
Poorer	.831**
Middle	.686**
Richer	.585**
Richest	.596**
Alcohol Consumption	
No ®	
Yes	9.110**

Independent variables	Exp(B)
Father's Education	
No education ®	
1-4 years	1.21
5-7 years	1.046
8-9 years	1.095
10-11 years	1.06
12 years and above	1.154
Mother's Education	
No education ®	
1-4 years	0.933
5-7 years	0.951
8-9 years	0.852
10-11 years	0.888
12 yrs and above	.644**
Parents consuming tobacco	
None of the parents ®	
Father only	1.796**
Mother only	2.988**
Both parents	3.469**

Remarks: * $p<0.05$; ** $p<0.01$.
Source: Author's calculations.

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Status of the Elderly in the Family
Evidence from Rural Areas of Madhya Pradesh

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Introduction

Ageing is gaining increasing recognition as one of the mostinfluencing forces of change in societies. The rapidly growing numbers of the aged are now widely accepted as the key aspect of population ageing in the developing countries. Population ageing poses some important questions regarding dependency ratio, psycho-social attitudes and expectations of the family and the society involved and public policies (Heisel, 1984; Rajan, 1989; Rowland, 1994). Ageing of the population, not too long ago typical for the developed countries, has recently emerged as a growing interest and concern in Asian countries. Although the proportion of the elderly in the population in the developing countries is still substantially lower than that in the developed countries, yet the increase in expectation of life at birth has resulted in an increase in the number of elderly people and hence there is a need of creating better awareness about the needs of the elderly people (United Nations, 1994). There are two critical problems faced by the elderly in the developing countries of Asia. The first is the paucity of specific medical care while the second is the income insecurity (United Nations, 1994). The proceedings of the United Nations Round Table on 'Ageing of Asian Populations' has also noted a changing scenario for the elderly in the region, and they took into consideration the demographic, social, and economic factors that influenced the size and structure of families as well as the relationship between generations (United Nations, 1994).

There are now 370 million people aged at least 60 years in the developing countries. They account for 58 percent of the world elderly population. This proportion is projected to increase to 72 percent by 2020 when the elderly in the developing countries is projected to cross the one billion mark. In India, the current demographic scenario indicates that mortality has declined significantly and continues to show sign of further decline. This reduction in mortality, a desired goal, is contributing to an increase in size

of old population, suggesting that ageing in India is likely to have a number of demographic, social, economic, psychological, environmental and epidemiological problems for the elderly population (Audinarayana and Kavitha, 2003; Gulati 1989). Unless we take immediate measures to alleviate these problems, we shall be engulfed by them. In India, the elderly, that is the population aged at least 60 years comprises nearly 7 percent of the total population of the country. The average life span of Indians which was about 30 years at the time of independence in 1947 has now increased to 64 years (Indian Census, 2011, Kohli 1996, Nagle 1987, Raju 2004 and Vijaiunni 1997). High prevalence of poverty, low levels of literacy, and a general lack of basic amenities constitute major problems for the elderly, especially in the rural areas of the country. Life becomes increasingly stressful during the ageing process and the elderly become a liability, rather than an asset, to the families and communities involved (Yadava et al 1996a; 1996b). Relationship with sons and daughters largely decide the economic factors, which in turn, have an impact on the health of the elderly (Chaklader and Kabir, 2003). Some other important factors such as declining joint family system, fewer children due to acceptance of small family norm are also associated with the stressful life of the elderly (Bose, 1994; Kabir and Siddiquae, 2003).Usually, elderly people are neglected by the family members unless they are well to do or still earning (Patel, 1997; Sureender, 1997; Vijayanunni, 1997; Alok Ranjan, 2005).

Although, a number of studies on the elderly population have been carried out the south Asian countries including India, yet, majority of these studies are based on either scanty data or data from secondary sources. There are very few studies that are based on primary data. Information of socio economic, demographic and cultural profiles of rural elderly other related issues are very little (Chakrabarty, 2003) .This is especially the case in Madhya Pradesh where aging of the population has not yet been seen as a major demographic and development issue because of the preoccupation with the reduction in fertility and mortality.

The purpose of this paper is explore whether the elderly in the rural areas of Madhya Pradesh are perceived as a liability or as an asset at the family level. The analysis is based on a survey of the elderly people carried out in selected villages of the Sehore district of the state. Bivariate analysis has been carried out to analyse how a number of social, economic and cultural variables influence the perception of the family members about the eldelry in the family.

Data and Methodology

This study is based on a household survey carried out in the rural areas of 20 villages in four tehsils (sub-districts) of Sehore district of the state in the year 2013. All people at least 60 years old in the surveyed households were covered in this study. For the sake of operational convenience, the survey was confined to villages situated at a distance of maximum 15 kms from the headquarters of the sub-districts covered in the study. During

the survey, 980 people with age at least 60 years could be identified and all these old people were covered in the present study. Direct interview approach was adopted to collect both individual and household data. The individual level data collected during the survey included age, sex, educational and occupational characterstics of the elder, health and other old age related problems, attitude of family members towards the elderly, duration and type of morbidity, familial relations, etc. The household level data collected during the survey included household structure, household facilities, etc. In addition to the eldely in the household, one adult member of the household, especially, the eldest son of the elderly, whenever possible, was also interviewed during the survey. In case, the elederly had no son or the eldest son had died or migrated or formed separate household, any closest family member less than 60 years of age and living with the elderly was interviewed to get an idea of the perception of the household about the elderly in the household. It may however be pointed out that the different persons in the household may have different perceptions about the elderly in the household.

Population Characteristics of Sehore District

At the 2011 population census, the population of district Sehore was enumerated to be 1311332 comprising of 683743 males and 627589 females resulting in a population sex ratio of 918 females per 1000 males. The sex ratio of the population aged 0-6 years is estimated to be 912 female children for every 1000 children. The population of the district increased by 21.54 percent between 2001 and 2011. The population sex ratio in the state increased from 909 females per 1000 males in 2001 to 918 females per 1000 males in 2011 but the sex ration of the population aged 0-6 years decreases from 927 female children per 1000 male children in 2001 to 912 females children per 1000 male children in 2011.

The population aged at least 60 years in the district was enumerated to be 110599 at the 2011 population census of which 53716 were males and 56883 were females. This means that the elderly population constituted around 8.4 percent of the population of the district and the aged dependency ratio is 121 elderly population for every 1000 population aged 15-59 years. The proportion of elderly males was 7.9 percent while the proportion of the elderly females was 9.1 percent so that the sex ratio of the elderly population of the district is more favourable to females as compared to males - 1059 elderly females per 1000 elderly males.

The population of the district is relatively more aged than the population of Madhya Pradesh. In Madhya Pradesh, the proportion of the elderly is around 7.9 percent of the total population - 7.4 percent for males and 8.4 percent for females - while the aged dependency ratio is 112 elederly for every 1000 people aged 15-59 years. However, the sex ratio of the elderly population in Madhya Pradesh is relatively more favourable to females than the sex ratio of the elderly population in the district - 1063 elderly females per 1000 elderly males.

Results and Discussion

Role of Elderly in Daily Life of the Family. As already discussed, elderly play a very vital role in the Indian Society, particularly in relation to the family and the household. In the rural society, matters related to marriage of boys and girls are usually settled and arranged by the elderly members of the family. As a matter of fact, the elderly in the family have the knowledge about clan, sub caste, customs, status and other family related information. Although, the elderly in the family do not actively participate in the household level economic activities, yet, their economic and family management experience and skills contribute substantially in the utilisation of family resources and in augmenting family savings.

During the present survey, it was asked from the elderly whether members of their family took their advises in family related matters particularly in relation to marriage, selling or buying household goods and household property, etc. The responses given by the elderly surveys are summarised in table1. About two-third of the elderly respondents reported that members of their family used to take their advise in matters related to the marriage of boys and girls of the family. This proportion was nearly the same in case of male elderly (65.6 percent) and female elderly (64.3 percent). However, only about 52 percent of the elderly reported that their advise was taken in matters related to buying or selling of goods. This proportion was however substantially higher when the elderly was a male (59.3 percent) then when the elderly was a female (44.8 percent). Similarly, only about 35 percent of the elderly reported that their adwaise was taken in buying or selling the land proporty of the family and this proportion was gain higher in male elderly (38.4 percent) as compared to the female elderly (30.5 percent).

Elderly: Asset or Liability. In order to explore whether the elderly in the family are treated as household or family assets or household or family liability, one of the adult members of all the households surveyed were asked whether they perceived the elderly in the family as a liability or as an asset for the household. About 40 percent of the respondents were of the view that they perceived the elderly in the family as a liability while 60 percent perceive the elderly in the family as a liability (Table 2). Table 2 also examines characteristics of the elderly that influence their liability status in the family. For example, age of the elderly does not appear to be factor in deciding the liability status of the elderly in the family. Similarly, the marital status of the elderly also does not appear to be an influencing factor. However, monthly income and health status of the elderly definitely influence the liability status of the elderly in the family.

On the other hand, table 3 shows that household characteristics strongly influence the liability status of the elderly in the family. For example, household occupation, its social and economic status and the level of education of the members of the household have statistically significant influence on the liability status of the elderly in the family. However, the type of the household - nuclear or joint - does not have any influence on the liability status of the elderly in the family.

Finally, family members of the household surveyed were asked about how the presence of the elderly in the family was advantageous and how the presence of the elderly in the family was a disadvantage. More than 80 percent of the respondents wre of the view that the presence of the elderly in the family was advantageous in many ways (Table 4). The presence of the elderly helped not only in looking after the house and children in the family but they extended useful advice in a range of family related matters.

On the other hand, about 40 percent of the respondents were of the view that the presence of the elderly in the family is a disadvantage in a number of ways, the most common of which was the health related issues and concerns of the elderly. However, around 60 percent of the respondent argued that there was no reason to believe that the presence of the elderly in the family was a disadvanatge to the family. Concern about meeting the health related expenditure of the elderly appears to be the major reason behind perceiving the elderly as a disadvantage to the family.

Conclusions

The evidence available through the survey of household in district Sehore of Madhya Pradesh suggests that the status of the elderly in the family or the household is influenced by a number of factors related to the household as well as factors related to the eldely herself or himself. The analysis suggests that the economic and social status of the household is is a major influenceing factor in deciding the liability status of the elderly in the family. On the other hand, the helth status of the elderly is also a crucial factor in deciding the liability status of the elderly. The analysis also suggests that, in general, elderly are not regarded as liability in the family. Rather, the general perception is that the presence of the elderly is advantageous to the family.

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Table 1
Distribution of the elderly according to their advice taken by the family members in various activities

Advice	Advice taken			Total
	Yes	No	NA	
Related to marriage				
Male	340 (65.6)	143 (27.6)	35 (6.8)	518 (100.0)
Female	297 (64.3)	141 (43.5)	24 (5.2)	462 (100.0)
Total	637 (65.0)	284 (29.0)	59 (6.0)	980 (100.0)
Related to buying and selling of goods				
Male	307 (59.3)	176 (34.0)	35 (6.8)	518 (100.0)
Female	207 (44.8)	231 (50.0)	24 (5.2)	462 (100.0)
Total	514 (52.4)	407 (41.5)	59 (6.0)	980 (100.0)
Related to buying and selling of land				
Male	199 (38.4)	284 (54.8)	35 (6.8)	518 (100.0)
Female	141 (30.5)	297 (64.3)	24 (5.2)	462 (100.0)
Total	340 (34.7)	581 (59.3)	59 (6.0)	980 (100.0)

Remarks: Figures in the bracket denote percentages
* Either no family member below 60 years of age or no one in the working age group.
Source: Author's calculations

Table 2
Liability status of the elderly by selected characteristics of the elderly

Variable	Liability		Total
	No	Yes	
Age of the elderly			
60-69	364 (64.4)	239 (39.6)	603 (100.0)
70-79	165 (59.1)	114 (40.9)	279 (100.0)
80-89	44 (54.3)	37 (45.7)	81 (100.0)
90*	11 (64.7)	6 (35.3)	17 (100.0)
	χ^2=1.292; d.f.=3; p=0.731		
Marital status of elderly			
Single	7 (87.5)	1 (12.5)	8 (100.0)
Married	386 (62.0)	237 (38.0)	623 (100.0)
Widow	135 (54.0)	115 (46.0)	250 (100.0)
Widower	53 (55.8)	42 (44.2)	95 (100.0)
Separated	3 (75.0)	1 (25.0)	4(100.0)
	χ^2=5.660; d.f.=4; p=0.226		
Monthly income of the elderly			
Nothing	414 (62.8)	245 (37.2)	181 (100.0)
<2000	126 (49.4)	129 (50.6)	255 (100.0)
2001-4000	30 (65.2)	16 (34.8)	46 (100.0)
>4000	14 (70.0)	6 (30.0)	20(100.0)
	χ^2=15.335; d.f.=3; p=0.002		
Current health status of elderly			
Bad	191 (66.8)	95 (33.2)	286 (100.0)
Good	393 (56.6)	301 (43.4)	694(100.0)
	χ^2=8.674; d.f.=1; p=0.003		
N	584	396	980

Source: Author's calculations

Table 3
Liability status of the elderly by selected household characteristics

Variable	Liability		Total
	No	Yes	
Maximum education of household			
Illiterate	83 (47.7)	91 (52.3)	174 (100.0)
Pri-middle	246 (61.7)	153 (38.3)	399 (100.0)
High-inter	148 (57.6)	109 (42.4)	257 (100.0)
Graduate and above	107 (71.3)	43 (28.7)	150(100.0)
	χ^2=19.938; d.f.=3; p=0.000		
Household occupation			
Service	108 (59.7)	73 (40.3)	181 (100.0)
Business	219 (80.2)	54 (19.8)	273 (100.0)
Agriculture	188 (65.7)	101 (34.9)	289 (100.0)
Other	69 (29.1)	168 (70.9)	237 (100.0)
	χ^2=143.244; d.f.=3; p=0.000		
Economic status of household			
Low	214 (44.1)	271 (55.9)	485 (100.0)
Middle	187 (72.2)	72 (27.8)	259 (100.0)
High	183 (77.5)	53 (22.5)	236 (100.0)
	χ^2=96.871; d.f.=2;p=0.000		
Social status of household			
Low	199 (45.6)	237 (54.4)	436 (100.0)
Middle	253 (69.1)	113 (30.9)	366 (100.0)
High	132 (74.2)	46 (25.8)	178 (100.0)
	χ^2=64.731; d.f.=2; p=0.000		
Caste			
General	179 (66.1)	92 (33.9)	271 (100.0)
Other backward class	286 (64.0)	161 (36.0)	447 (100.0)
SC/ST	87 (47.5)	96 (52.5)	183 (100.0)
Muslim	32 (40.5)	47 (59.5)	79 (100.0)
	χ^2=36.261; d.f.=3; p=0.000		
Type of household			
Nuclear	105 (64.8)	57 (35.2)	162 (100.0)
Joint	479 (58.6)	339 (41.4)	818 (100.0)
	χ^2=2.199; d.f.=1; p=0.138		
Total	584	396	980

Source: Author's calculations

Table 4
Reasons why elderly in the family are advantageous and disadvantageous to the family

Response given by family members*	Religion and caste				Total
	Hindu			Muslim	
	General	OBC	SC/ST		
Advantages of the presence of elderly in the family					
Advice	2	11	2	2	17
	(0.74)	(2.46)	(1.09)	(2.53)	(1.73)
Only to look after the house	12	26	8	3	49
	(4.43)	(5.82)	(4.37)	(3.80)	(5.00)
Only to look after the children	1	12	1	7	21
	(0.37)	(2.68)	(0.55)	(8.86)	(2.14)
All the above	227	352	149	65	793
	(83.76)	(78.75)	(81.42)	(82.28)	(80.92)
Not advantageous	29	46	23	2	100
	(10.70)	(10.29)	(12.57)	(2.53)	(10.20)
Disadvantages being ages of elderly (liability)					
Taking care during illness	38	64	54	19	175
	(14.02)	(14.32)	(29.51)	(24.05)	(17.86)
Imposing old ideas/customs	36	21	9	6	72
	(13.28)	(4.70)	(4.92)	(7.59)	(7.35)
No time for caring elderly	7	44	13	12	76
	(2.58)	(9.84)	(7.10)	(15.19)	(7.76)
All the above	11	32	20	10	73
	(4.06)	(7.16)	(10.93)	(12.66)	(7.45)
Nothing	179	286	87	32	584
	(66.05)	(63.98)	(47.54)	(40.51)	(59.59)
N	271	447	183	79	980

Source: Author's calculations

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Prevalence and Risk Factors of Polypharmacy among Elderly in India

Evidence from SAGE Data

Mili Dutta
Lokender Prashad

Introduction

Population ageing is a result of high life expectancy and declining fertility. It is now a global phenomenon as in almost every country of the world, the old population is rapidly increasing. The process of ageing is compressed into two or three decades over a single generation. The number of the aged people is projected to be around 1.5 billion in 2050 with 80 percent of them in the developing countries (Suzman and Beard, 2011).

Ageing is usually accompanied with chronic illnesses (Olshansky and Carnes, 2010). High rate of chronic illnesses increases the likelihood of taking multiple medications by the old people. This tendency, known as polypharmacy, is becoming a common problem among old persons (Haider et al, 2008). Polypharmacy refers to taking multiple concurrent medications to address multiple coexisting health problems. It is estimated that, globally, 44 percent old men and 57 percent old women take at least five medicines per week (Hajjar, Cafiero and Hanlon, 2007; Frazier, 2005). Polypharmacy, however, increases the risk of drug-related events such as falls, confusion and functional decline. In one of the studies, it was found that the old people commonly used both prescribed and non-prescribed medicines together which led them into the risk of major drug-disease reaction (Jyrkkä, 2011). National Health and Nutrition Examination Survey (NHANES-III) reveals that nearly 74 percent of the old people in India used the prescribed medications. The survey also revealed that half of the old people aged 65-74 years used two or more prescribed drugs while 12 percent of them used five or more prescribed drugs to address their health problems. This shows that the prevalence of polypharmacy among the old people in India is quite substantial, if not alarming. There is however little systematic investigation of the prevalence of polypharmancy in the country and the risk factors associated with it. The present paper is an attempt in this direction.

Review of Literature

The process of ageing involves many changes in biological, functional, psychological and social factors of the old people which vary with the genetic factors and age-related vulnerability (Kunsella and Phillips, 2005). Ageing is generally associated with chronic illnesses, comorbidity, disability and social isolation (Alami et al, 2003; Christensen et al, 2009). It is very rare that the old people suffer with only one disease (Marengoni et al, 2008; 2011). Multimorbidity which usually refers to co-occurrence of more than two diseases ranges from 55-98 percent among the old people. It has also been observed that multimorbidity increases with age; it is higher in females and in the old people with low socio-economic status (Sousa et al, 2009).

There is no universally accepted definition of polypharmacy other than use of multiple drugs by an individual (Fulton and Allen, 2005; McPhee and Papadakis, 2010). There are many definitions of polypharmacy - quantitative as well as qualitative (Hajjar, Cafiero and Hanlon, 2007; Jyrkkä, 2011). In a number of studies, polypharmacy has been classified as minor polypharmacy and major polypharmacy. Minor polypharmacy refers to concurrent use of two to four prescribed medications while major polypharmacy refers to concurrent use of five or more prescribed medications (Bjerrum et al, 1998; Thoman et al, 1999; Veehof et al, 2000). On the other hand, polypharmacy is defined in some studies as the prescription and use of multiple medications to deal with concurrent multiple diseases and health problems (Hajjar, Cafiero and Hanlon, 2007; Fulton and Allen, 2005; Veehof et al, 2000).

One reason behind the high prevalence of polypharmacy in the old people is the Inappropriate prescription of drugs. In any case, a high prevalence of polypharmacy may lead to drug-disease interaction and drug reaction (Jyrkkä, 2011). It has been observed that the Physical Component Summary (PCS) score was associated with the degree of polypharmacy and, after controlling other socio-economic factors, this association remained significant. At the same time, low medication has been found to be associated with the low quality of life of the old people (Henderson, Buchwal and Manson, 2006).

Need for the Study

Inappropriate medication and use of inadequate drugs by the old people is a major public health concern these days. It is accompanied with detrimental effects on the old people. It is rated as the fifth major cause of death among the old people. Polypharmacy can also affect the quality of life of the old people. There are however very few studies on the predictors of polypharmacy among the old people in India. Since the old population in India is projected to increase quite rapidly in the years to come, there is a need to analyse the levels and patterns in the prevalence of polypharmacy among the old people in India along with the identification of the risk factors associated with polypharmacy.

Objectives

- To assess the prevalence of polypharmacy among the old population - population at least 60 years of age in India.
- To find out patterns of polypharmacy by different socio-demographic characteristics of the old people in the country.
- To analyse risk factors associated with the practice of polypharmacy among the old people of the country.

Data and Methodology

The International Institute for Population Sciences, Mumbai (IIPS) conducted a Study on Global Ageing and Adult Health (SAGE) in India in collaboration with the World Health Organization, Geneva. This study was part of the global longitudinal study ageing and adult health which covered six countries - China, India, Ghana, Mexico, Russia and South Africa. In India, the study was carried out six states- Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. Total number of respondents covered under the study were 11,230 out of which 4,670 were persons aged 18-49 years - 3,625 women and 1,045 men - and 6,560 were persons aged at least 50 years - 3,256 women and 3,304 men. During the study 3618 old people - people with at lest 60 years of age - were also interviewed. The present paper is based on the data related to 3618 old people covered under SAGE.

The variables used in the present analysis are described below.

Dependent variable. Polypharmacy is taken as the dependent variable in the present analysis. Ploypharmacy is defined as the use of four or more medications concurrently (Henderson, Buchwal and Manson, 2006). It is a dichotomous variable which takes value 1 if an old person is taking at least four medications and zero otherwise.

Independent variables. Independent variables used in the present analysis include: 1) sex of the respondent (male and female); 2) education of the responent (no education, less than primary, primary education completed, secondary education completed, high school education and college/university and above); 3) wealth quintile to which the respondent belongs (poor, medium, rich); 4) self-reported health status of the respondent (good, moderate, bad) and 5) current work status of the respondent (working, non-working). In addition, three variables related to diabetes, depression and hypertension were also included as independent variables in the analysis. These three variables are dichotomous variables. If an old person was having diabetes at the time of the survey, a score of 1 was assigned to the old person. Otherwise, a score of 0 was assigned to the old person concerned. Similar scores were assigned, if an old person is suffering from depression or was having hypertension. The analysis has been carried out using SPSS and STATA software packages.

Results

Out of 3618 old people covered in the present analysis, 1920 (53.1 percent) were males and 1698 (46.9 percent) were females. More than three-fifth of the respondents were married at the time of the survey. Moreover, more than 85 percent of the respondents were Hindus by religion and more than three-fourth of the respondants belonging to the Hindu religion were non Scheduled Castes/Tribes. More than half of the respondents surveyed had no education.

The prevalence of polypharmacy in the surveyed population is estimated to be 4.2 percent which is high by the international context. Table 1 shows the distribution of the respondents using polypharmacy by different socio-demographic characteristics, self-rated health and morbidity conditions. The prevalence of polypharmacy is found to be high in male (5.3 percent) compared to females (3.0 percent). The prevalence of polypharmacy is found to be the highest among the old-old (aged 70-79 years). The prevalence of polypharmacy has also been found to be higher in urban area (7.5 percent) as comapred to that in the rural areas (2.5 percent). Table 1 also suggests that the prevalence of polypharmacy increases with the increase in the education of the respondent. In respondents having college/university level education, the prevalence of polypharmacy is estimated to be 12.6 percent compared to only 2.5 percent in respondents with no education. Similarly, the prevalence of polypharmacy is found to increase with the increase in the standard of living of the respondent. The prevalence of polypharmacy is found to be 6.4 percent in respondent belonging to high wealth quintile group compared to only 5.4 percent in respondents belonging to lower and middle wealth quintile group.

The prevalence of polypharmacy is found to be the highest among those respondents who rated their health as bad (5.8 percent). By comparison, the prevalence of polypharmacy is found to be only 1.5 percent in respondents who rated their health as good. On the other hand, the prevalence of polypharmacy has been found to be very high in non-working respondents (6.9 percent) as compared to working respondents (1.9 percent). The prevalence of polypharmacy in respondents diagnosed with diabetes is estimated to be 21.4 percent. This proportion is 12.8 percent in respondents diagnosed with depression and 11.1 percent in respondents having hypertension.

Table 2 presents results of the multivariate logistic regression analysis which was used to examine predictors of polypharmacy among the old people. It may be seen from the table that the likelihood of polypharmacy is more among the old-old (70-79 years) as compared to the young old (60-69 years). On the other hand, the likelihood of polypharmacy is substantially higher in the old people having less than primary education as compared to respondents having no education. Interestingly, the difference in the prevalence of polypharmacy in old people having at least primary education and old people having no education has not been found to be statistically significant. The likelihood of polypharmacy has been found to statistically significantly lower among the elderly belonging to high wealth quintile group as compared to the elderly belonging to poor

wealth quintile group. Old people who rate their health as bad are more likely to use polypharmacy than the old people who rate their health as good. Similarly, the likelihood of using polypharmacy is strongly and significantly more among those elderly who are diagnosed with either diabetes or depression or hypertension as compared to the elderly who are not suffering from these chronic ailments.

Conclusions

The analysis shows that the use of polypharmacy is emerging as a public health concern among the elderly in India. The prevalence of polypharmacy is particularly hingh among those who rate their health as bad and those who are suffering from such chronic ailments as diabetes, depression and hypertension. Interestingly, elderly with high standard of living appear to be less likely to use polypharmacy compared to the elderly with low standard of living. Effective communication between the elderly and health services providers is necessary to reduce the prevalence of polypharmacy as unnecessary use of drugs and medications has its own imlications which may be detrimental to the health of the old people. It is expected that findings of the present analysis will be helpful for programme managers, policymakers, researchers, academician and social workers who are working in the field of ageing and health.

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Table 1
Polypharmacy among elderly by selected socio-demographic characteristics

Variables	Percentage	N
Sex		
Male	5.3	46
Female	3.0	31
Age		
Young old (60-69 years)	2.2	37
Old old (70-79 years)	8.1	33
Oldest old (80+ years)	1.9	7
Place of Residence		
Urban	7.5	35
Rural	2.5	42
Education		
No education	2.1	26
Less than primary	7.8	18
Primary school completed	3.1	12
Secondary school completed	4.6	8
High school completed	10.5	5
College/University and above	12.6	8
Wealth Quintile		
Poor	6.4	20
Middle	5.4	27
High	9.2	30
Self-rated Health		
Good	1.5	6
Moderate	4.0	34
Bad	5.8	37
Current Working Status		
Working	1.9	11
Non-Working	6.9	42
Diabetes		
No	1.9	42
Yes	21.4	35
Depression		
No	3.5	55
Yes	12.8	22
Hypertension		
No	0.9	12
Yes	11.1	65

Source: Author's calculations.

Table 2
Likelihood estimates of polypharmacy

Variable	Odds Ratio	Confidence interval
Sex		
Male®		
Female	1.217	[0.56, 2.65]
Age		
Young old (60-69 years)®		
Old old (70-79 years)	1.877*	[0.97, 3.61]
Oldest old (80+ years)	0.554	[0.15, 2.08]
Place of Residence		
Urban®		
Rural	0.56	[0.27-1.17]
Education		
No education®		
Less than primary	4.430***	[1.78-11.02]
Primary school completed	2.611*	[0.99, 6.89]
Secondary school completed	2.143	[0.68, 6.73]
High school completed	0.913	[0.22, 3.87]
College/University and above	2.673	[0.72, 9.99]
Wealth Quintile		
Poor®		
Middle	1.102	[0.49, 2.48]
High	0.339**	[0.14, 0.83]
Self-rated Health		
Good®		
Moderate	1.907	[0.70, 5.23]
Bad	3.523**	[1.24, 10.02]
Current Working Status		
Working®		
Non-working	1.944	[0,87, 4.35]
Diabetes		
No®		
Yes	4.205***	[2.14, 8.25]
Depression		
No®		
Yes	5.987***	[2.45, 14.62]
Hypertension		
No®		
Yes	11.629***	[5.49, 24.63]

* p<.05; ** p<.01; *** p<.001

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Status of Women at the Village Level A Case Study

Anita Dubey

Introduction

According to the 2011 population census, there are around seven lakh villages of varying population size in India. Women living in these village constitute an important component of the social and economic production system of the village. However, women in villages have not been identified under the main stream of village development process. In the village society and economy, women are widely treated as subbordinate to men and their participation in the social and economic production system of the rural economy and society has always been treated as residual.

Participation of women in village level social and economic production activities is an important avenue through which they can overcome their subordination within the family and society. One can predict condition of a nation by looking at the status of its women. Women can also play a creative role in the sustainable utilisation of resources available at the village level to promote sustainable development. There is a need to effectively promote women's productive role in the social and economic production system of the village, to encourage women for village level entrepreneurship and to utilise women as human resource for growth and diversification of the village economiy. It is argued that by empowering women living in the villages of India, productivity of the village social and economic production system can be increased by 20-25 percent which may contribute significantly to ensure food security and eliminate hunger at the village level. It is estimated that at present about 66 percent of the rural women remains unutilised and a substantial proportion remain under utilised in the village production system. With social and economic development and associated modernisation, however, the scenario is changing fast and opportunities of employment for women have increased. There is now increasing recognition of the need to empower women for sustainable development.

Despite the fact that women can contribute very significantly in the village level social and economic production system, there are very few studies to analyse the status of women in the villages of India and to explore their involvement in the village-based social and economic production system. Such an analysis is essential to explore the possibilities of increased involvement of the women in the village based social and economic system leading to their empowerment.

In this paper, we present the case study of village Khonp in district Chhatarpur of Madhya Pradesh with reference to the participation of the women in the village social and economic production system and the status of women in the village society. The paper is based on the experience and interaction of the author with a select group og women in in the village. The paper puts forward a set of recommendations for empowering the women at the village level so that they can productively contribute to the economy and the society of the village.

Objectives

Specific objectives of the study which provided the data for the present paper are as follows:

- To study the social and cultural background of village women, especially women farmers, and to analyse their economic profile.
- To analyse the motivational factors that influence the capacity and the productivity of village women.
- To identify the factors that may contribute towards empowering women at the village level.
- To put forward a set of recommendations for enhancing the status of women through their increased participation in the village production system.

The study Village

The study village for the present paper is village Khonp in district Chhatarpur of Madhya Pradesh. District Chhatrpur is located in the Bundelkhand region of the state which is one of the most backward regions of the country. The village Khonp is located at a distance of 10 Kms from the district headquarters town of Chhatarpur on the Chhatarpur-Kanpur national highway. Selected demographic information related to the village is given in table 1. According to the 2011 population census, total population of the village was 2340 around 2011 out of which 1224 were males and 1116 were females. There were 445 households in the village so that the average household size was more than five per houshold. The child population - population aged 0-6 years - in the village was more than 16 percent of the total population. Scheduled Castes constitute about 17 percent of the population of the village whereas Scheduled Tribes constitute less than 1.5

percent of the village population. Literacy in the village is relatively low. According to the 2011 population census, only about 60 percent of the village population aged 7 years and above was able to read and write with understanding. Among females, the literacy rate was only 52 percent. Agriculture is the primary occupation in the village, although the work participation rate is less than 50 percent. This shows that opportunities for productive engagement of the working age population of the village is quite limited. Among the workers, only around 42 percent are main workers in the sense the work is available for at least six months in the year. Rest of the workers are marginal workers as they get work for less than six months in a year on average.

Table 2 gives details about amenities and other facilities available in the village as revealed through the 2011 population census. There is a middle school in the village to provide basic education to children. The village also has a health sub-centre and an Aanganwadi Centre under the Integrated Child Development Scheme. The village does not have piped water system for drinking water. Villagers depend upon open well and hand pumps for drinking water purposes. On the other hand, toilets are largely absent in the village and open defecation is the norm for males as well as females of the village.

Communication facilities in the village appear to be satisfactory. The village is connected to the nearby national highway through all weather pucca road and bus service is available in the village. Moreover, land line telephone facility is available in the village and the village also falls in the coverage area of mobile telephone.

Table 3 presents the land use pattern of the village. The net sown area under the village is less than 45 percent of the total geographical area of the village, although more than 60 percent of the net sown area is irrigated. A very substantial proportion of the geographical area of the village is barren an uncultivable which means that the scope of expanding the agriculture production system in the village is limited. The lack of employment opportunities in the village are reflected in the low work participation rate in the village as revealed through the 2011 population census.

Table 4 presents selected indicators reflecting the status of women of the village as revealed through the 2011 population census. Males outnumber females in the village, a pattern which is common in this part of the country. However, the child sex ratio - sex ratio of the population aged 0-6 years is highly favourable to females which shows that the village is largely free from the problem of sex selective abortions. At the same time, the fact that the child sex ratio is highly favourable to females while the sex ratio of the population aged 7 years and above is highly unfavourable to females indicates that female mortality in the age group 7 years and above is substantially higher in females as compared to males. Similarly, the sex ratio of the literate population is highly unfavourable to females in the villages and the same is the case in the sex ratio of the working population of the village. This shows that the status of women in the village is low and they appear to depend on men in almost all aspects of life. This observation is also supported by the fact that less than 15 percent of the female workforce of the village is main worker or they get job for at least six months in a year on average. Most of the female workers in the village appear to be casual labourers.

Findings from Indepth Interviews

In an attempt to substantiate the findings based on the data avaiable through the 2011 population census, the author conducted indepth interviews with 35 randomly selected women of the village. Majority of the women interviewed were middle aged women in the age group 30-45 years (54 percent) and were illiterate (77 percent). Moreover, all but seven of them were married, four were unmarried and three were widow. Majority of the women interviewed (57 percent) were engaged in some type of agricultural activity and more than three-fourth of them belonged to joint family.

All the selected women were interviewed personally on the basis of an information schedule that was developed and pilot tested for the purpose. During the course of the discussions, all women were specifically asked about the challenges that they faced at the level of the family and the society in the village and how they respond to these challenges in their day to day life. The responses given by the females during the interview were classified into five categories for the purpose of the analysis - social challenges, financial challenges, educational challenges, challenges related to the lack of knowledge and all other challenges. Findings of this exercises are summarised below.

Challenges Faced by Women. Almost all women of the village interviewed by the author reported that they faced a number of social, financial and educational challenges in their day to day life. Main challenges reported by the respondents may be summarised as under:

- Majority of the women interviewed reported that they had very limited degree of financial freedom or autonomy despite the fact that many of them were engaged in one or the other type of productive activities. The reason was that employment opportunities in the village, even for men, were very limited so that it was only rare that women get full time employment for the most part of the year.
- A substantial proportion of women interviewed, especially married and widow, reported that they did not have direct ownership of the property and so they had to depend upon the male members of the family for subsistence and support especially when the scope of productive engagement for women in the village was extremely limited.
- The women interviewed were generally unaware of the opportunities of financial and other assistance available to them. Although, the data available through the population census suggest the existence of self-help groups in the village, yet these organisations of women appear to be domant as most of the women interviewed were unaware of their existence. The society of the village was predominently male dominated society.
- The women interviewed had very little idea about their capacities. They had little idea about what could they do either at their own or as a group. It appears that there was little effort in the village to organise the women folk and to engage them in some productive activities.

- The women interviewed lacked totally the professional attitude at the work place as well as in the family largely because they had no professional education. More than three fourth of the women interviewed were illiterate and so they lacked self-confidence. They were totally dependent on the male members of the family because of their illiteracy.
- Another challenge faced by the women of the village appeared to be motivation. Most of the women interviewed were found to be hardly motivated for their empowerment and uplift. They appeared to be largely satisfied with their present family, social and economic environment that prevailed in the village. One reason for the lack of motivation among the women interviewed appeared to be the fact that majority of them were illiterate and had little capabilities.
- The women interviewed were near totally ignorant about the resources available to them for their increased participation in the social and economic production system of the village. For example, most of the women did not know about the agro-based household production activities that might be initiated at the household level.
- Some of the women reported about the market-oriented risks such as inflation or increase in the prices of commodities as a major challenge to them and to their family. One women argued that the village economy was not self-sufficient and therefore villagers had to depend upon outside resources which increased the vulnerability in the village.

It appeared after detailed discussion and interaction with the women in the village that there was an immediate need of identifying new opportunities for productive engagement of both men and women of the village in productive activities so as to improve their financial status. At present there is no banking facilities in the village and it appears that if banking facilities are provided in the village, women of the village may be engaged in productive activities which may lead to their financial security. The easy flow of funds for women may be associated with a comprehensive programme of women entrepreneur development so as to develop the necessary capacity and build the confidence among the women of the village. Last but not the least, there is a need to create, sustain and support women organisation in the village which can be networked with similar organisation in the district and the state.

Conclusions

Despite the fact that women are important human resources for the nation and they can contribute significantly to development of the nation and the society, the present study highlights the poor to very poor status of women in the village studied. It appears that most of the women in the village had little knowledge about different development schemes designed for the empowerment of women and mass illiteracy among women appear to be a major reason for this situation. It appears that continuous attempt to inspire, encourage, motivate and co-operate with women entrepreneurs at the village level is necessary for their empowerment.

Table 1
Demographic situation in village Khonp, district Chhatarpur, Madhya Pradesh

SN	Particulars	Total	Male	Female
1	Total households	445		
2	Population	2340	1224	1116
3	Population (0-6 years)	383	187	196
4	Scheduled Castes population	391	205	186
5	Scheduled Tribes population	33	20	13
6	Literates	1192	712	480
7	Workers	945	590	355
8	Main workers	396	344	52
	8a Cultivators	111	102	9
	8b Agriculture labourers	165	138	27
	8c Others	120	104	16
9	Marginal workers	549	246	303
	9a Cultivators	37	8	29
	9b Agricultural labourers	475	222	253
	9c Others	37	16	21
10	Non-workers	1395	634	671
11	Effective literacy rate (percent)	60.9	68.7	52.2
12	Work participation rate (percent)	48.3	56.9	38.6
13	Main workers as proportion of total workers (percent)	41.9	58.3	14.6

Source: Population census 2011.

Table 2
Amenities available in village Khonp, district Chhatarpur, Madhya Pradesh

SN	Amenity	Availability
1	Primary school	Available
2	Middle school	Available
3	Health sub-centre	Available
4	ASHA (Accredited social health activitist)	Available
5	Aanganwadi Centre	Available
6	Source of drinking water	Well Hand pump
7	Toilets	No toilet facility Open defecation
8	Electricity	Available
9	Connectivity	Connected to the main road through pucca all wether road. Bus service is available.
10	Communication	Land line phone available Mobile phone coverage
11	Self-help groups	Available
12	Integrated Child Development Scheme	Available

Source: Population census 2011.

Table 3
Land use in village Khonp, district Chhatarpur, Madhya Pradesh

SN	Particulars	Area in hectares	Proportionate distribution
1	Total area under village	1097.1	100.0
2	Area under forest	0.0	0.0
3	Area under non-agricultural use	109.3	10.0
4	Barren and uncultivable land	200.6	18.3
5	Permanent pastures	64.5	5.9
6	Cultivable land	82.4	7.5
7	Fallow	109.7	10.0
8	Current fallow	50.2	4.6
9	Net area sown	480.3	43.8
10	Net sown area irrigated	295.4	61.5

Source: Population census 2011.

Table 4
Selected indicators reflecting status of women in village Khonp, district Chhatarpur, Madhya Pradesh

SN	Indicator	Level
1	Population sex ratio (Females per 1000 males)	912
2	Child sex ratio (Girls 0-6 years per 1000 boys 0-6 years)	1048
3	Literate sex ratio (Literate females pr 1000 literate males)	674
4	Worker sex ratio (Female workers per 1000 male workers)	601
5	Main workers sex ratio (Female main workers per 1000 male main workers)	151
6	Marginal workers sex ratio (Female marginal workers per 1000 male marginal workers)	1232

Source: Population census 2011.