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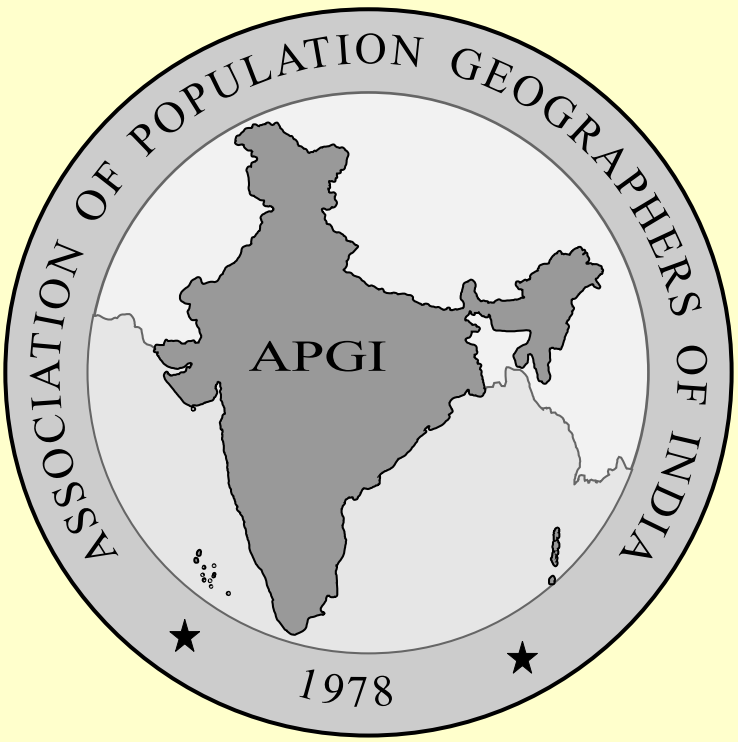


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## *Editorial Note*

Covid-19 continues to control our movements and work. We are amidst the third wave, spreading like wildfire but less damaging in hospitalization and deaths. Nonetheless, the APGI recently lost its highly dependable and caring friend in Kunwar Surjit Singh, our Executive Council member and Secretary-General of ISPER, Amaravati Enclave, Panchkula. We all pray for his soul to rest in peace.

Amidst this period of anxiety and grief, we have tried to present the present number of Population Geography before you. Of course, we highly regret the delay.

The contributors of papers in this number are a mix of young and mature scholars from geography and other disciplines. In this number, the diverse themes covered include the study of fertility differentials across religious groups in India, perception of the urban environment at the level of municipal wards in Hyderabad City, the association between demographic dividend and economic growth at the state level, application of quality test on literacy data by age-groups available from the Census of India, the disparity in available maternal health care services at the district level in the hill state of Uttarakhand, the district-level gap in child health care services in rural West Bengal, demographic characteristics of the rural population in East Medinipur district, son preference in Mahendragarh district of Haryana, dynamics of Wular Lake and their impact on quality of water and human health in villages located in Lake's surroundings, and a comprehensive review of geogrphic research on COVID-19 pandemic.

The traditional and modern techniques of data analysis and interpretation have been put into service by the authors. The findings of these studies are worthy of special attention. These are to be noted for their applied value.

We regret that you will miss the Map Series, a popular and regular feature of the Population Geography journal. We hope to bring it back in the next issue. In the third edition of Geo-Reflections, Professor Samantha shares her experiences and dilemmas faced as a student and a researcher in reading books on Urban Geography and applying concepts and theories devised based on work experiences in the developed world. She highlighted how the knowledge was produced and disseminated from the Western World through colonial routes and hinted at the anti-colonial scholarship's recent challenges. On the whole, it makes fascinating and eye-opening reading. Finally, I express my sincere gratitude to the Members of the Executive Committee of the Association of Population Geographers of India (APGI) and the Editorial Board of Population Geography for their unqualified help and support in discharging my duties as the Editor. My special thanks are to Professor K.R. Dikshit, Mr. Mohan Singh, Professor Nina Singh, and Professor R.Vaidyanathan, for their encouragement, help, support and guidance.

Surya Kant
Editor

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# Fertility Differentials in India by Religious Groups

Dewaram Abhiman Nagdeve[1] and Prashant Bhimrao Dongardive

**Abstract:** The paper examines fertility differentials in India by the religious groups by picking up data available from the National Family Health Survey (NFHS 4), 2015-2016. For data analysis and to find the nature of association between the dependent and independent variables, bi-variate, logistic regression, and multivariate statistical techniques have been put to practice.

The findings of the study reveal that there existed sharp differentials in fertility rates among the religious groups in India. The Jain population exhibited the low and the Muslims the highest fertility rates among the major religious groups in the country. Hindu and Muslim populations in India have a fertility rate in the ratio of 2:3. However, among different religious groups in India, the fertility rate among Hindus is next only to the Muslims.

It is has been noted that there is a negative relationship between education, wealth index, and fertility rates. The results of the multivariate analysis show that the socioeconomic status of a religious group does not necessarily harm fertility, rather the socioeconomic status varies according to the religious context even after a tab is kept on other socioeconomic and demographic variables.

Keywords: Religious Groups, Hindus, Muslims, Fertility rate, Differentials, India

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## Introduction

India has though achieved a replacement level of fertility country as a whole yet there are wide differentials in fertility rates at the regional as well as religious group levels. Religion continues to play an important role in population growth due to different religious beliefs, and socio-cultural practices and taboos. As a result, the Muslim population in India, in general, finds less interest in adopting family planning practices in comparison to the Hindu and the other religious groups in the country. Moreover, the role of physiographic and climatic conditions can't be overlooked.

It is stated that religion has a special significance, as human behaviour has been greatly influenced by social practices due to religious sanctions in India (Das and Pandey, 1985). The major religious groups in India are the Hindus, the Muslims, the Christians, the Sikhs, the Buddhists and Jains. The Hindu population accounted for 82.7 per cent of the total population in 1971 but the share declined to 79.8 per cent by 2011. Against this, the proportional share of the Muslim population has increased from 11.2 per cent to 14.2 per cent during this period. The proportional shares of the Christian, the Sikh and the Jain population have also declined from 2.6 per cent, 1.9 per cent, and 0.5 per cent to 2.3 per cent, 1.72 per cent, and 0.37 per cent,

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respectively during this period. The share of the Buddhist population has remained constant (0.7 per cent) during this period.

The higher growth and fertility rates among Muslims as compared to Hindus are not new. Several studies conducted in the past also confirm this (see Jain, 1939; Davis, 1951; United Nations, 1961; Driver, 1963; Rele and Kanitkar, 1966; Saksena, 1973; Visaria and Visaria, 1974; Das and Pandey, 1985). Also, several studies, conducted at the national level in recent years, examined the influence of religion on fertility (see Bhat, 1996; Ramesh, et al, 1996; Dreze and Murthi, 2001). Analysis of the data available from India's three rounds of National Family Health Surveys shows that fertility transition is continuing in all the major religious groups of India. Religious differentials are gradually narrowing down and fertility rates for all religious groups are expected to fall further towards the replacement level and even below it (Alagrajan and Kulkarni, 2008).

Several studies confirm the role of several socio-economic factors such as education, economic status of the household, occupation, caste/tribe status and religion on fertility. Female education is considered among the most important ones (see Zachariah 1984; Cochrane 1988; Unisa and Bhagat 2000; Dreze and Murthi 2001). The role of educational attainments has been noted for both the Hindus and the Muslims in India. Hence, studies conclude that irrespective of religion, education is the most important determinant of fertility (Rele and Kanitkar, 1976), taking place among all sections of society- rich and poor, Hindus and Muslims, upper caste and lower castes (Visaria and Visaria, 1994; James, 1999; James and Nair, 2005). According to Bongaarts and Potter (1983), socio-economic factors must be the principal causes of fertility trends and differentials. While the role of socioeconomic factors influencing fertility cannot be denied, their relationship with religion and the influence on fertility is increasingly being debated (Jeffery and Jeffery 2000, 2002; Iyer 2002; Morgan et al 2002: Bhat 2004; Dharmalingam and Morgan 2004; Chattopadhyay et al 2004; Bhagat and Praharaj, 2005). The fertility differentials due to religious factors result in varied contribution population growth of India by the people belonging to different religious groups in India. Therefore, the study of the factors contributing to high fertility and fertility differentials by religions assumes great significance. There are studies on Hindu-Muslim fertility and family planning differentials in India but only a few on fertility differentials by religions in India.

Taking a cue from the above statements, the present study examines inter-religion fertility differentials in India in the light of the following research questions:

1. Whether the impact of religious factors including customs, traditions and beliefs on fertility differ across religions in India?
2. Is the role played by the religious factors in fertility differentials is more than that of socio-economic factors? and
3. Within socio-economic factors, is it the educational level of females in child-bearing age groups or the living standard of the households to which such women belong play a more significant role in fertility differentials?

## MATERIALS AND METHODS

### Data sources

The data available from the National Family Health Survey (NFHS)-4 have been used for conducting the present study. The NFHS surveys, conducted in representative sampled households throughout India, happen to be large-scale multi-round surveys covering different aspects of health, fertility and family planning in India.

All the ethical protocols including individual consents have been obtained before seeking a response to a set of questions on fertility and the use of family planning. Individual and household-level background characteristics have been used to show fertility differentials by religious groups in India. Data were collected in two phases during 20th January 2015 and 4th December 2016. A total representative sample of 628,900 households and 723,875 eligible women aged 15-49 years were covered. Of the total 723,875 eligible women, 699,686 ever-married women and 499, 627 currently married women were interviewed. The household response rate has been as high as 97.6 per cent and eligible women's response rate is 96.7 per cent. The details of the study design as well as the sampling frame and sample implementation have been detailed in the NFHS report (IIPS and ICF, 2017). The NFHS-4 provides information based on religious categories. Most of the women belonged to one of the seven main religion groups (Hindu, Muslim, Christian, Sikh, Buddhist and Jain), and the rest were designated as belonging to "other religions". Of the 699,686 ever-married women, 519,281 were the Hindu, 94,591 the Muslim, 52,113 the Christian, 15,300 Sikh, 8, 981 the Buddhist/Neo-Buddhist, 1, 028 Jain and the remaining 8,392 'others' by religion. The seven main religious groups list here have been taken for the analysis below.

### Techniques of analysis

For establishing the association between dependent and independent variables individually, data have been analyzed using bivariate and logistic regression analysis. The multivariate analysis has been conducted to estimate the magnitude of net differentials after controlling or adjusting for the effects of other socio-economic and demographic characteristics. First, the net effect of religion on cumulative fertility is estimated using multiple classification analysis (MCA), where the mean number of children ever born to a woman has been used as the dependent variable. In addition to the religious variables, other socio-economic and demographic factors including age group, age at first intercourse, marital duration, place of residence, education, and family wealth Index have been used as independent variables to test the characteristics hypothesis.

## RESULTS

### Age-specific fertility rates and total fertility rates by religious groups in India

Age-specific fertility rates are much higher for Muslims than in Hindus, Christians, Sikhs, and Buddhists/Neo-Buddhists while it is lowest for Jains in all age groups (see Table 1). The peak or prime age of childbearing is 20-29 years in all religions, with the fertility rates declining steadily thereafter. The early childbearing tendency is highest among Muslims. The Hindus, Christians, Sikhs, and Buddhists/Neo-Buddhists fall in order. It is the lowest among the Jains.

For the Muslim and the Christian women total fertility was concentrated only 65.0 per cent in the prime childbearing age group of 20-29 years. This is 73.0 per cent for the Hindu, 74.0 per cent for the Jain, and 76 per cent for the Sikh, Buddhist/Neo-Buddhist. There is also a moderate amount of early childbearing in the age group of 15-19 years, accounting for 12.0 per cent of total fertility in India; and ranging from the lowest of 4.0 per cent for Jains to the highest of 13.0 per cent for Buddhists/Neo-Buddhists. Fertility at 35 years and more accounts for only 5.0 per cent of total fertility, ranging from 4.0 per cent (the lowest) each for Hindus, Sikhs, and Buddhists/Neo-Buddhists to 12.0 per cent (the highest) each for Jains. The average total fertility rate (TFR) was 2.18 births per woman in India but varied from 2.62 births for the Muslims to only 1.2 births for the Jains, the Hindus falling in between with 2.13 births. It shows that TFR for the Muslims is higher by half-child in comparison to the Hindus, both the groups having higher fertility than other major religious groups of India.

**Table 1: India: Age-specific and total fertility rates by religious groups, 2015-16**

| Fertility Rates | Hindu | Muslim | Christian | Sikh | Buddhist/ Neo-Buddhist | Jain | *Other Religion | Total |
|---|---|---|---|---|---|---|---|---|
| **Age-Specific Fertility Rate** | | | | | | | | |
| 15-19 | 0.0514 | 0.0548 | 0.0422 | 0.0226 | 0.0466 | 0.0105 | 0.0780 | 0.0515 |
| 20-24 | 0.1853 | 0.1922 | 0.1329 | 0.1269 | 0.1656 | 0.0694 | 0.1977 | 0.1839 |
| 25-29 | 0.1245 | 0.1502 | 0.1262 | 0.1142 | 0.0948 | 0.1085 | 0.1385 | 0.1276 |
| 30-34 | 0.0466 | 0.0809 | 0.0634 | 0.0403 | 0.0281 | 0.0232 | 0.0502 | 0.0510 |
| 35-39 | 0.0145 | 0.0323 | 0.0250 | 0.0112 | 0.0118 | 0.0142 | 0.0350 | 0.0169 |
| 40-44 | 0.0035 | 0.0094 | 0.0059 | 0.0017 | 0.0005 | 0.0147 | 0.0122 | 0.0042 |
| 45-49 | 0.0012 | 0.0034 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0021 | 0.0014 |
| **TFR (15-49)** | 2.13 | 2.62 | 1.99 | 1.58 | 1.74 | 1.20 | 2.57 | 2.18 |
| **Total** | **519281** | **94591** | **52113** | **15300** | **8981** | **1028** | **8392** | **699686** |

*Other religion includes Jews, No religion and Other.
Note: Rates are given for ever-married women and the period of 1-36 months preceding the survey (2013-15 for NFHS-4).
Age-specific fertility rates are expressed per woman. Rates for the age group 45-49 might be slightly biased due to truncation.
TFR = Total fertility rate expressed per woman

*Source: Authors' calculation using NFHS-4 2015-16 dataset. Weights are used to estimate these values.*

## Childbearing pattern by religious groups in India

The actual childbearing performance gives an idea of the preference for the small family among religious groups in India. The distribution of currently married women by religion and number of living children has been presented in Table 2. It has been found that 35.0 per cent of the currently married women in India have the two, another 20.0 per cent of the three, and yet another 16.0 per cent more than the four children.

Half of the currently married Jain women had two children. This share was 42.0 per cent for the Christian and the Sikh, 36.0 per cent for the Hindu, and 35.0 per cent for Buddhist/Neo-Buddhist and only 25.0 per cent or the lowest for the Muslim. A quarter of currently married women among the Buddhist/Neo-Buddhist had three children. This share was 20.0 per cent for the Hindu and the Muslim, 19.0 per cent for Sikh, 17.0 per cent for Christian and only 15.0 per cent or the lowest for the Jain. The percentage of currently married women having more than four children is as high as 26.0 per cent for Muslims and as low as only 3.0 per cent for the Jains, the Hindus falling between 14.0 per cent. It may also be noticed that more than 84.0 per cent of women have three or lesser number of living children in India, the proportion ranging from a high of 97.0 per cent for the Jain to a low of 74.0 per cent for the Muslim women.

**Table 2: India: Percentage distribution of currently married women in terms of number of living children by religious groups, 2015-16**

| No. of living children | Hindu | Muslim | Christian | Sikh | Buddhist/ Neo-Buddhist | Jain | Other | Total |
|---|---|---|---|---|---|---|---|---|
| 0 | 10.5 | 10.8 | 9.5 | 8.5 | 9.2 | 7.4 | 12.2 | 10.5 |
| 1 | 19.7 | 17.4 | 21.2 | 23.5 | 20.3 | 25.0 | 21.8 | 19.5 |
| 2 | 35.6 | 25.4 | 41.8 | 42.1 | 34.6 | 49.5 | 26.1 | 34.5 |
| 3 | 19.8 | 20.1 | 16.8 | 18.9 | 25.1 | 15.4 | 20.9 | 19.8 |
| 4+ | 14.4 | 26.4 | 10.8 | 7.2 | 10.9 | 2.7 | 19.0 | 15.8 |
| **Total** | **379,442** | **63,866** | **32,847** | **10,847** | **6,083** | **738** | **5,804** | **499,627** |
| **Per cent** | **75.9** | **12.8** | **6.6** | **2.2** | **1.2** | **0.2** | **1.2** | **100.00** |

*Source: Author's calculation using NFHS-4 2015-16 dataset. Weights are used to estimate these values.*

**Differentials in the mean number of children ever born by Religious groups**

The mean number of children ever born (MCEB) is one of the cohort measures used in fertility analysis. The children ever born to currently married women of reproductive age groups may indicate the actual childbearing performance of the population. The mean number of children ever born by religious groups according to background characteristics of currently married women in India has been presented in Table 3. The analysis revealed that the average MCEB in India is 2.4. However, it ranges from a high of 2.9 among Muslim women to only 1.8 among the Jain women, being 2.8 among the Christian, 2.3 among the Hindus. In the case of 40 & above women age-group, MCEB is 4.3 for Muslims, 3.2 for Hindus, and only 2.3 for Jains. Again, MCEB for the Muslim women in the age group of fewer than 18 years is the highest (3.3 children) and the lowest (2.4 children) for the Jain women.

On the other side of the scale also, the Muslim women topped in MCEB. The MCEB among the Muslim women married for 15 years and more was as high as four. This number made 3.1 for Hindus and only 2.3 for Jains.

As expected, MCEB for urban women was lower than that in rural areas for all the religions in India. However, the Jain religion is the exception to this rule. In their case, MCEB among currently married women was 1.9 both in rural and urban areas. Both the numbers were high for the Muslim women and the urban-rural gap was the maximum for the women from the 'other religions' followed by the Hindu and the Christian women. Against this, the gap was nil in

the case of the Jain women and the least for the Sikh women. Interestingly, even though MCEB is the highest in urban and rural areas both for the Muslims, the urban-rural gap in MCEB is marginally lower than the Hindu, the Christian, and the Buddhist/neo-Buddhist women (Table 3). It means factors other than urban-rural differentials in awareness, living cost, literacy level and medical health facility are more important in the case of Muslims in comparison to other religious communities of India. In other words, the religious factors are more important in the case of the Muslim population than urban-rural gaps of awareness, facilities and cost of living.

**Table 3: India: Mean number of children ever born (MCEB) among religious groups by background characteristics of currently married women, 2015-16.**

| Background characteristics | Hindu | Muslim | Christian | Sikh | Buddhist/ Neo-Buddhist | Jain | Other | Total |
|---|---|---|---|---|---|---|---|---|
| **Age group** | Mean number of children ever born (MCEB) | | | | | | | |
| 15-19 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 2.0 | 0.4 | 16864 |
| 20-29 | 1.5 | 1.7 | 1.5 | 1.5 | 1.4 | 1.3 | 1.8 | 177223 |
| 30-39 | 2.6 | 3.2 | 2.3 | 2.4 | 2.3 | 1.9 | 2.9 | 173590 |
| 40 and above | 3.2 | 4.3 | 2.7 | 3.0 | 2.7 | 2.3 | 3.8 | 131950 |
| **Age at consummation of marriage** | | | | | | | | |
| <18 | 2.8 | 3.3 | 2.7 | 2.5 | 0.0 | 2.4 | 2.8 | 209528 |
| 18 and above | 2.0 | 2.4 | 2.0 | 1.9 | 1.9 | 1.8 | 2.0 | 290087 |
| **Marital duration** | | | | | | | | |
| <5 | 0.7 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 | 0.7 | 96113 |
| 05-09 | 1.9 | 2.1 | 1.8 | 1.8 | 1.8 | 1.6 | 1.9 | 90790 |
| 10-14 | 2.4 | 2.9 | 2.4 | 2.2 | 2.3 | 2.0 | 2.7 | 83169 |
| 15 and above | 3.1 | 4.0 | 2.8 | 2.6 | 3.0 | 2.3 | 3.7 | 229555 |
| **Residence** | | | | | | | | |
| Rural | 2.4 | 2.9 | 2.3 | 2.0 | 2.4 | 1.9 | 2.5 | 360349 |
| Urban | 2.0 | 2.6 | 1.9 | 1.9 | 2.1 | 1.9 | 2.0 | 139278 |
| **Women's education** | | | | | | | | |
| Illiterate | 3.2 | 3.8 | 3.0 | 2.8 | 2.9 | 2.3 | 3.3 | 172686 |
| Primary | 2.5 | 2.9 | 2.7 | 2.3 | 2.8 | 2.7 | 2.5 | 72881 |
| Secondary | 1.9 | 3.0 | 2.0 | 1.9 | 2.0 | 2.1 | 1.7 | 209380 |
| Higher Secondary and above | 1.3 | 1.4 | 1.4 | 1.3 | 1.3 | 1.5 | 1.1 | 44680 |
| **Standard of living index** | | | | | | | | |
| Low | 2.8 | 3.2 | 2.7 | 2.9 | 2.5 | 1.7 | 2.6 | 185623 |
| Medium | 2.3 | 2.8 | 1.3 | 2.5 | 2.2 | 1.9 | 2.3 | 165720 |
| High | 1.9 | 2.4 | 1.8 | 1.9 | 2.1 | 1.8 | 1.9 | 148284 |
| **Total** | **2.3** | **2.9** | **2.8** | **2.2** | **2.1** | **1.8** | **2.4** | **499627** |

*Source: Author's calculation using NFHS-4 2015-16 dataset. Weights are used to estimate these values.*

The MCEB declines gradually with increases in the level of mother's education for all the religions. However, there has been noticed a slight increase in the case of Muslim women with an increase in educational level from primary to secondary. Another notable fact is that inter-religion differentials in MCEB decline with the increase of mothers' education. Even in the case

of Muslim women, MCEB which was 3.0 for the women having educational level up to secondary level came down sharply to 1.4 for women those attaining the educational level of higher secondary and above; placing the Muslim women almost at par with the women belonging to the all other religious communities in India. In this way, the importance of a mother's education is established.

Similarly, the living standard households, in general, find a close association with MCEB for women belonging to all religions. The women belonging to low wealth index households of all the religions registered high MCEB. With the change in index level of households from low to medium and then from medium to high, MCEB registered a decline almost for the women belonging to all religions. The decline in MCEB is, however, comparatively higher for the Hindu, the Sikh and the Buddhist/neo-Buddhist women, lower for the Muslim and 'other religions' women, skewed for the Christian women and increasing for the Jain women. The increasing trend seen in the case of Jain women needs to be further investigated. On the whole, the role of socio-economic characteristics of the households is clear in the case of women belonging to all the religions in India.

**Analysis of cumulative fertility: net effects of religion on children ever born**

In the following, we attempt to ascertain whether any observed fertility differentials based on religion have been caused by variations in socio-economic characteristics of households or are the effects of religion per se. For this purpose, we have undertaken an analysis of cumulative marital fertility (children ever born). Table 4 presents the unadjusted and adjusted relationship between religion and fertility along with other socio-economic variables and covariates. The results of multiple classification analysis show that the unadjusted deviations by religion were large, the Muslim women recording cumulative fertility significantly above the average (being 2.38) and those from the Buddhist/Neo-Buddhist below this.

Results from Model 1 revealed that even after controlling for socioeconomic variables, the pattern of differentials exists. Nonetheless, the gap gets narrower. The adjusted MCEB to the Muslim, Christian and Hindu women continued to be above the average, against below this for the Buddhist/Neo-Buddhist women. In Model 2, marital duration has been used as the covariate along with socio-economic and demographic variables, earlier used in Model 1.

In Model 2, also, the Muslim women registered higher fertility than the average and the difference between Buddhist/Neo-Buddhist and Hindu was much smaller than that for Buddhist/Neo-Buddhist and Muslim, even after adjustment. The unadjusted difference in the adjusted MCEB between Muslim and Buddhist/Neo-Buddhist was 0.65 and between Hindu and Buddhist/Neo-Buddhist only 0.20. After controlling the effects of other factors and covariates (see Model 2), we find that the difference in the adjusted MCEB between Muslim and Buddhist/Neo-Buddhist is 0.63, and between Hindu and Buddhist/Neo-Buddhist is only 0.10. The difference between adjusted means is close to that of unadjusted ones. This indicates that the observed (unadjusted) differences have not been explained by the other socio-economic and demographic factors, used in the analysis. Thus, the characteristics hypothesis does not gain

support as far as Muslim-Buddhist/Neo-Buddhist differentials are concerned. It means that above the average fertility noticed among Muslim women is explained by the educational level rather than their relatively low level of household wealth index.

**Table 4: Unadjusted and adjusted mean number of children ever born by religious groups, socio-economic and demographic variables, India, 2015-16.**

| Background Characteristics | No. of Cases | Unadjusted MCEB | Eta | Model 1 | | Model 2 | |
|---|---|---|---|---|---|---|---|
| | | | | Adjusted MCEB | Beta | Adjusted MCEB | Beta |
| **Grand mean** | **499,627** | 2.38 | | | | | |
| **Religion** | | | 0.106 | | 0.107*** | | 0.120*** |
| Hindu | 379,442 | 2.42 | | 2.41 | | 2.39 | |
| Muslim | 63,866 | 2.89 | | 2.88 | | 2.92 | |
| Christian | 32,847 | 2.74 | | 2.81 | | 2.87 | |
| Buddhist/Neo-Buddhist | 6,083 | 2.24 | | 2.27 | | 2.29 | |
| Other | 17,389 | 2.2 | | 2.36 | | 2.40 | |
| **Age at consummation of marriage** | | | 0.252 | | 0.182*** | | 0.020*** |
| <18 | 209,528 | 2.99 | | 2.99 | | 2.53 | |
| 18 and above | 290,099 | 2.13 | | 2.13 | | 2.46 | |
| **Age Group** | | | 0.500 | | 0.468*** | | 0.134*** |
| 15-19 | 16,864 | 0.39 | | 0.22 | | 1.65 | |
| 20-29 | 177,223 | 1.63 | | 1.73 | | 2.51 | |
| 30-39 | 173,590 | 2.82 | | 2.81 | | 2.71 | |
| 40 and above | 131,950 | 3.49 | | 3.38 | | 2.29 | |
| **Place of residence** | | | 0.092 | | 0.01*** | | 0.009*** |
| Rural | 360,349 | 2.59 | | 2.5 | | 2.50 | |
| Urban | 139,278 | 2.24 | | 2.46 | | 2.47 | |
| **Education** | | | 0.407 | | 0.188*** | | 0.132*** |
| Illiterate | 172,686 | 3.33 | | 2.88 | | 2.78 | |
| Primary | 72,881 | 2.68 | | 2.55 | | 2.49 | |
| Secondary | 209,380 | 1.97 | | 2.27 | | 2.32 | |
| Higher Secondary and above | 44,680 | 1.39 | | 1.95 | | 2.19 | |
| **Wealth Index** | | | 0.208 | | 0.121*** | | 0.139*** |
| Poor | 185,623 | 2.91 | | 2.74 | | 2.77 | |
| Middle | 165,720 | 2.42 | | 2.44 | | 2.43 | |
| Rich | 148,284 | 2.05 | | 2.24 | | 2.21 | |
| | | | | Multiple R = 0.626 | R2=0.392 | Multiple R=0.666 | $R^2$ = 0.444 |

*Source: Author's calculation using NFHS-4 2015-16 dataset. Weights are used to estimate these values.*

Among the other variables, education and household wealth index (both in Model 1 and Model 2) at different levels show a significant effect on fertility. In sum, results of both the models (1 and 2, presented in Table 4) show that the fertility among the Muslim women was above the average and the differentials in cumulative fertility by religion exist even after controlling for other socioeconomic and demographic variables and covariates. Clearly, the characteristics hypothesis (controlling the socio-economic and demographic variables) alone

does not explain differentials in cumulative marital fertility by religion in India. Since child mortality, fertility desires, and behaviour, that is, high infant mortality induces an urge to have more children, to ensure the survival of at least a few children in adulthood. As the fertility level approaches the replacement level of fertility, the role of child mortality becomes increasingly important. Hence, it is desirable to include child mortality as an independent variable along with the socio-economic variables in the analysis of cumulative marital fertility. However, this was not possible to include child mortality as an explanatory variable in the multiple classification analysis of children ever born because children ever born and child loss has a reciprocal effect (Alagrajan and Kulkarni, 1998).

**Differentials in MCEB by Religion and Son Preference**

The differentials in the MCEB by religion, son preference and socioeconomic and demographic characteristics of currently married women in India have been presented in Table 5. In India, the MCEB is three with son preference, but it comes down to 2.4 without son preference. The MCEB having the son preference varies from a low of 2.1 for Jain to a high of 3.3 for Muslim women. But without the son preference, it ranges from a low of 2 for the Jains to a high of 2.6 for the Muslims. The MCEB by son preference and for women in the age group 40 years and above is 4.7 for Muslims, 3.8 for Hindus, and only 2.7 for Jains. The MCEB with son preference in the case of women having age at consummation of marriage below 18 years has been found 3.4, as compared to 2.7 without son preference. This MCEB with son preference varies from a low of 2.3 for Jains to a high 3.8 for Muslims. The Muslim women married for 15+ years have the MCEB with son preference as high as 4.5. This comes down to 3.7 for Hindus and only to 2.5 for Jains. The MCEB with son preference is higher in rural areas than urban areas for all the religions in India. The MCEB with son preference and the marital duration below 10 years is 3.2 for Muslims, 2.9 for Hindus and only 2.6 for Jains. Women with longer marital duration and son preference have more MCEB as compared to those having lesser marital duration and son preference. The MCEB declines gradually with the reduction in son preference and an increase in the level of mother's education for all the religions except for the Jains. The difference in MCEB with and without son preference declines with the increase of mother's education, indicating its importance in the case of all the religions. The MCEB declines with or without son preference after a rise in the value of household wealth index: MCEB is 3.3 for women belonging to households having low wealth index, and only 2.4 for women belonging to those falling under high wealth index. It means the MCEB declines with the rising wealth index value of households for all religions and vice versa. The MCEB with and without son preference varies according to socio-economic characteristics, indicating their significance for religions in India.

The logistic regression analysis has been used to know the influence of socio-economic and demographic characteristics on the son preference by religion in India, and results are presented in Table 6. The analysis reveals that among the Hindus and Muslims, the son preference increases significantly among women in older age groups than those in 15-19 age groups. Especially, the son preference decreases among the women having 18+ age at the consummation of marriage. The likelihood of son preference decreases in urban areas for Hindus,

Muslims, and Sikhs against a slight increase for Christian women in India. The possibility of son preference is the highest among illiterate women. However, it significantly decreases with increased educational levels in almost all religions. Similarly, the likelihood of son preference among women significantly decreases with increasing household wealth index for all the religions in India.

**Discussion**

The analysis reveals that there are wide inter-religion fertility differentials in India. The total fertility rate is half child higher for Muslims in comparison to the Hindus, and both these groups have higher fertility than other religious groups.

The Jains exhibited the lowest fertility among all the religious groups in the country. However, with the increase in educational levels and standards of living, the inter-religion fertility differentials become narrower and narrower. For religious factors, the use of contraceptives is quite low among Muslims, considered an important factor behind the fertility differentials. It is, however, true that the use of contraceptives has increased rapidly among Muslims in recent years. Nonetheless, a relatively higher level of fertility among Muslims will have to be understood independent of socio-economic and political contexts.

Multivariate analyses on cumulative fertility show that inter-religion differentials do exist even after controlling the other socioeconomic and demographic variables. However, the analyses of interaction effects of religion and other socioeconomic factors on fertility show that the factor of religion is not constant across the levels of socio-economic factors. Our study has also found that the differentials persisted even after controlling for the effect of socio-economic and demographic characteristics, such as age at the consummation of marriage, women education, and household wealth index, all presumed to influence fertility. However, it has been observed that the influence of these factors on differentials, if any, is not very large; making it difficult to attribute the fertility differential to the factor of religion alone unless other variables are controlled simultaneously through MCA or other multivariate analysis.

For confirming these findings, an in-depth investigation has needed considering the importance and sensitivity of religious fertility. However, efforts should have been made to promote family planning programs among all religions. There is enough flexibility, especially among the Hindus, Buddhists, Sikhs and Jains, for modern reforms in scientific methods of family planning. The misconception in the minds of those people who reject family planning on religious grounds shall have been removed and the correct knowledge shall have been imparted through their community and religious leaders. Another important task is to ensure that the education of the females and their uplift receive increasing attention in development programmes because religious differences concerning fertility are narrowing, as concern for a smaller and better-educated family continues to spread (Das and Pandey, 1985). The fertility by son preference and no son preference significantly decreases with increasing education and household wealth index in almost all the religions in India. This indicates that religious fertility differentials by religion will disappear with the improvement of socio-economic status.

**Table 5: India: MCEB having son preference and socio-economic and demographic characteristics of currently married women by religious groups, 2015-2016**

| Background Characteristics | Hindu | | Muslim | | Christian | | Sikh | | Buddhist/ Neo-Buddhist | | Jain | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| **Age Group** | | | | | | | | | | | | | | | | |
| 15-19 | 0.0 | 0.4 | 0.5 | 0.4 | 0.4 | 0.6 | 0.4 | 0.4 | 0.2 | 0.5 | NA | 2.0 | 0.3 | 0.4 | 0.4 | 0.4 |
| 20-29 | 2.0 | 1.5 | 2.0 | 1.7 | 1.9 | 1.5 | 1.5 | 1.3 | 2.0 | 1.5 | 1.4 | 1.3 | 2.1 | 1.7 | 2.0 | 1.5 |
| 30-39 | 3.2 | 2.5 | 3.7 | 3.1 | 2.7 | 2.3 | 2.4 | 2.2 | 2.6 | 2.4 | 1.8 | 1.9 | 3.3 | 2.8 | 3.3 | 2.5 |
| 40 | 3.8 | 3.0 | 4.7 | 4.1 | 3.0 | 2.6 | 3.0 | 2.6 | 3.4 | 3.0 | 2.7 | 2.2 | 4.2 | 3.8 | 3.9 | 3.1 |
| **Age at consummation of marriage** | | | | | | | | | | | | | | | | |
| <18 | 3.3 | 2.6 | 3.8 | 3.1 | 2.9 | 2.6 | 2.8 | 2.5 | 3.2 | 2.7 | 2.3 | 2.4 | 3.4 | 2.6 | 3.4 | 2.7 |
| 18 and above | 2.5 | 1.8 | 2.8 | 2.2 | 2.4 | 1.9 | 2.2 | 1.9 | 2.3 | 1.8 | 2.0 | 1.7 | 2.6 | 1.9 | 2.6 | 1.9 |
| **Marital Duration** | | | | | | | | | | | | | | | | |
| <5 | 0.8 | 0.7 | 0.9 | 0.8 | 1.0 | 0.8 | 0.9 | 0.8 | 1.0 | 0.7 | 1.1 | 0.7 | 0.8 | 0.7 | 0.8 | 0.7 |
| 5-9 | 2.1 | 1.8 | 2.3 | 2.0 | 2.1 | 1.8 | 1.7 | 1.8 | 1.9 | 1.8 | 1.5 | 1.6 | 2.1 | 1.8 | 2.1 | 1.8 |
| 10-14 | 2.9 | 2.3 | 3.3 | 2.8 | 2.6 | 2.3 | 2.3 | 2.2 | 2.2 | 2.3 | 2.1 | 2.0 | 3.2 | 2.5 | 2.9 | 2.4 |
| 15 and above | 3.7 | 2.9 | 4.5 | 3.9 | 3.1 | 2.7 | 2.9 | 2.6 | 3.3 | 2.9 | 2.5 | 2.2 | 3.9 | 3.6 | 3.8 | 3.0 |
| **Residence** | | | | | | | | | | | | | | | | |
| Urban | 0.0 | 1.9 | 3.1 | 2.5 | 2.1 | 1.9 | 2.3 | 1.9 | 2.3 | 2.3 | 2.1 | 2.1 | 2.8 | 2.8 | 2.6 | 2.6 |
| Rural | 3.1 | 2.3 | 3.4 | 2.8 | 2.8 | 2.2 | 2.4 | 2.0 | 3.0 | 3.0 | 2.2 | 2.2 | 3.0 | 3.0 | 3.1 | 3.1 |
| **Women's education** | | | | | | | | | | | | | | | | |
| Illiterate | 3.6 | 3.0 | 4.0 | 3.6 | 3.3 | 2.8 | 3.1 | 2.7 | 3.5 | 2.8 | 2.2 | 2.4 | 3.6 | 3.1 | 3.6 | 3.1 |
| Primary | 2.9 | 2.4 | 3.1 | 2.8 | 2.9 | 2.7 | 2.6 | 2.2 | 3.0 | 2.7 | 1.2 | 3.0 | 2.9 | 2.4 | 3.0 | 2.5 |
| Secondary | 2.2 | 1.8 | 2.4 | 2.0 | 2.2 | 2.0 | 1.9 | 1.8 | 2.2 | 2.0 | 2.4 | 2.1 | 1.9 | 1.7 | 2.2 | 1.8 |
| Higher Secondary & above | 1.4 | 1.3 | 1.7 | 1.4 | 1.7 | 1.4 | 1.1 | 1.3 | 1.5 | 1.2 | 1.9 | 1.5 | 1.8 | 1.0 | 1.5 | 1.3 |
| **Wealth Index** | | | | | | | | | | | | | | | | |
| Poor | 3.3 | 2.6 | 3.6 | 3.1 | 3.2 | 2.6 | 3.2 | 2.8 | 3.2 | 2.4 | NA | 1.7 | 3.1 | 2.4 | 3.3 | 2.6 |
| Medium | 2.8 | 2.1 | 3.2 | 2.6 | 2.5 | 2.2 | 3.0 | 2.4 | 2.7 | 2.1 | 2.3 | 2.0 | 2.9 | 2.1 | 2.9 | 2.2 |
| Rich | 2.3 | 1.8 | 2.9 | 2.2 | 2.0 | 1.8 | 2.0 | 1.9 | 2.3 | 2.0 | 1.6 | 1.9 | 2.0 | 1.9 | 2.4 | 1.9 |
| **Total** | **3.0** | **2.2** | **3.3** | **2.6** | **2.6** | **2.1** | **2.4** | **2.0** | **2.7** | **2.2** | **2.1** | **1.9** | **3.0** | **2.3** | **3.0** | **2.4** |

*Source: Author's calculation using NFHS 4 2015 16 dataset. Weights are used to estimate these values.*

**Table 6: Results of logistic regression (Odds ratio) for son preference by socio-economic and demographic characteristics of women in India, 2015-16**

| Background Characteristics | Hindu | Muslim | Christian | Sikh | Buddhist/ Neo-Buddhist | Jain | Other | Total |
|---|---|---|---|---|---|---|---|---|
| **Age Group** | | | | | | | | |
| 15-19® | | | | | | | | |
| 20-29 | 1.098*** | 1.193*** | 0.970 | 1.559 | 2.598 | 0.520 | 1.937* | 1.124*** |
| 30-39 | 1.152*** | 1.290*** | 1.033 | 2.156* | 2.025 | 0.734 | 1.733 | 1.181*** |
| 40 and above | 1.293*** | 1.304*** | 1.115 | 2.407* | 3.086 | 1.000 | 2.079* | 1.299*** |
| **Age at consummation of marriage** | | | | | | | | |
| <18® | | | | | | | | |
| 18 and above | 0.899*** | 1.059** | 0.997 | 0.801* | 0.867 | 0.425** | 1.341* | 0.919*** |
| **Marital Duration** | | | | | | | | |
| <5® | | | | | | | | |
| 5-9 | 1.188*** | 1.181*** | 1.091 | 1.149 | 2.133*** | 0.278* | 1.110 | 1.168*** |
| 10-14 | 1.255*** | 1.127** | 1.418** | 1.030 | 3.092*** | 0.424 | 1.598* | 1.216*** |
| 15 and above | 1.364*** | 1.182*** | 1.489** | 1.020 | 3.296*** | 0.456 | 1.680* | 1.308*** |
| **Residence** | | | | | | | | |
| Rural® | | | | | | | | |
| Urban | 0.888*** | 0.795*** | 1.071 | 0.749*** | 0.954 | 0.624 | 1.313 | 0.903*** |
| **Women's education** | | | | | | | | |
| Illiterate® | | | | | | | | |
| Primary | 0.711*** | 0.718*** | 0.812* | 0.742** | 1.231 | 0.917 | 0.477*** | 0.707*** |
| Secondary | 0.547*** | 0.537*** | 0.748*** | 0.565*** | 0.631*** | 0.439 | 0.634*** | 0.535*** |
| Higher Secondary and above | 0.476*** | 0.364*** | 0.664*** | 0.445*** | 0.942 | 0.388 | 0.488* | 0.436*** |
| **Wealth index** | | | | | | | | |
| Low® | | | | | | | | |
| Medium | 0.637*** | 0.862*** | 0.668*** | 0.816 | 0.917 | 1.594 | 0.649** | 0.665*** |
| High | 0.539*** | 0.901*** | 0.583*** | 0.759* | 0.510*** | 1.000 | 0.366*** | 0.583*** |
| **Constant** | **0.384*** ** | **0.381*** ** | **0.231*** ** | **0.176*** ** | **0.030*** ** | **1.300** | **0.135*** ** | **0.383*** ** |

*Source: Author's calculation using NFHS-4 2015-16 dataset. Weights are used to estimate these values.*

## Conclusion

Briefly, there are wide inter-religion fertility differentials in India. The total fertility rate is half child higher for Muslims in comparison to the Hindus, and both these groups have higher fertility than other religious groups. Among all the religious groups, the Jains exhibited the lowest fertility in the country. However, with the increase in educational levels and standards of living, the inter-religion fertility differentials become narrower and narrower.

Multivariate analyses on cumulative fertility show that inter-religion differentials do exist even after controlling the other socioeconomic and demographic variables. However, the analyses of interaction effects of religion and other socioeconomic factors on fertility show that the factor of religion is not constant across the levels of socio-economic factors. The study found that the differentials persisted even after controlling for the effect of socio-economic and demographic characteristics, such as age at the consummation of marriage, women education, and household wealth index, all presumed to influence fertility. However, it has been observed that the influence of these factors on differentials, if any, is not very large; making it difficult to attribute the fertility differential to the factor of religion alone unless other variables are controlled simultaneously through MCA or other multivariate analysis.

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# Perception of Urban Environment–A Case of Hyderabad City

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**Abstract:** The paper addresses the behavioural dimension of cities. The way people behave, interact and leave an impression on a city depends on a whole host of perceptive elements towards Physical surroundings, Social Environment, Security and Amenities and Infrastructure that have been addressed in this study. The study is based on a sample of 300 households in Hyderabad City where a multi-stage stratified sampling frame was adopted. The results are presented through maps and graphs.

Perception of the physical surroundings includes the awareness or response of the people to the natural phenomena in the vicinity of their houses as it strengthens their liking for that area or otherwise. Positive perception of the Social surroundings includes the affinity of groups inhabiting an area and the camaraderie that builds up as a result. Positive perception of Security relates to the feeling of safety that people may have in an area. Likewise, perception of the Amenities and Infrastructure relates to the presence or absence of the basic essential infrastructure that people expect in an area in which they reside.

**Keywords:** Perception, Mental Maps, Ranking of localities, Bonding with city

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## Introduction

Cities are behavioural entities where people live, work and move. This is besides their being economic, demographic, structural and social units. The development and use of the city depend to a marked extent on the 'Mental Image' or 'Perception' of its residents and other users. Spatial Cognition of the environment of the city and sentiments are significant factors so far as decisions about the use of the city are concerned. These decisions do not depend on just the physical distance and attributes but the perceived or cognitive distance and attributes. Cognition, in turn, depends on the series of filters through which information passes in the mind of the perceiver. The Image of the city at any point in time depends on the intensity of impact, familiarity, mobility, specialization and experience. The greater the intensity of interaction and familiarity with the surroundings the higher will be the sense of the interaction of the residents and integration into the city fabric.

## Conceptual Background

Imageability is, by and large, based on physical perceptible objects. Other factors influencing imageability are the social meaning of an area, its function, history, name etc. The city image, in terms of physical form, has five elements: paths, edges, districts, nodes and landmarks. A mosaic of these elements together with their interaction, in the mind of the perceiver, comprises the total

synthetic image of the city environment. This comprehensive image can be visualized at various levels of urban hierarchy i.e. the street, neighbourhood, city or metropolitan region. In addition to variability in image perception by scale, images also vary in viewpoint, time of day or season. Images also shift with physical changes in the city environment.

The sequence in which an image develops is reflected in a succession of steps involved in drawing mental maps. While in the initial stages, the images of various parts of the city and the different elements are disjointed, with increasing strength of image development, the city is treated as a whole and interaction is considered possible in every direction and at any distance. However, it is difficult to find such a well-knit image that includes the totality of element types without myopic considerations and outlook. The images that one comes across are quite often tinted by cultural types or other factors and these have to be taken note of when drawing up plans for environmental amelioration. The future course of growth and development in the city, as also traffic patterns, residential localities etc. depend on the cognitive maps in the minds of the residents.

Human behaviour in space is an overt manifestation of spatial cognition of the environment. Environmental perception helps people in forming cognitive images of places and is influenced by location, experience or familiarity with an area, mobility, value systems, social class, cultural regimes, education, age and personality factors among others. While the impact of some of these factors is subtle, that of others is incidental. Spatial information that is gathered by an individual during working, shopping, recreation, visiting friends and relatives; apart from inputs from the media, travel information etc passes through a series of filters in the mind of the perceiver before finally crystallizing as cognitive representations. As the multifaceted environmental picture is too large and unwieldy to be handled by a single individual in all its manifestations, he makes use of inbuilt filters to screen out unnecessary noise and retain only that which he considers relevant. Once such images take shape in the spatial learning process of a given area, over a while, there are very few additions and deletions depending on circumstantial contingencies subsequently.

Thus, images are selective and subjective judgements of the total environmental picture at any given point in time and are tinted by elements in the information field of the perceiver. While in the initial stages of learning, the image of various parts of an area and its different elements like landmarks, paths and districts, is disjointed, with increasing strength of image development more well-knit and integrated images emerge (Lynch, 1962). With the advancing of age and environmental awareness, there is a definite change in the qualitative aspect of image acquisition (Spooner, 1992). Gender and class or cultural differences found in environmental awareness (Ferguson, 1979; Gould and White, 1974) are more incidental than real and find an explanation in the daily activity patterns of individuals, where those with more wide-ranging activities are better informed about their environments (Evans, 1980; Gilmartin and Paton, 1984; Lowe and Pederson, 1983). Also, when knowledge about an environment is gained from multiple perspectives as against a single perspective, it is more flexible and complete (Evans and Pedzek, 1980). The synthetic image of the environment that an individual carries in his mind depends on

a variegated mix of visual, auditory, olfactory and kinesthetic information that he encounters in his action space (Downs, and Stea, 1977). Activity space includes places visited for work, social purposes, shopping, recreation etc. and focuses on the home where all trips originate and terminate. It is a function of time in the life cycle of an individual (Lowe and Pederson, 1983). More often than not it is the perceived and hence the cognitive image rather than the ground reality that determines human response to distance, location, etc. A positive image may scale down the effect of distance just as one would travel a long distance to visit a good friend than a more casual acquaintance. Hence, mental images concerning social proximity and physical distance interact to produce a given response, whether, it is a journey, a letter or a phone call (Gould, and White, 1974). Similarly, a positive view of a shop may tend to shorten the perceived distance between the shop and the consumer (Thompson, 1963).

Environmental image can be conceived of at a variety of hierarchical scales ranging from those about micro–spatial units like a room, on one hand, to the entire nation, on the other. Even urban areas, the subject matter of study here, can be visualized at various levels in the urban hierarchy like the street level, the neighbourhood level, city level and metropolitan regional level. In addition to variability in image perception by scale, images also shift with physical changes in the city environment. The image of the city at any point in time depends, besides other factors, on the intensity of impact and experience. The greater the degree of interaction and familiarity with the surroundings, the greater the sense of integration of the residents into the city fabric (Ferguson, 1979; Spencer and Dixon, 1983; Evans, 1980). The use and growth of the city depend to a marked degree on the mental image of its residents and other users (Lloyd, 1989). Spatial cognition of the city milieu and sentiments are significant factors so far as decisions about travel routes, residential localities, social interaction, in essence, the use of the city are concerned.

It is found that travel, exposure, interaction and familiarity contribute to more balanced cognitive images of the urban environment as against piecemeal, disjointed and at times erroneous images that are made for by lack of information or interaction. While the employees who have had a longer stay in the city exhibit a more balanced viewpoint in judging places, those who have come to the city within the past one year exhibit a relative degree of ignorance on certain counts and a greater reliance on secondary sources of information. The exposure of the employees, in general, to other environments, often stands them in good stead in cognizing urban environments. Otherwise, they may resort to the temperamental judgement of places and situations with abundant flourish (Markandey, 1997).

**Research Objectives**

The present study seeks to draw up cognitive images of the environment of Hyderabad City based on the perception of a sample of its residents. The parameters against which the residents are asked to evaluate the environment are Physical surroundings, Social Environment, Security and Amenities and Infrastructure. Perception of the physical surroundings includes the awareness or response of the people to the natural phenomena in the vicinity of their houses as it strengthens their liking for that area or otherwise. Positive perception of the Social surroundings includes the affinity of groups inhabiting an area and the camaraderie that builds up as a result. Positive

perception of Security relates to the feeling of safety that people may have in an area. Likewise, perception of the Amenities and Infrastructure relates to the presence or absence of the basic essential infrastructure that people expect in an area in which they reside.

## Methodology

A sample of 300 households was taken in Hyderabad, the capital city of Telangana State. A multi-stage stratified sampling frame was adopted for collecting data employing a structured questionnaire. The survey was conducted in the months of January and February in the year 2020. One-tenth of wards in every circle of the city were chosen and thereafter 1.0 per cent of households in the sampled wards were chosen. While choosing the samples, care was taken to represent the people along the entire socio-economic spectrum in a given sample unit. To that extent, the sample was also purposive.

**Table 1: Sampling Frame developed to survey the sampled households, 2020**

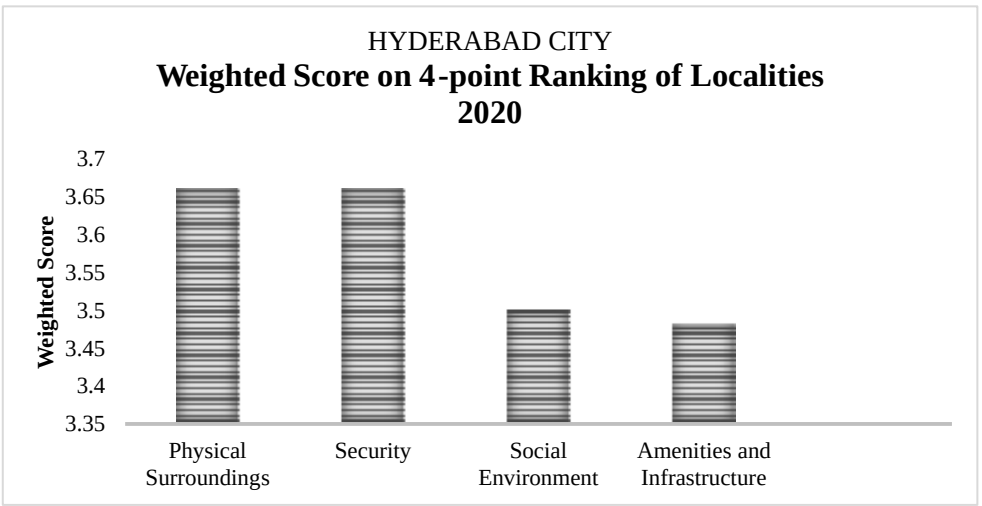
| Sl. No | Core/ Periphery | Zones | Circle | No. of Wards | 10% Sample wards | Name of Sample wards | 1% Sample population |
|---|---|---|---|---|---|---|---|
| 1 | Peripheral Municipalities | East Zone | Kapra Circle I | 4 | 1 | Cherlapally | 20 |
| 2 | | | Uppal Kalan Circle II | 3 | 1 | Habsiguda | 20 |
| 3 | | | LB Nagar/ Gaddi Annaram Circle III | 10 | 1 | Kothapet | 20 |
| 4 | | West Zone | Serilingampally Circle XI and XII | 4 | 1 | Gachibowli | 10 |
| 5 | | | Ramachandrapuram Circle XIII | 1 | 1 | Ramachandrapuram | 10 |
| 6 | | | Patancheru Circle XIII | 1 | 1 | Patancheruvu | 10 |
| 7 | | | Kukatpally Circle XIV | 8 | 1 | Old Bowenpally | 10 |
| 8 | | North Zone | Qutbullapur Circle XV | 7 | 1 | Gajula Ramaram | 10 |
| 9 | | | Alwal Circle XVI | 3 | 1 | Alwal | 10 |
| 10 | | | Malkajgiri Circle XVII | 5 | 1 | Moula Ali | 20 |
| 11 | Core City Municipalities | South Zone | Circle IV | 27 | 3 | Saidabad, Kanchanbagh, Pathargatti | 20 |
| 12 | | | Circle V | 18 | 2 | Falaknuma Begum Bazar | 20 |
| 13 | | | Circle VI Rajendra Nagar | 4 | 1 | Shivrampally | 20 |
| 14 | | Central Zone | Circle VII | 16 | 2 | Karwan, Toli Chowki | 20 |
| 15 | | | Circle VIII | 3 | 1 | Sultan Bazar | 20 |
| 16 | | | Circle IX | 16 | 2 | Himayat Nagar, Vidya Nagar | 20 |
| 17 | | | Circle X | 15 | 2 | Ameerpet, Banjara Hills | 20 |
| 18 | | Secunderabad Division | Circle XVIII | 11 | 1 | Marredpally | 20 |

Initially, a 5-point scale was employed in the questionnaire to elicit the views of the residents on various aspects of the environment. The residents were asked to rank their locality on a progressive scale from 1 to 5, where 5 indicated Very Good, 4 Good, 3 Satisfactorily, 2 Bad and 1 Very Bad for Physical Surroundings, Social Environment, Amenities and Infrastructure as well as Security situation. However, after deciphering the raw data, it was found that none of the residents ranked their locality as very bad on any of the counts, so the scale was recast at the tabulation stage to read 4 as Very Good, 3 Good, 2 Satisfactory and 1 Bad on a 4-point scale. A 4-point scale was thus employed to assess the levels of satisfaction or otherwise among the residents. Weighted scores of each of the variables have been plotted on graphs as well as on the map as located bars.

**Perception on Likert Scale**

'Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement. Sometimes a neutral scale is used, where the middle option of "neither agree nor disagree" is not available (25).

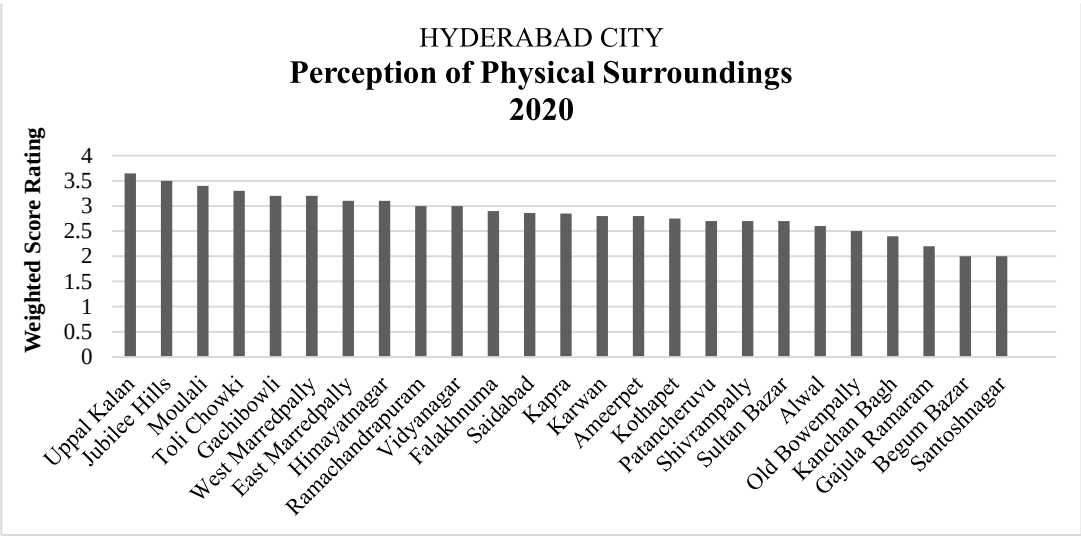
It is found that generally the city is viewed favourably from the perspective of Physical surroundings and Security by its residents and not so favourably from the viewpoint of Social Environment and Amenities and Infrastructure (Fig. 1). As many of the city residents are migrants from rural areas, the fascination of the Physical Surroundings and Security captivates many of them. However, when it comes to amenities and infrastructure, they have high expectations in the city and hence find something amiss. Also, they miss the kind of close and well-knit social environment that is a norm in the rural areas and hence find the social environment less suitable for their interest.




*Source: Field Survey, 2020* Fig. 1

While there are only minor spatial variations in the Total Weighted Scores . The fact that stands out is that certain circles on the periphery of the city are viewed favourably from the

perspective of Security and it emerges very clearly in the case of Ramachandrapuram and Patancheruvu which are also industrial areas in the northwestern part of the city. The high score is also clearly perceptible in the case of Kothapet and Moula Ali in the eastern part of the city. Most of the variables have been ranked by the residents in a way that all four variables appear to be like each other in most of the localities. The residents have taken a similar stance in ranking them unless they find something spectacularly different as in the case of security cited above or as concerning the Physical Surroundings which are rated better in the case of Jubilee Hills and Moula Ali compared to the other three variables in the locality or as they are rated adversely in Kanchan Bagh vis-a-vis the other variables in that locality. In some cases, like Begum Bazar and Santoshnagar, among others, all the variables seem to have a subdued standing. The subdued standing is more evident to the south of R. Musi in the southern part of Hyderabad, though Kanchan Bagh as an exception displays a better perception of amenities and infrastructure apart from the social environment. Better Amenities could be associated with the location of certain Central Government labs and institutions and the infrastructure that goes with them and the social environment which is viewed favourably could be related to homogenous social groups from the labs with better bonding.

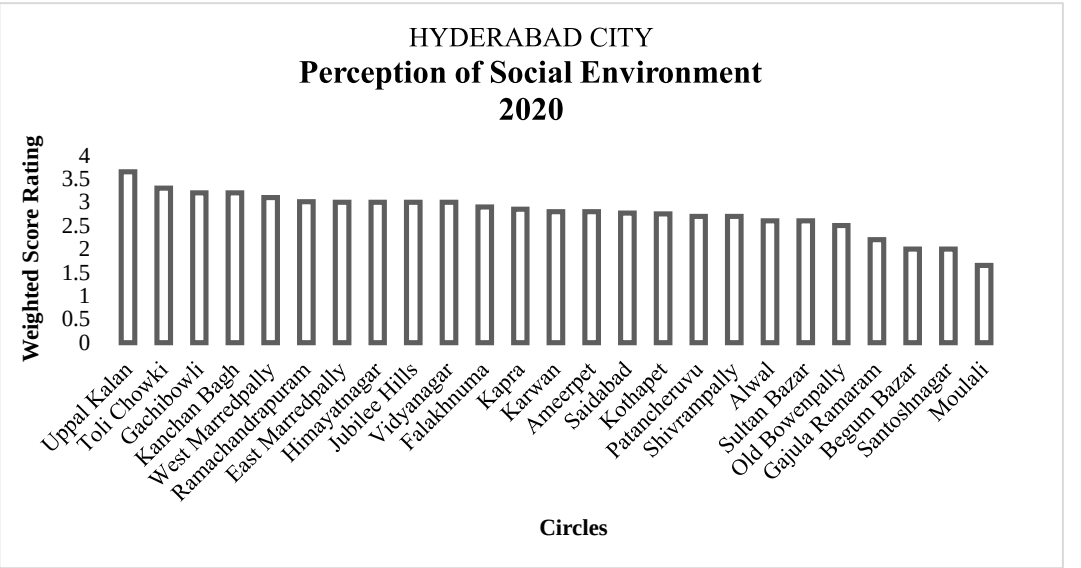



*Source: Field Survey, conducted by the author in 2020* Fig. 2

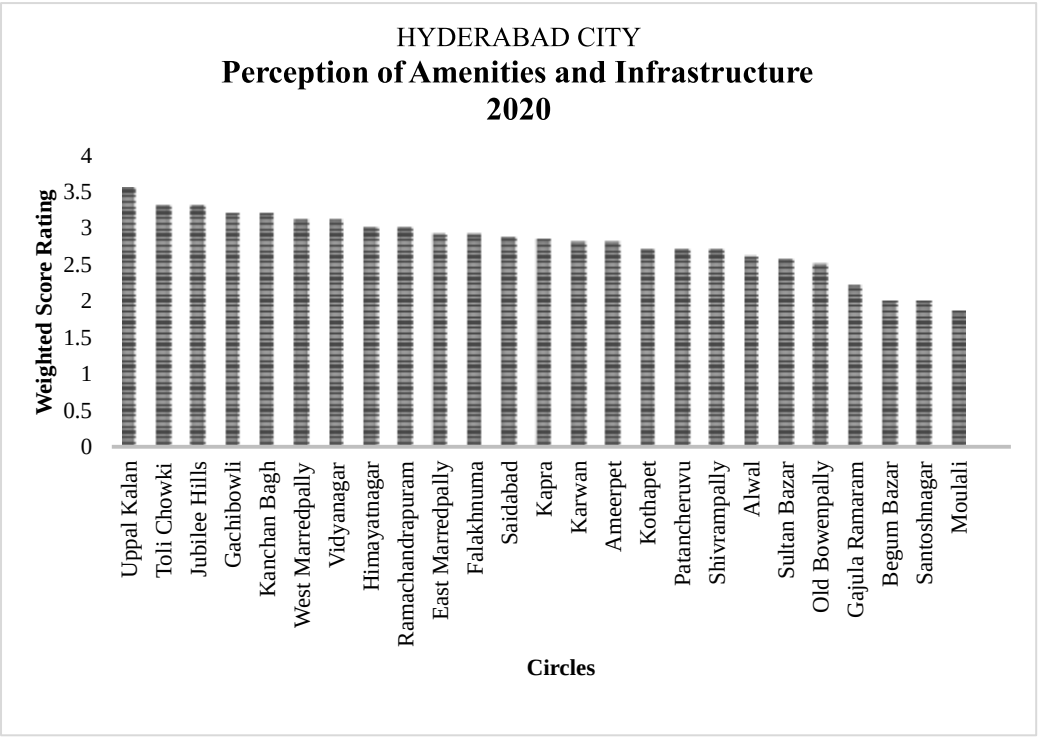
Physical surroundings are viewed favourably by the residents of Uppal, Jubilee Hills and Moula Ali (Fig. 2) as also mentioned above. One reason for localities or the city in its totality being favourably viewed on the scale of the Physical surrounding is the ground reality itself, where that particular place may have serene and appealing physical surroundings as is the case of Jubilee Hills, which is an upscale locality with a huge park to vouch for its favourable physical surroundings. However, the other factor where people view an area favourably could be their adaptability to that environment and adaptability is more evidenced in the case of those on lower

levels of the socio-economic ladder. By the same argument and in contradistinction to adaptability is sensitivity to the environment which may be more evident in the case of those on a higher level concerning education, income and such other traits. This, however, may not be the case with the people residing in Santosh Nagar, Begum Bazar etc who ranked their locality as very low on the scale of the physical surrounding and the ground reality may be reflected in their ranking.

Fig. 3 concerning the ranking of the locality on the Social Environment scale shows places like Uppal Kalan, Toli Chowki, Kanchanbagh etc as being high on the scale and Santosh Nagar etc being low. While Uppal comprises middle-class residences, Toli Chowki has lower-middle-class residences; in both instances, the bonding between the residents of the locality may be more and hence a favourable perceived environment. Jubilee Hills which has Upper-class residences ranks the Social Environment as the lowest among all the variables. The anonymity among the residents and lack of social contact could be responsible for this kind of outcome.




*Source: Field Survey, conducted by the author in 2020* Fig. 3

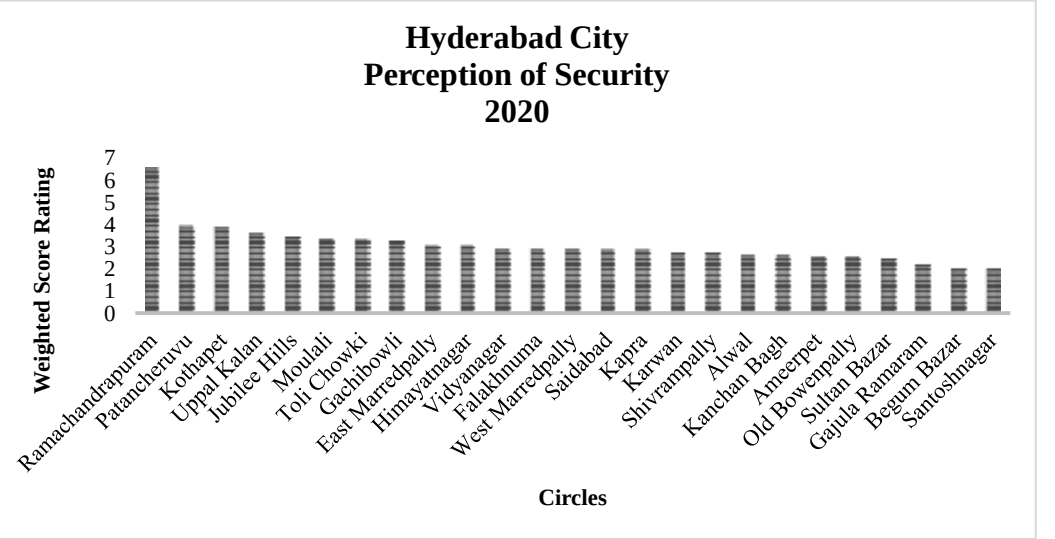



*Source: Field Survey, conducted by the author in 2020* Fig. 4

Perception of Amenities and infrastructure (Fig. 4), shows that people in Uppal Kalan, Toli Chowki, Jubilee Hills, Kanchan Bagh etc are satisfied with the Amenities and infrastructure in their respective localities and have rated their localities as high on this count. Most of them are in the core of the city and even places like Uppal Kalan which are on the relative periphery are well equipped with various facilities and amenities, including the Metro Rail connectivity. Those like Moula Ali, Begum Bazar, Gajula Ramaram, Old Bowenpally etc which are ranked low on this count are apparently deficient with regard to various amenities and infrastructure and can be considered in the development plans of the city based on the perception of those who reside there and use or need to use the various facilities in which these areas are wanting. Even a place like Sultan Bazar which is in the heart of the city and home to many educational and health institutions is relatively low in the rankings on this count. Congestion, crowding and an apparent lack of adequate infrastructure have in all likelihood prompted the residents to give this kind of a response.

From the viewpoint of Security (Fig. 5), Ramachandrapuram and Patancheruvu, which are Industrial townships on the periphery of the city, rank very high and quite understandably so. Kothapet and Uppal Kalan, which are also on the periphery of the city are also ranked high on this scale. This is in contrast to the general understanding that the residents of the core areas feel more secure compared to those on the periphery. However, these peripheral localities have additional institutional security provided by the various institutions that are located here. In

contrast, people in Gajula Ramaram, Begum Bazar, Santosh Nagar etc express a relative feeling of insecurity.




*Source: Field Survey,2020* Fig. 5

**Conclusion**

Ranking of localities on a 4-point scale shows that people with better incomes and education have a sense of sensitivity when it comes to certain issues of the environment and also apathy for those involving bonding with people in their locality. Conversely, those having lower levels of income and education, have a greater tendency towards adaptability to the given environment and a better social bonding as evidenced from the localities which have these stereotypes.

It also shows that while some peripheral localities are well ingrained in the city fabric and the residents rank them as high, others have not taken to the city mores and have a long way to go, many of them having been incorporated into the city in the recent past.

**Acknowledgements:**

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# Demographic Dividend and Economic Growth in India: A State-Level Analysis

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**Abstract:** The demographic dividend is the stimulated economic growth that may arise from a decrease in mortality and fertility rates of a country leading to change in the age structure of the population. As it's a time-bound opportunity and India is experiencing a decline in fertility rates presently, it is expected that demographic dividend will lead India to new economic heights and in this regard, the study analyses the changing pattern of demographic dividend and the relationship between demographic dividend and economic growth of major Indian states using fixed effect model covering a period of 1991 to 2016. The results show that the relationship between NSDP per capita and demographic dividend is positive, thereby validating the hypothesis that demographic dividend has a positive impact on economic growth, though, in the case of some states, factors other than the demographic dividend have also played a decisive role.

***Keywords:*** Demographic Dividend, Population, Economic Growth, Fertility Rate, Mortality Rate

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## Introduction

India, being the second most populated country in the world and supposed to be the first by 2024, has entered such a phase of demographic transition that represents a surge in the working-age population. This burgeoning labour force, consequently, allows lowering of dependency ratio (dependents to working-age population) and accelerating rate of economic growth. Hence, the growth benefits derived from an increased share of the working-age population due to demographic transition is referred to as the demographic dividend (Gribble and Bemner, 2012). India's demographic dividend-the window of opportunity that a large workforce creates to strengthen an economy- could add two percentage points to the country's economic growth rate over the next two decades (Aiyar and Modi, 2011)

But at the state level, the scenario is interesting to analyze. There exists a wide disparity across the Indian states. Currently, some of the states are experiencing youth bulge combined with their lower performance towards the development of physical and human infrastructure, boosting employability and achieving sustained growth. Against this, some of the states have a higher dependency ratio combined with their appreciable performance towards various socio-economic developmental dimensions. The states need to understand that this shift in the age structure of the population has developmental consequences and frame their economic policies accordingly. The growth benefit of demographic dividends is not automatic as states need to

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promote economic security and ensure that this burgeoning workforce must be diverted towards productive channels.

The changing age structure leading to the emergence of demographic dividends can increase economic growth through six channels: (i) the way of growing labour force, as more people reach working age, (ii) the way of fiscal space as expanded by the demographic dividend to divert resources from spending on children to invest in physical and human infrastructure, (iii) is the increase in the share of female workers in the workforce that, in turn, naturally accompanies a decline in fertility and can be a new generative force of growth, (iv) is the rise in the savings rate, as the working-age is also regarded to be the prime period for savings, (v) is an additional boost to savings as a result of greater longevity, which comes across as an incentive to save for longer periods of retirement, and (vi) is a massive shift towards a middle-class society that is already in the process. The states need to work through these channels in their respective policy dimensions to grow sustainably.

**Association between demographic dividend and economic growth**

The dynamics of changing age structure play a critical role in analysing the impact of population growth on economic growth. But it has always been a debatable issue in terms of the impact being positive, negative or neutral.

The Malthusian Approach argues that population growth is an obstacle in the path of economic development, and therefore, population growth doesn't lead to economic growth in due course of time. This notion was based on the theory of diminishing returns to scale. Malthus states that the nations with higher fertility rates would have lower levels of income and the nations with lower fertility rates would have higher levels of income. The reason behind this phenomenon is that the higher population levels are likely to drive down the wage rate or, we can say, the cost of labour as a factor of production. At the same time, the high surge in demand for food would elevate food prices. In addition to this, the increased food production would be incapable to correspond with the continuously increasing population. The rationale given by the Malthus behind this is that the population grew geometrically while the food production is supposed to grow arithmetically. He further states that nature has its controls and checks to balance the world's population levels. A hike in population levels would drag down the prevailing wage rate and result in a shortage of food. Consequently, there would be widespread starvation, droughts, famines, etc. and the population would come back to equilibrium. Another negative, or rather we can say, pessimistic view about high population growth is related to resource dilution. The continuously growing population leads to a dilution of the resource base of a nation as it needs to be shared amongst more & more people with time. These pessimistic views are generally framed in line with the socio-economic conditions prevailing in most of the developing countries with of the world with high population growth (Malthus, 1798).

On the other hand, Simon Kuznets argues that population growth supplements economic growth. But what is needed to be taken into consideration is the occurrence of various phases of demographic transition (from high fertility and mortality rates to low fertility and mortality rates)

resulting in changing age structure. The positive view or the optimistic school of thought is based on harnessing the potential of economies of scale as well as division and specialization. This approach tries to define links between population growth, innovation and increasing returns to scale on the ground that with the increase in population, the stock of human capital grows and human capital plays a significant role in accelerating the pace of economic growth. In addition, the increased population would motivate humans to initiate innovations and live sustainable lives. On account of this reason, the prices of natural resources are likely to reduce over the period. The increasing returns to scale in the manufacturing and services sector, as well as increasing productivity in the agricultural sector, would help to accommodate the growing population which, in turn, would increase economic growth. The technological advancement would lead to an increase in productivity and neutralize the ill effects of the increasing population on the nation's development. An example of the same is the advent of the 'green revolution (Boserup,1965; Kuznets, 1967; 1973).

However, the neutralists having a completely different view state that population growth and economic growth are not linked with each other at all. Population growth isn't supposed to hinder or promote the economic growth of a nation. The economies with a weakly designed institutional framework and higher population growth need to separate the twin-dimensional impact of these factors on their economic growth. Therefore, the rapid population growth has an overall negative effect on the economic growth but the impact of this phenomenon is somehow faded when the institutions, policies, markets and technological advancement taking place in an economy is taken into consideration (Birdsall et al., 2001; Bloom and Canning, 2004).

Further, employing cross-country data (see Bloom and Williamson,1998); Bloom et al., 2002) show a positive relationship between the growth rate of the share of the working-age population to the total population and economic growth. At some point in time, all the countries are likely to experience demographic transition. This change in population composition creates a bulge in the working-age population (when working-age population growth is more than total population growth) which will be used as a growth agent. However, whether this window of opportunity is utilized, as noted by Bloom et al. (2002), will depend on the policy environment. Moreover, it is a well-known fact that population growth is a key driver of advancing economic prosperity. More people imply more scientists, inventors and engineers that contribute to innovation and technological progress. This leads to an improved standard of living with the country and its people transforming from being dependent to self-reliant. While this virtuous cycle may have been true for some economies, the suggested result in India seems ambiguous. This may be because of cross-country disparities in terms of increasing the working-age population and using its potential for sustainable development (Kremer, 1993).

At times, India's population growth is linked with family welfare planning. Almost all the southern states, Kerala, Tamil Nadu, Andhra Pradesh, Telangana and Karnataka are doing well in family welfare while the states, like Uttar Pradesh, Bihar, Madhya Pradesh, Jharkhand, Chhattisgarh and Rajasthan are lagging far behind. While India claiming to be the first country in the world to have formulated a State-sponsored population control policy is lagging far behind its

counterparts. Consequently, in the coming years, there will be growing demographic disparity in India leading to widespread economic disparity in the country. This is going to be a matter of serious concern for our economic planning and policymakers. This demographic disparity is also likely to result in considerable social turbulence and may also lead to political instability (Bose, 1996; 2006).

This apart and more importantly, the demographic window is at best an opportunity to exploit in time but it does not automatically guarantee the use of the opportunity to the fullest possible extent. The existing complementary policies and institutional framework largely affect a country's ability to realize as well as exploit the demographic dividend in a time-bound manner. These policies and institutional support can be classified into various categories including health, population and family planning, labour markets, macroeconomic, financial, and education. The demographic dividend, if provided with the right policy environment can help create a "virtuous cycle" of sustained growth (Utsav, 2010). In addition, Aiyar and Mody (2011) argued that the total population and the growth rate of the working-age population have a considerable impact on India's economic growth. The study concludes that the largest expansions in the share of working-age population till date have occurred in southern and western states, which in turn, have led India in terms of recent economic growth while the major portion of the remaining demographic transition will be concentrated in lagging states, thereby, raising the prospect of substantial income convergence among rich and poor states in the coming decades. This result is robust to a correction mainly to account for inter-state migration. It also concludes that the economic policies launched and reforms introduced in the Indian economy at the national level from time to time are, usually, most complementary to demographic change. India's widespread demographic disparity across Indian states has serious implications at various levels. Demographic variations at large may cause considerable social turbulence and may even pose a threat to the political stability of the country. However, at the same time, the demographic heterogeneity also provides a unique opportunity to fill the labour deficit within the country through inter-state migration. Though migration is likely to be development driven, there is the possibility of increased conflict and unrest for the respective reasons. (James, 2011)

In India, the population is projected to increase by 371 million persons during 2001–26 with nearly 50.0 per cent of the increase would take place in Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttarakhand states. The largest populated Indian state of Uttar Pradesh alone would account for almost one-fifth of the total population increase. Contrary to this, the states of Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu , in the combine, would account for only about 13.0 per cent of India's total population growth during the same period as per the data released by the Registrar General of India. These differences will have serious implications for the socio-economic development of the country as a whole (Navaneetham and Dharmalingam, 2012).

Furthermore, the growth optimists are assured in India's demographic dividend as a matter of fact that India's dependency ratio will come down more sharply in the coming decades and increased working-age population will mean increased workers, especially in the productive

age groups, increased incomes, increased savings, increased capital per worker, and accelerated growth. And because demographic change is associated with fertility decline, the transition period may be accompanied by greater participation of females in the labour force (Economic Survey, 2012-13: 26).

In India, the states differ widely in terms of the rate and level of development. Some of the states with better policy frameworks and governance have already used their workforce to place themselves on the front foot at the platform of developed states. On the other hand, the lagging states are still tagged as 'developing states' as they have to use their bulging young population as one of their growth channels. Though they started doing well on various economic parameters, they are still lagging. Therefore, India's share of the working-age population to that of the non-working age population will peak later and at a lower level than that for other countries but last longer. The pinnacle of the growth augmentation due to the demographic dividend is fast approaching, with peninsular states peaking soon while the hinterland states peaking much later (Economic Survey, 2016-17:3-4).

**Data Sources and Methodology**

The study is based on secondary data collected from different decadal census reports published from the Office of Registrar General and Census Commissioner, Government of India, New Delhi and *Handbook of Statistics on the Indian Economy*, published from the Reserve Bank of India, Mumbai for the period ranging from 1991 to 2016. The Per Capita Net State Domestic Product is a dependent variable and demographic dividend is an independent one. Demographic Dividend is the share of the working-age population in the total population of the major Indian States.

In this study, panel data analysis is used and Fixed Effects Method is preferred over to Random Effect Method as suggested by the Hausman specification test and is also conceptually convenient. Further, Fixed Effect Method is chosen because the number of time observations is larger and the number of cross-section units is comparatively small so there is likely to be limited variation in the values of parameters estimated by the Fixed Effect Method and Random Effect method. The choice then depends upon conceptual convenience which may favour Fixed Effects Method. Besides, while comparing the Pooled Method and Fixed Effect Method, the F-statistics suggested that there is a significant difference between the coefficients estimated and therefore Fixed Effect Method is suitable.

Considering that higher demographic dividend will result in higher NSDP per capita in the selected Indian states:

$H_0$: demographic dividend of major Indian states hasn't had a positive effect on their NSDP per capita.

$H_1$: demographic dividend of major Indian states has a positive effect on their NSDP per capita.

Based on this hypothesis, the estimated model is:

Per Capita NSDP = *f* (Demographic Dividend)

Mathematically: log NSDP $(PC)_{in} = \alpha + \beta_1 \log (\text{Demographic Dividend}_{in}) + \varepsilon_{in}$

| **Table 1: Panel Data Estimation Results Based on Fixed Effect Model** | | | |
|---|---|---|---|
| Independent Variable | Coefficients | t-statistic | p-value |
| Andhra Pradesh | 0.17448 | 3.034 | 0.0031 ** |
| Assam | -0.14705 | -3.95 | 0.0001 *** |
| Bihar | -0.48981 | -9.498 | 0.0000 *** |
| Jharkhand | -0.25157 | -5.663 | 0.0000 *** |
| Gujarat | 0.05249 | 1.507 | 0.1352 |
| Haryana | 0.17248 | 4.401 | 0.0000 *** |
| Himachal Pradesh | 0.09764 | 2.773 | 0.0066 ** |
| Jammu & Kashmir | -0.06158 | -1.729 | 0.0871 . |
| Karnataka | 0.11196 | 3.232 | 0.0016 ** |
| Kerala | 0.11051 | 3.144 | 0.0022 ** |
| Madhya Pradesh | -0.20222 | -4.478 | 0.0000 *** |
| Chattisgarh | -0.08859 | -2.068 | 0.0413 * |
| Maharashtra | 0.13195 | 3.784 | 0.0002 *** |
| Odisha | -0.13749 | -3.884 | 0.0001 *** |
| Punjab | 0.13723 | 3.945 | 0.0001 *** |
| Rajasthan | -0.07771 | -1.644 | 0.1035 |
| Tamil Nadu | 0.06309 | 1.75 | 0.0834 . |
| Uttar Pradesh | -0.26268 | -4.911 | 0.0000 *** |
| Uttarakhand | 0.03822 | 0.86 | 0.3918 |
| West Bengal | -0.13124 | -3.799 | 0.0002 *** |
| R-squared (Adjusted) = 0.9545 (0.9424), p-value (F-statistic) = 0.0000<br>***'***', '**', '*' and '.' denote statistical significance at 0.1%, 1%, 5% and 10% respectively.*** | | | |

Source: Calculation by authors

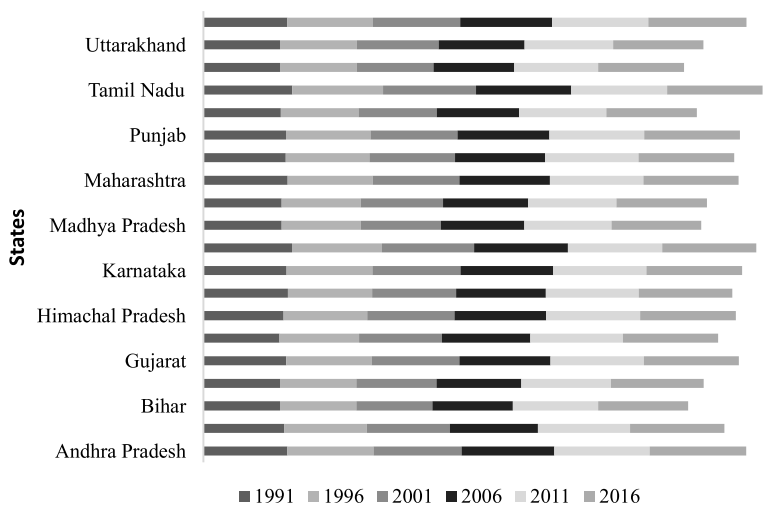
**Discussion and analysis**

In line with the results of panel data using fixed-effect model ( see Table 1), the value of coefficients for Andhra Pradesh (0.1745), Gujarat (0.0525), Haryana (0.1723), Himachal Pradesh (0.0976), Karnataka (0.1121), Kerala (0.1105), Maharashtra (0.1319), Punjab (0.1372), Tamil Nadu (0.0631) and Uttarakhand (0.0382) is positive and significant (except Gujarat and Uttarakhand), depicting that they have taken the advantage of their increased working-age population to the maximum extent for increasing their rate of economic growth. The working-age population in the states of Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu and Uttarakhand has increased by 15.05%, 14.74%, 25.19%, 19.42%, 15.01%, 6.24%, 13.13%, 16.02%, 7.52% and 17.61% from 1991 to 2016 while NSDP per capita has increased by 230.48%, 415.76%, 256.25%, 268.30%, 295.75%, 286.85%, 265.19%, 131.40%, 327.01% and 603.65% respectively during the same period. In the case of

these states, the demographic dividend has influenced the NSDP per capita at large. The performance of all these states on respective socio-economic parameters has continually improved over some time because the factors translating demographic dividend into an accelerated rate of economic growth have been taken care of by these states seriously. These states have taken into account the pro-growth reforms such as employment generation and poverty alleviation schemes, health and education promoting policies, reduction in dependency ratio, social and financial inclusion besides encouraging sustainable investments in key areas to induce growth.

The positive impact of an increasing share of the working-age population in the total population on economic growth is at risk. The scenario can be reversed and impact the economy adversely if a favourable age structure takes place in an inhibitory policy and poor institutional environment. The young population of richer states is slowly ageing and the bulge in the working-age population is shifting to other low-demographic transition states of India.

**Fig 1: Change (%) in demographic dividend by major states 1991-2016**

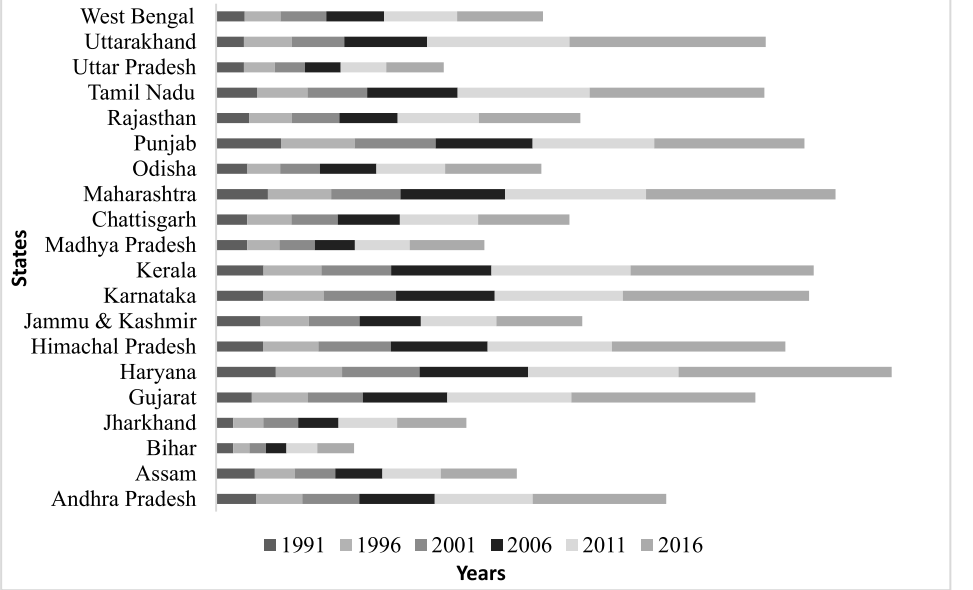



Source: Registrar General and Census Commissioner of India (2001-2026)

However, in the case of, the value of coefficients (Table 1) for Assam (-0.1470), Bihar (-0.4898), Jharkhand (-0.2516), Jammu & Kashmir (-0.0616), Madhya Pradesh (-0.2022), Chhatisgarh (-0.0886), Odisha (-0.1375), Rajasthan (-0.0777), Uttar Pradesh (-0.2627) and West Bengal (-0.1312) is negative and significant (except for Rajasthan), depicting that they haven't taken the advantage of their increased working-age population to the required extent for increasing their rate of economic growth and the benefits of demographic dividend in these states aren't reaped to the desirable level. The working-age population in the states of Assam, Bihar,

Jharkhand, Jammu & Kashmir, Madhya Pradesh, Chhattisgarh, Odisha, Rajasthan, Uttar Pradesh and West Bengal is increased by 16.7, 17.4, 21.0, 11.0, 14.7, 15. 8, 16.2, 17.3, 12.1 and 17.0 per cent during 1991-2016 while NSDP per capita has increased by 95.5, 112.0, 301.0., 93.3, 139.6, 192.2, 205.8, 206.8 106.8 and 200.5 per cent, respectively during the same period. In the case of these states, the demographic dividend has influenced the NSDP per capita to a limited extent. It is evident from the percentage change in working-age population impacting increase in NSDP per capita that there is a considerable hike in the working-age population in these states ranging from 10-20 per cent but the NSDP per capita has nearly doubled, except Jharkhand- an outlier in this case. This shows that these states haven't considered the factors well which are critical in translating the demographic dividend into the accelerated rate of economic growth.

**Fig 2: India: Change in NSPD per capita (Rs.) by major states 1991-2016**




Source: RBI's Handbook of Statistics on the Indian Economy, various years

Moreover, the significant socio-economic factors which are likely to pull the economic growth in the coming years include accessibility and affordability of education and health accompanying better training and skill development programmes, thereby eliminating the adverse impact on the employment prospects, require an immediate approach for aiding in reaping the prevailing benefits as well as projected benefits of demographic dividend. One of the major reasons that these states are lagging in establishing a stronger positive relationship between demographic dividend and economic growth is migration. Since these states are lacking on the required level of improvement concerning various developmental parameters for harnessing the full potential of its bulging economically viable population, their rising working-age population is migrating to other states which are demographically advanced and in need of labour presently to maintain their achieved growth. As the deceleration in TFR in

these states is quite sluggish and the demographic window of opportunity will last for 10 years or more from now, therefore, the continued lower performance on certain significant growth and development indicators is likely to make them sluggish as well while placing them on a level playing field with demographically advanced states of India.

**Conclusion**

The increase in the working-age population in all the major states of India during the study period ranges from 14.0 per cent to 25.0 per cent, except for Kerala (6.2%), Tamil Nadu (7.5%) and Jammu & Kashmir (11.0%). However, the increase in NSDP per capita is subject to wider variations across these states. It remained to fluctuate about double in demographically laggard states, except Jharkhand, while not less than two and half times in the case of demographically advanced states, except Punjab. This implies that the states where the demographic window of opportunity will remain open for a long time aren't currently implementing such a policy framework as to reap the benefits of their rising demographic dividend. The demographically laggard states also have to take into account that there shouldn't be a higher dependency ratio in the coming years as some states like Uttar Pradesh (3.1), Bihar (3.3), Madhya Pradesh (2.8), Jharkhand (2.6), Chhattisgarh (2.5) and Rajasthan (2.7) are still struggling to lower down TFR to replacement rate.

However, this process of demographic advantage is not automatic. The policy environment besides policy choices in the arenas of governance, macroeconomic management, trade, and human capital formation could have a significant effect on the realization of the demographic dividend. At the same time, it is extremely important to provide the bulging youth of the country with an economic environment in which working-age people are productively employed. If the required measures aren't undertaken for the same and that too in a time-bound manner, this demographic window could result in a demographic disaster rather than a demographic dividend. In consideration of these demographic realities, the Indian policymakers need to immediately adopt and integrate those measures which can help accelerate India's demographic transition and magnify India's demographic dividend. If the required actions aren't taken by the policy-makers in due course of time, India could experience a demographic drag on its economy and could fall prey to potential demographic threats to its economy at the same time.

India has now reached the critical mass and is, probably, requires to jump over a stage ahead in the typology of development, thereby, translating a large demographic entity into a growth pattern that is increasingly technology-oriented and innovation-indued as far as sustained drivers of change are concerned. Since, India will not be able to afford to limit the realization of a better tomorrow to be deterred by the so-called doubts of not being able to convert the demographic window of opportunity into a sustained economic growth trajectory, therefore, the country's policymakers need to look forward with strong and active faith on an urgent basis by chalking out the holistic approach for harnessing the full potential of India's swelling workforce. Since the demographic transition across India hasn't been uniform by its very nature, hence this must not be the case that less developed states are less prepared to harness the full potential of their emerging workforce. The demographic dividend is a time-bound opportunity, and policymakers need to have a greater incentive to accentuate their efforts to promote human capital so that it can contribute to economic growth and job creation. India must not create the divide between a developed world and a developing world in its interior.

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# Quality Test on Age-Specific Literacy Data in Indian Census Using Whipple's Index

Prasenjit Sinha and Jayanta Datta[1], Agartala

**Abstract:** The article examines the age-specific data quality of single-year age returns, available in the 2011 Census for all states/union territories (UTs) by measuring preference of terminal digits for '0' and '5' secured with Whipple's Index (WI). It further explored category-wise (illiterate-literate, rural-urban, male-female) association between digit preferences and literate proportion at the level of states/UTs.

The study reveals that digit preference is highest among illiterates. Further, it is more in the rural than the urban areas, but almost similar for both the genders. Digit preference and literacy rates are inversely associated at the state level in India, indicating age errors can be reduced by improving the quality of literacy data. Whereas digit preference among illiterate-literate, rural-urban and male-female find a strong positive association, indicating the presence of various intra-state factors specific to individual states/UTs. The training of the enumerators, awareness about the importance of data, and improvement in literacy level are necessary for improving age statistics.

***Keywords:*** Age data, Age heaping, Census-2011, India, Whipple's Index.

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## Introduction

The tendency of miss reporting or rounding off of age by an informant due to inability, personal biases or any other reason introduces *heaping* or digit preference in age data. At the onset of the 19th century or before that, there was a very narrow requirement of age reporting at all. With the advancement of human civilization and following the industrial revolution, literacy encountered a boom. Western countries visualized the importance of age-sex information for policy formulation and proper planning (Crayen and Baten, 2006). Consequently, the scientific study of errors in age data started in the modern world. Since then, several studies have been conducted in developed and developing countries revealing a strong correlation between numeracy and literacy (A'Hearn et al., 2009). The majority of these studies indicate that the level of heaping in age reporting was continuously decreasing with the attainment of literacy (Agrawal and Khanduja, 2015; A'Hearn et al., 2009).

In India, the household head, generally the male, provides the information for the whole family and the awareness regarding the importance of reporting the exact age, though increasing yet quite low still as compared to developed nations. A significant proportion of the population in the country is still illiterate, hence the age data available in the Indian Census suffer from several

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problems such as ignorance of age, negligence in reckoning the correct age, deliberate misstatement, and misunderstanding of the question (Jaipal and Visaria, 1975).

It is quite practical that an educated informant can estimate the age of all the household members more reliably and scientifically than the uneducated ones. However, in societies like the Indian, where one's age is not important, the ages of others may seem even less significant (Ewbank, 1981). Although illiteracy, inability, and ignorance lead to the age approximation, the fundamental causes of error in census data are normative and behavioural (Saxena et al., 1986)

Information on age is of great importance as it reveals the nature of the population, the number of persons living within a specified age interval. Precise and correct information about the age distribution of a region or country is essential for effective policy formulation. Age misreporting will invite faulty planning, thereby wasting resources. So it will be more scientific to spend more time, energy and resources to minimize the extent of heaping, by educating people regarding its importance and by imparting extensive training to the field workers and improving the scrutiny of received information.

**Research objective**

In the light of the above statements, the main objective of the present study is to evaluate age data quality among (i) illiterate-literate; (ii) rural-urban; (iii) male-female and the combined population of all Indian States/UTs for the census-2011, by measuring terminal digit preferences for '0' and '5'. Our second objective is to examine the association within (i) illiterate-literate; (ii) rural-urban; (iii) male-female differentials of Whipple's Index among the states/UTs. The third objective of the study is to measure the extent of association between the percentage of literates and WI values for all States/UTs for the combined population for the age range 23-62 years.

**Data sources and methodology**

Secondary data set "C-13: Single Year Age Returns by Residence and Sex–2011" and "C-13 (Appendix): Single Year Age Returns by Residence, Sex and Literacy Status–2011" were downloaded from the website of Census of India, Office of the Registrar General & Census Commissioner, India (https://censusindia.gov.in/2011census/population_enumeration.html).

There are several indices available in the literature to measure age errors. Important among these included Whipple's Index, Myer's Blended Index, UN Age-sex Accuracy Index, Age Ratio Scores. However, Whipple's Index (WI) is an easy and reliable measure to detect the preferences of terminal digits '0' and '5' (Spoorenberg, 2009). Literature unveils that the census age data of India is affected by the preference of terminal digits '0' and '5' (Ansary and Arif, 2018). For this reason, the present study has decided to use Whipple's Index (WI).

Linearity assumption in the five-yearly age data does not hold good for single-year age returns outside the age range of 23 to 62 years. The formula to compute Whipple's Index (WI) for five years age range (preference of digits at an interval of five, i.e., ending with the digit '0' or '5') for the age group (23-62) is presented below:

$$WI = \frac{\sum_{i=25,30,..60} P_i}{\sum_{i=23}^{62} P_i} 500$$

Where $P_i$'s are single-year age returns or population aged ith last birthday.

The range of Whipple's index lies between 0 and 500. When we get '0', we infer those digits '0' and '5' are not reported at all, getting '100' indicates that there is no preference for '0' or '5', and getting '500' will mean that '0' and '5' are the only reported digits. As per the United Nation's recommendation, WI values are summarized and given in Table 1 (*United Nations Workshop on Census Data Evaluation for English Speaking African Countries*, 2012)

Table 1: Summary of Whipple's Index (WI) values as per the UN recommendation.

| WI values | Data quality | Percentage Deviation |
|---|---|---|
| < 105 | Highly accurate | < 5% |
| 105–110 | Fairly accurate | 5–9.99% |
| 110–125 | Approximate | 10–24.99% |
| 125–175 | Rough | 25–74.99% |
| > 175 | Very Rough | ≥ 75% |

*Source:* United Nations Workshop on Census Data Evaluation for English Speaking African Countries, Kampala, Uganda, held during 12-16 November 2012

**Results and Discussion**

Computed WI values for all states/UTs for (i) illiterate, literate; (ii) rural, urban; (iii) male, female and combined population are presented in Table 2.

Table 2: Computed WI values for (i) Illiterate, Literate; (ii) Rural, Urban; (iii) Male, Female and total population by states/UTs,

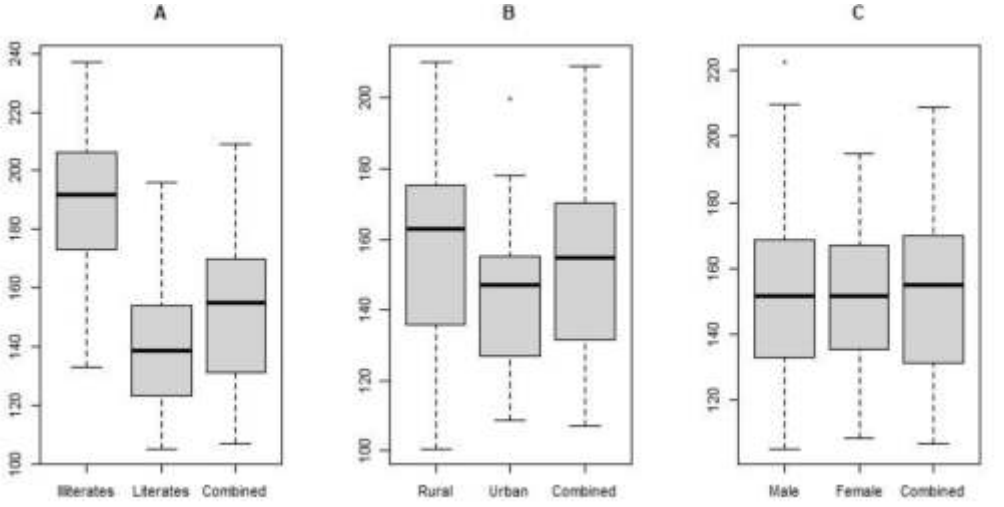
| States | Illiterates | Literates | Rural | Urban | Male | Female | Total | literate (in %) |
|---|---|---|---|---|---|---|---|---|
| Jammu and Kashmir | 207.06 | 145.06 | 176.63 | 156.36 | 167.42 | 173.32 | 170.17 | 59.49 |
| Himachal Pradesh | 170.91 | 121.02 | 131.48 | 118.71 | 124.21 | 135.89 | 130.08 | 81.82 |
| Punjab | 199.30 | 138.38 | 161.16 | 145.70 | 160.61 | 149.22 | 155.05 | 72.64 |
| Haryana | 193.58 | 142.62 | 163.68 | 148.34 | 161.57 | 153.98 | 157.93 | 69.95 |
| Uttarakhand | 205.71 | 144.04 | 164.48 | 152.83 | 160.25 | 161.02 | 160.64 | 73.09 |
| Uttar Pradesh | 197.69 | 179.91 | 190.55 | 178.22 | 209.69 | 164.18 | 187.50 | 57.30 |
| Madhya Pradesh | 189.92 | 156.26 | 174.00 | 159.95 | 180.25 | 158.52 | 169.72 | 60.02 |
| Chhattisgarh | 194.82 | 148.04 | 170.14 | 154.54 | 168.73 | 163.61 | 166.18 | 61.22 |
| Rajasthan | 198.54 | 164.03 | 184.11 | 167.19 | 191.74 | 166.54 | 179.43 | 55.38 |
| Gujarat | 178.49 | 135.66 | 152.25 | 140.89 | 151.99 | 141.86 | 147.10 | 73.28 |
| Maharashtra | 213.20 | 143.52 | 171.10 | 142.64 | 151.01 | 164.12 | 157.38 | 80.11 |
| Goa | 178.35 | 119.72 | 128.90 | 124.69 | 122.94 | 129.69 | 126.29 | 88.80 |
| Karnataka | 237.17 | 155.90 | 199.22 | 153.27 | 174.25 | 187.00 | 180.57 | 69.64 |
| Andhra Pradesh | 231.82 | 161.91 | 204.93 | 164.99 | 187.60 | 194.79 | 191.23 | 58.07 |
| Tamil Nadu | 212.98 | 136.88 | 172.37 | 137.22 | 147.77 | 161.81 | 154.87 | 76.37 |
| Kerala | 171.44 | 116.65 | 121.61 | 116.98 | 117.24 | 121.28 | 119.39 | 95.01 |
| Bihar | 222.63 | 196.05 | 210.28 | 199.86 | 222.64 | 194.75 | 208.99 | 51.33 |
| Jharkhand | 214.27 | 172.42 | 198.23 | 170.72 | 193.37 | 188.37 | 190.91 | 55.80 |
| Orissa | 201.97 | 154.76 | 173.11 | 155.93 | 163.84 | 176.28 | 170.01 | 67.70 |
| West Bengal | 196.13 | 149.79 | 166.66 | 156.80 | 158.36 | 168.44 | 163.23 | 71.00 |
| Assam | 204.79 | 157.37 | 177.50 | 152.57 | 168.79 | 178.12 | 173.34 | 66.33 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tripura | 174.46 | 133.03 | 143.82 | 127.17 | 134.44 | 143.59 | 138.87 | 85.91 |
| Meghalaya | 145.89 | 123.96 | 134.18 | 119.13 | 132.62 | 128.58 | 130.61 | 69.68 |
| Arunachal Pradesh | 181.08 | 143.87 | 163.20 | 149.39 | 158.28 | 161.36 | 159.72 | 57.39 |
| Manipur | 154.73 | 130.50 | 138.77 | 131.61 | 135.17 | 137.87 | 136.53 | 75.14 |
| Sikkim | 142.54 | 113.65 | 120.15 | 119.69 | 119.18 | 121.04 | 120.02 | 77.93 |
| Mizoram | 139.63 | 109.46 | 116.12 | 108.81 | 112.86 | 111.26 | 112.07 | 91.36 |
| Nagaland | 159.16 | 127.23 | 137.78 | 126.71 | 133.31 | 135.38 | 134.30 | 77.85 |
| **Union Territories** | | | | | | | | |
| NCT, Delhi | 213.78 | 135.63 | 162.94 | 148.24 | 149.37 | 147.70 | 148.59 | 83.42 |
| Chandigarh | 181.71 | 121.28 | 146.46 | 131.03 | 133.58 | 128.84 | 131.44 | 83.18 |
| Daman & Diu | 176.40 | 139.18 | 126.71 | 149.76 | 149.64 | 135.82 | 144.52 | 85.66 |
| Dadra & Nagar Haveli | 154.90 | 134.11 | 140.58 | 140.64 | 142.75 | 137.68 | 140.61 | 68.75 |
| Puducherry | 188.26 | 115.26 | 137.99 | 121.23 | 119.65 | 132.79 | 126.38 | 84.76 |
| Lakshadweep | 132.99 | 105.21 | 100.71 | 108.67 | 105.47 | 108.61 | 106.98 | 93.64 |
| A & N Islands | 181.17 | 122.21 | 133.66 | 127.53 | 126.99 | 136.38 | 131.28 | 84.61 |
| **INDIA** | **206.42** | **153.42** | **180.52** | **152.88** | **174.55** | **167.40** | **171.04** | **66.75** |

*Source:* Authors' computation

Notes: (i) Figures are in absolute numbers, rounded up to two digits.; (ii) Percentage of literates is computed for the age range 23-62 years by dividing the total literate population for the age range 23-62 by the total literate and illiterate population of this age group. Percentage of illiterate = 100 – Percentage of literates.

Box-and-whisker plots for WI values for all states/UTs for (A) illiterate, literate, combined; (B) rural, urban, combined; and (C) male, female, combined are also presented in Figure 1 (A, B, C).




*Source:* Authors' computation

Fig. 1: Box-and-whisker plots for WI values for all states/UTs for (A) Illiterate, Literate, Combined; (B) Rural, Urban, Combined; and (C) Male, Female, Combined. Two outliers, not extreme (B and C concerning Bihar-urban and Bihar-male) is observed. A massive gap in median WI values for illiterates and literates is observed (A). There is a comparatively lesser gap in median WI values between rural-urban (B). The gap in WI values for male-female is the least (C).

## Literacy differentials

Box-and-whisker plots for WI values (Fig. 1 A) reveal that age data quality for literate is far better compared to illiterate. The median WI value for the literate is 138.4, whereas it is 189.9 for

the illiterate. The observed average (median) WI value in the combined population is 154.9. The absolute difference in median WI values for the illiterate and combined population is 35 points, whereas this gap for literate with the combined population is only 16.5 points.

Lakshadweep, Mizoram, Sikkim, Meghalaya, Manipur, Dadra & Nagar Haveli, Nagaland, Himachal Pradesh, Kerala, and Tripura are the top-ranking states/UTs with computed WI values (Table 2, Table 3) for illiterate laying in the range of 125-175, indicating rough data quality. These states/UTs have an average literate proportion of 79.01 % compared to 69.74 % for the rest of the county, having the data quality very rough. Whereas Lakshadweep and Mizoram are the only states to have fairly accurate data of the illiterate population with WI values of 105.21 and 109.46, respectively; these two states are among the top three states with the highest percentage proportion of literate for the age group 23-62. While Sikkim, Puducherry, Kerala, Goa, Himachal Pradesh, Chandigarh, Andaman & Nicobar Islands, and Meghalaya are the states/UTs with approximate data quality for literate (WI values falling between 110 and 125). All other states/UTs except Uttar Pradesh and Bihar have rough data (WI values lies between 125-175). Uttar Pradesh and Bihar are the states where data quality is very rough. Notably, however, there is a significant improvement in data quality for literate compared to the illiterate population in these two states. Of the 35 states/UTs in the illiterate population, 25 showed very rough data quality compared to only 2 states showing very rough data for the literates.

**Rural-Urban differentials**

Box-and-whisker plots for WI values (Fig. 1 B) reveal that age data quality is better for the urban than rural population. The median WI value for rural is 162.9, and 145.7 for the urban population. The absolute difference in median WI values for the rural and combined population is 8 points, whereas the absolute difference between the urban and the combined population is 9.2 points.

Daman & Diu and Lakshadweep were the only UTs where WI values (Table 2) for the urban area were more than rural, indicating rural data superiority. Dadra & Nagar Haveli showed almost equal WI values for both rural and urban populations. All other states/UTs were reported with lower WI values in urban areas indicating superior age data quality. For rural populations, eight states showed very rough data quality, whereas only two states were falling under this category in the case of urban areas. This indicates that life and practices in urban areas are more centric on time and calendars.

**Gender differentials**

Box-and-whisker plots for WI values (Fig.1 C) reveal that age data quality for the female is slightly better in comparison to the male population. The median WI value for the male population is 151.0, whereas it is 149.2 for females. The observed median WI value in the combined population is 154.9. The absolute difference in median WI values for the male and the combined population is by 3.9 points, whereas this gap for females with the combined population is by 5.7 points. For males, Lakshadweep (WI 105.47; Table 2) is the only state with fairly accurate data quality.

Table 3: Classification of states/UTs among literates and illiterates based on WI values

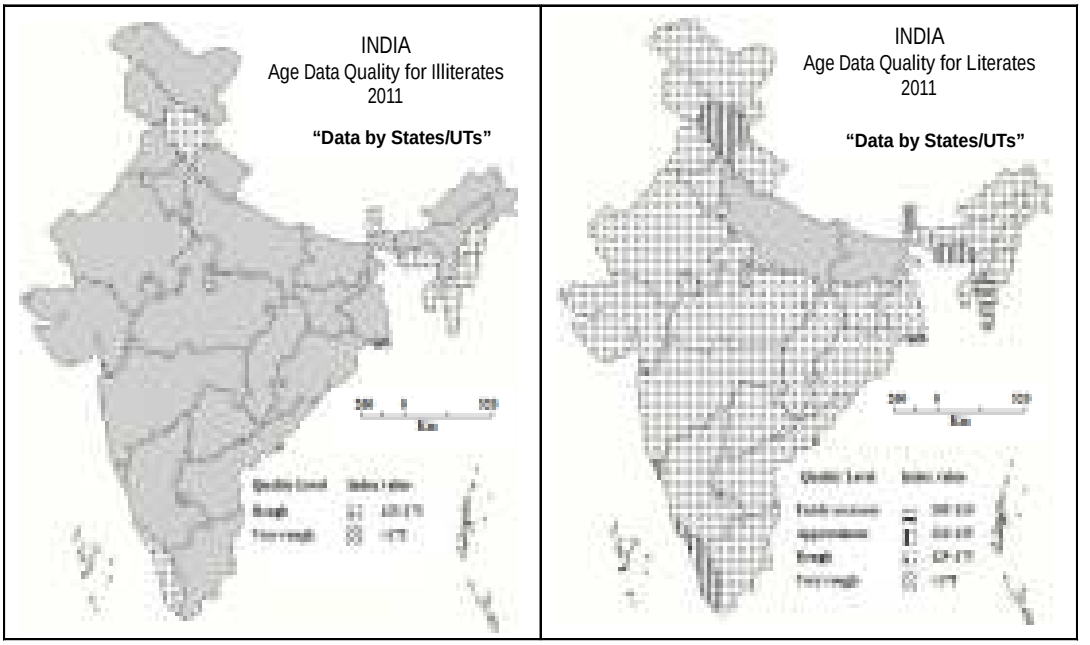
| WI values (Data quality ) | < 105 (Highly accurate ) | 105–110 (Fairly accurate ) | 110–125 (Approximate) | 125–175 (Rough) | > 175 (Very Rough ) |
|---|---|---|---|---|---|
| Illiterates | | | | Lakshadweep, Mizoram, Sikkim, Meghalaya, Manipur, Dadra & Nagar Haveli, Nagaland, Himachal Pradesh, Kerala, Tripura | Daman & Diu, Goa, Gujarat, Arunachal Pradesh, Andaman & Nicobar Islands, Chandigarh, Puducherry, Madhya Pradesh, Haryana, Chattisgarh, West Bengal, Uttar Pradesh, Rajasthan, Punjab, Orissa, Assam, Uttarakhand, INDIA, Jammu and Kashmir, Tamil Nadu, Maharashtra, Delhi, Jharkhand, Bihar, Andhra Pradesh, Karnataka |
| Literates | | Lakshadweep Mizoram | Sikkim, Puducherry, Kerala, Goa Himachal Pradesh, Chandigarh, Andaman & Nicobar Islands, Meghalaya | Nagaland, Manipur, Tripura, Dadra & Nagar Haveli, Delhi, Gujarat, Tamil Nadu, Punjab, Daman & Diu, Haryana, Maharashtra, Arunachal Pradesh, Uttarakhand, Jammu and Kashmir, Chattisgarh, West Bengal, Orissa, Karnataka, Madhya Pradesh, Assam, Andhra Pradesh, Rajasthan, Jharkhand | Uttar Pradesh, Bihar |

*Source: Authors' computation*.

Table 4: Descriptive statistics for illiterate, literate and combined population

| Population | Mean | Standard Error | Median | Standard Deviation | Sample Variance | Kurtosis | Skewness | Range |
|---|---|---|---|---|---|---|---|---|
| Illiterates | 187.07 | 4.42 | 189.92 | 26.12 | 682.25 | -0.44 | -0.28 | 104.18 |
| Literates | 139.84 | 3.45 | 138.38 | 20.43 | 417.45 | 0.46 | 0.63 | 90.84 |
| Combined | 152.06 | 4.19 | 154.87 | 24.77 | 613.46 | -0.55 | 0.24 | 102.01 |

Source: Authors' computation.




*Source: Prepared by authors using Map Chart* (*India|Create a Custom Map*, n.d.)

Fig. 2: Whipple's Index values for all states/UTs for illiterates (left) and literates (right)

Six states/UTs, Mizoram, Kerala, Sikkim, Puducherry, Goa and Himachal Pradesh have approximate data. Madhya Pradesh, Andhra Pradesh, Rajasthan, Jharkhand, Uttar Pradesh and Bihar are the worst age reporting states with data quality very rough. Data quality in all the other states is rough. For females also, Lakshadweep (WI 108.61) tops the list with fairly accurate data quality. The three states of Mizoram, Sikkim and Kerala reported approximate data quality. Orissa, Assam, Karnataka, Jharkhand, Bihar and Andhra Pradesh are the six states with very rough data quality. The rest of the country showed a rough data quality. Uttar Pradesh (45.5 point deviation), Bihar (27.9 point deviation), Rajasthan (25.2 point deviation), Madhya Pradesh (21.7 point deviation) showed the highest deviations in WI values for the male-female population. All these states have a literacy rate of 60.0 per cent or below (Table 2) and fall under the category of the bottom 10 states concerning the percentage of literates. These states in the combine subsume almost thirty-seven per cent of the total population of the country as per the 2011 Census and surprisingly have better age data for the females. As per the national figure, the WI value for the male is 174.55, and for females, it is 167.40 both the sexes have rough data. The majority of the states/UTs have a very narrow difference in the values of Whipple's Index among both genders.

Table 5: Classification of states/UTs among rural and urban population based on WI values.

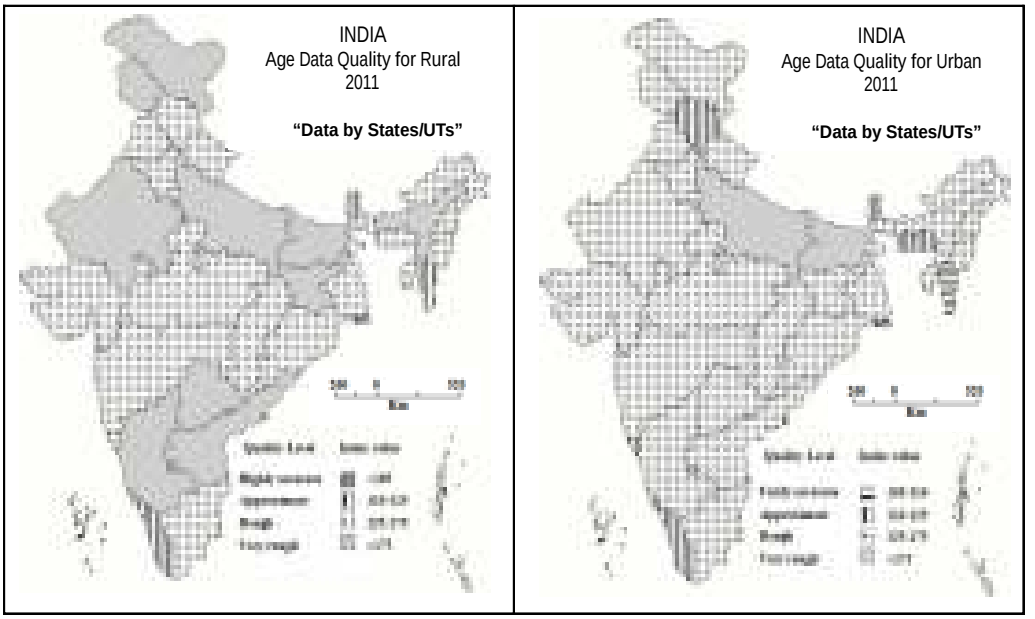
| WI values (Data quality ) | < 105 (Highly accurate ) | 105–110 (Fairly accurate ) | 110–125 (Approximate) | 125–175 (Rough) | > 175 (Very Rough ) |
|---|---|---|---|---|---|
| Rural | Lakshadweep | | Mizoram, Sikkim, Kerala | Daman & Diu, Goa, Himachal Pradesh, Andaman & Nicobar, Islands, Meghalaya, Nagaland, Puducherry, Manipur, Dadra & Nagar Haveli, Tripura, Chandigarh, Gujarat, Punjab, Delhi, Arunachal Pradesh, Haryana, Uttarakhand, West Bengal, Chattisgarh, Maharashtra, Tamil Nadu, Orissa, Madhya Pradesh | Jammu and Kashmir, Assam, Rajasthan, Uttar Pradesh, Jharkhand, Karnataka, Andhra Pradesh, Bihar |
| Urban | | Lakshadweep Mizoram | Kerala Himachal Pradesh Meghalaya Sikkim Puducherry Goa | Nagaland, Tripura, A & N Islands, Chandigarh, Manipur, Tamil Nadu, Dadra & Nagar Haveli, Gujarat, Maharashtra, Punjab, Delhi, Haryana, Arunachal Pradesh, Daman & Diu, Assam, Uttarakhand, Karnataka, Chhattisgarh, Orissa, Jammu and Kashmir, West Bengal, Madhya Pradesh, Andhra Pradesh, Rajasthan, Jharkhand | Uttar Pradesh, Bihar |

*Source: Authors' computation*.

Table 6: Descriptive statistics for rural, urban and combined population.

| Population | Mean | Standard Error | Median | Standard Deviation | Sample Variance | Kurtosis | Skewness | Range |
|---|---|---|---|---|---|---|---|---|
| Rural | 157.01 | 4.61 | 162.94 | 27.25 | 742.35 | -0.67 | 0.06 | 109.57 |
| Urban | 143.09 | 3.47 | 145.70 | 20.52 | 421.15 | 0.30 | 0.42 | 91.19 |
| Combined | 152.06 | 4.19 | 154.87 | 24.77 | 613.46 | -0.55 | 0.24 | 102.01 |

Source*: Authors' computation.*




*Source:* Created by authors using Map Chart (India | Create a Custom Map, n.d.)

Fig. 3: Whipple's Index values for all states/UTs for rural (left) and urban (right).

Table 7: Classification of states/UTs among male and female population based on WI values

| WI values (Data quality ) | < 105 (Highly accurate ) | 105–110 (Fairly accurate ) | 110–125 (Approximate) | 125–175 (Rough) | > 175 (Very Rough ) |
|---|---|---|---|---|---|
| Male | | Lakshadweep | Mizoram, Kerala, Sikkim, Puducherry, Goa, Himachal Pradesh | Andaman & Nicobar Islands, Meghalaya, Nagaland, Chandigarh, Tripura, Manipur, Dadra & Nagar, Haveli, Tamil Nadu, Delhi, Daman & Diu, Maharashtra, Gujarat, Arunachal Pradesh, West Bengal, Uttarakhand, Punjab, Haryana, Orissa, Jammu and Kashmir, Chattisgarh, Assam, Karnataka | Madhya Pradesh, Andhra Pradesh, Rajasthan, Jharkhand, Uttar Pradesh, Bihar |

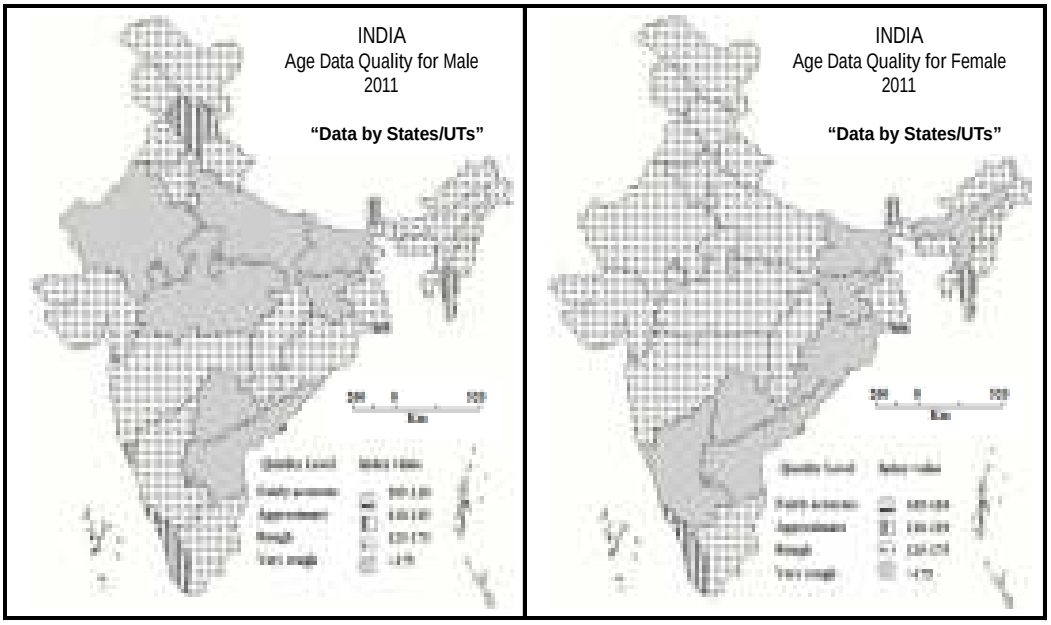
| | | | | | |
|---|---|---|---|---|---|
| Female | | Lakshadweep | Mizoram, Sikkim, Kerala | Meghalaya, Chandigarh, Goa, Puducherry, Nagaland, Daman & Diu, Himachal Pradesh, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Manipur, Gujarat, Tripura, Delhi, Punjab, Haryana, Madhya Pradesh, Uttarakhand, Arunachal Pradesh, Tamil Nadu, Chattisgarh, Maharashtra, Uttar Pradesh, Rajasthan, West Bengal, Jammu and Kashmir | Orissa, Assam, Karnataka, Jharkhand, Bihar, Andhra Pradesh |

*Source: Authors' computation*.

Table 8: Descriptive statistics for male, female and combined population.

| Population | Mean | Standard Error | Median | Standard Deviation | Sample Variance | Kurtosis | Skewness | Range |
|---|---|---|---|---|---|---|---|---|
| Male | 152.50 | 4.72 | 151.01 | 27.90 | 778.17 | -0.02 | 0.53 | 117.17 |
| Female | 151.42 | 3.91 | 149.22 | 23.13 | 534.90 | -0.74 | 0.15 | 86.18 |
| Combined | 152.06 | 4.19 | 154.87 | 24.77 | 613.46 | -0.55 | 0.24 | 102.01 |

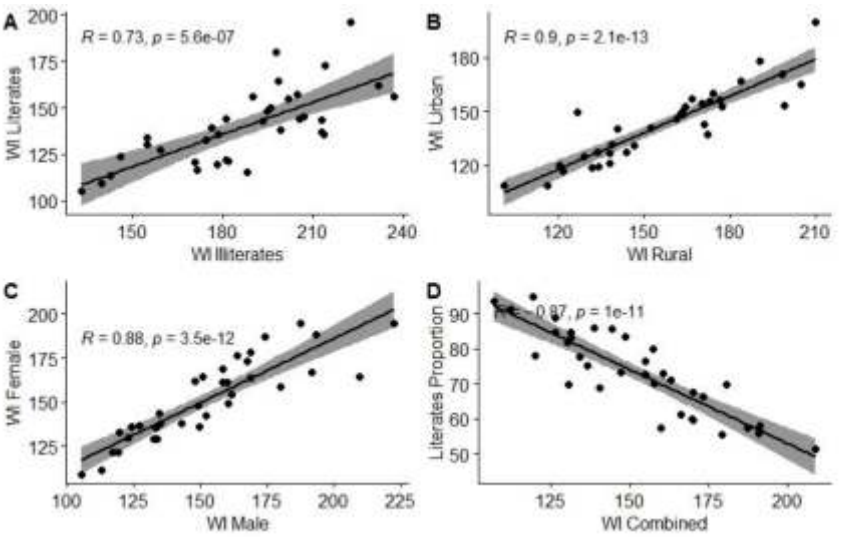
Source: Authors' computation.




*Source:* Created by authors using MapChart (India | Create a Custom Map, n.d.)

Fig. 4: Whipple's Index values for all states/UTs for male (left) and female (right).

We computed Pearson's product-moment correlation (R), and plotted to scatter diagrams of WI values for (A) illiterate-literate; (B) rural-urban; (C) male-female and (D) percentage literates with WI values for the combined population with 95 per cent confidence band as shown in Figure 5.




*Source: Authors' computation.*

Fig.5: Scatter plot of WI values for (A) illiterate-literate; (B) rural-urban; (C) male-female and (D) percentage literates with WI values for combined population. Figures 'A', 'B' and 'C', clearly reve als a direct positive association, with high computed Pearson's product-moment correlation coefficient (R), small p-value and a narrow 95% confidence band. Figure 'D' indicates an inverse correlation between WI values and percentage literates in the combined population for the age range 23 to 62 years.

From the scatter plot (Fig. 5, 'A', 'B', and 'C'), it is evident that (A) literacy differentials; (B) rural-urban differentials; and (C) sex differentials in the self-reporting of age show a high positive correlation. We can observe that an increase (or decrease) in the WI values in one category results in an increase (or decrease) in the WI values of the other among these differentials, indicating the presence of intra-state factors in regulating the quality of data. Fig.5 (D) shows an inverse association as the percentage of literates in the combined population for states/UTs in the age group 23-62 years increases, the corresponding WI values decreases with computed Pearson's correlation coefficient of -0.87. This implicates to an increasing percentage of literates can accomplish superior age data quality. However, the evidence of a strong positive correlation between WI values for illiterates and literates was theoretically unexpected, indicating the presence of various effects related to the respective region or state. Further, it is observable that for rural-urban and male-female also, there is a similar pattern of change in the values of the Whipple's Index among states/UTs. Thus a robust indication and there is immense importance to carry out a detailed intrastate study. It is mainly because the diverse factors may be affecting the WI values. The informant may be literate or illiterate but unable or biased or with little awareness regarding their correct age. All these factors are unique and may specifically be related to a community with similar customs, traditions, rituals and ethnicity. The intra-state factors on age data reporting are essential determinants of age data quality.

## Conclusion

The results of the paper indicate that tendency of misreporting or rounding off of age was highest among illiterates. It further affirmed that the age approximation errors are lesser in the urban population compared to the rural. Almost similar patterns of approximation errors among males and females have been observed. The high inverse association between the proportion of literates and WI values among the states/UTs indicates age heaping can be reduced by imparting education and awareness. Misreporting or heaping among states/UTs show a high positive association among illiterate-literate, rural-urban, and male-female populations. This indicates that the presence of intra-state factors affects the quality of the reported data. In a diverse and large country like India, we cannot rule out the proxy biases, intentional misreporting, enumerator's biases or inefficiency leading to poor data quality. Heaping in self-reported data can be minimized by improvising rigorous training of the enumerators, imparting mass awareness campaigns on the need for quality age data and educating the population.

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# Levels of Maternal Health Care in Uttarakhand: A District-Level Analysis

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**Abstract:** The paper makes an objective assessment of the utilization pattern of the maternal health care services in Uttarakhand state using data available from the National Family Health Survey (NFHS-IV) conducted during 2015-16, the Sample Registration System, 2004-06 to 2016-18, and the Human Development Report of the state published in 2018. The data available from these sources were processed with the help of simple statistics, coefficient of determination or $R^2$, and composite index based on a z-score method to understand the development level of maternal health care services in the study area. For showing the spatial pattern of maternal health care services data have been mapped and charts prepared using cartographic techniques in ArcGIS 10.5 software.

The study reveals wide disparities in the availability and utilization of maternal health care services at the district level. The districts of Dehradun, Nainital and Pithoragarh exhibited a high level of such facilities against the low to very low level in Haridwar and Udham Singh Nagar districts. Happily, the maternal mortality ratio registered a sharp decline during 2004-2015 from 440 in 2004 to 89 in 2015, but it recorded a sharp increase recently: from 89 to 99 between 2015-17 and 2016-18, an increase considered a very high in the national context. Likewise, the level of maternal health care utilization is also found low in the state.

**Keywords:** Maternal health, associated factors, maternal mortality, composite index.

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## Introduction

In 1948, the WHO defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Health is the real wealth of any nation or region and the health of women is a basic key of human development. Once our first prime minister stated, "You can tell the condition of a nation by looking at the status of its women". The health of women is linked with social, economic and cultural factors influencing all aspects of their life. According to a report published by the WHO (2018), nearly 99.0 per cent of all maternal deaths happen in developing countries. India, in the group of the developing countries, has a high maternal mortality ratio: 113 per one lakh live births (SRS, 2016-18). It is, however, to be noted that the maternal mortality ratio has registered a sharp decline in India from 540 to 190 per one lakh live births during 2004-2013. Against this, the world average has declined from 321 to 217 per one lakh live births during the same period (Kundu, 2017). Nonetheless, according to UN inter-agency approximations, the MMR at the international level declined by 38 per cent;

[1] Corresponding Author

from 342 to 211 per one lakh live births from 2000 to 2017 respectively. On the one hand, during the same period, India has comparatively low maternal deaths 122 per one lakh live births in 2015-17, which was much lower as compared to the world average (211 per 1 lakh live births). Relatively, at the same time, Uttarakhand observed low maternal deaths (89 per one lakh live births). Nevertheless, it has been observed that the progressive state, Kerala has only 42 maternal deaths per 1 lakh live births, almost half to Uttarakhand state implying that the state has a long way to go in containing maternal deaths.

In India, the national rural health mission has been established with a vision to provide affordable and quality health care services at accessible locations in the countryside to serve the rural population, in general, and its vulnerable sections, in particular. Under the mission, a special focus has been placed on the states included in the Empowered Action Group (EAG). This category of states is included Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Odisha, Rajasthan, Uttar Pradesh and Uttarakhand. Important in this context is to adopt the right strategies for improving maternal, reproductive, and child health. A study of Anantapur district in Andhra Pradesh (1986) revealed that more than half of the maternal deaths happened among women of the reproductive age group (Bhatia, 1993). In this district, there were about eight maternal deaths per 1000 live births. At the national level, Uttar Pradesh, which recorded the highest numbers of maternal deaths, nine of each ten deliveries take place at home and in nearly half of the cases the baby is delivered by the family member (Rama Rao et al., 2001). By now, several studies have been conducted on maternal mortality, maternal health care and interconnected issues in India. Gupta et al. (2015) conducted a study on the role of the National Rural Health Mission (NRHM) to decrease maternal and child health abnormalities in Haryana. There are other studies also on maternal mortality conducted for different periods and places (see Sidramshettar, 2004; Kateja, 2007).

In Uttarakhand, which is included in the group of EAG states, the maternal death rate was 188 per 1 lakh live births in 2012-13. Moreover, there are wide sub-regional variations. The ratio in the Garhwal was 190 against 183 per 1 lakh live births in the Kumaon regions (Annual Health Survey, 2012-13). Notwithstanding inter and intra-regional disparities in maternal mortality ratio (MMR) in the state of Uttarakhand, there has been a disturbing trend in recent years. There has been an increase registered in MMR in recent years in the state. The MMR increased to 99 in the years 2016-18 from 89 in the years 2015-17.

**Objectives of the Study**

Taking a cue from the above statements, the main objectives of the present research work is to study the levels of maternal health care services along with an examination of inter-district disparities existing therein. In addition, it will attempt to identify the factors working behind the existing disparities in the levels of maternal health care at the sub-regional level in the state of Uttarakhand.

**Data sources and Methodology**

The study is based on secondary data sources acquired from the Sample Registration System (SRS) for the period from 2004-06 to 2016-18 and the IV National Family Health Survey (NFHS-IV) conducted during 2015-16. SRS data have been used to study the changing scenario of maternal mortality at the state level. Unfortunately, maternal mortality ratio (MMR) data are not available at the district level, preventing the examination of the scenario at the district level.

The levels of maternal health have been constructed with the help of eight indicators including (i) mothers having an antenatal check-up in the first trimester, (ii) mothers having at least 4 ANC visits, (iii) mothers having received at least one tetanus toxoid (TT) injection, (iv) mothers having consumed IFA for 1 00 days or more, (v) mothers who had a full antenatal check-up,(vi) institutional births, (vii) institutional births in a public facility, and (viii) mothers receiving postnatal care within 2 days of delivery ( see Table 1). For getting a composite picture of maternal health at the district level, the Z-score method has been pressed into service.

A combo chart has been prepared to examine the association between maternal health status and the human development index (HDI). Coefficient of determination or $R^2$, a statistical measure, has been used to determine whether differences in one variable can be explained by variations in another. The significant relationship with the highest value of the coefficient of determination ($R^2$) has been taken into consideration because the maximum percentage of the total variation of the dependent variable (y) by an independent variable (x) can be explained with the help of the highest value of $R^2$. To analyse the consistency and variability in maternal health, descriptive statistics (mean, standard deviation) and coefficient of variation has been used. Further, the CV index is often expressed as a per cent and the ratio of the standard deviation to the mean, in the selected variables of maternal health has been calculated to understand the inter-district disparity. Higher the index value higher would be the disparity in the status of women's health and vice versa. Per capita income, female literacy rate, women work participation rate, and primary health centre has been correlated with the maternal health variables. The Choropleth mapping technique has been used to map the proceeded data information, maps prepared in ArcGIS 10.5 environment.

DISCUSSIONS AND ANALYSIS

In the following section, the discussions will focus on maternal health care status and its pattern at the district will be analysed in the state of Uttarakhand. As indicated before levels in maternal health care have been arrived at with the help of above listed eight indicators.

**Maternal health pattern in Uttarakhand**

We start with a discussion on individual indicators used to prepare a composite picture in levels of maternal health care followed by an examination of the regional pattern of inequalities in maternal health care.

On average, 53.5 per cent or higher than the majority of the mothers had received antenatal check-ups in the first trimester in Uttarakhand during 2015-16 (see Fig. 1). There were, however, wide inter-district differentials on this count. It ranged from a high of 71.9 per cent in Dehradun district to a low of only 42.0 per cent in Bageshwar district, differing by 30.0 per cent.

The former is a valley district having the state capital headquarters and the latter one is a mountainous district in the Kumaon Hills. On the whole, less than half or six of the 13 districts in the state in 2011 had this share higher than the state average. These included Dehradun (71.9 per cent), Nainital (65.7 per cent), Garhwal (61.4 per cent), Almora (57.7 per cent), Rudraprayag (55.5 per cent), and Tehri Garhwal (53.8 per cent). The remaining more than half or seven districts had this share below the state average. Locationally, most of the districts of this category were in the Kumaon region of the state.

Now coming to the next indicator of maternal health care, we find that the state average for the mothers having at least 4 ANC visits was quite low in comparison to antenatal check-ups in the first trimester. The state average for mothers paying at least 4 ANC visits made only about 31.0 per cent in comparison to 53.5 per cent share for antenatal check-ups in the first trimester. Moreover, there were very wide inter-district differentials in this regard. It ranged from a high of 47.1 per cent in Dehradun district to only 17.2 per cent in Rudraprayag district. In eight of the thirteen districts in the state, this share was below the state average. Such districts included Rudraprayag (17.2 per cent), Chamoli (20.3 per cent), Uttarkashi (22.2 per cent), Bageshwar (23.4 per cent), Tehri Garhwal (23.8 per cent), Haridwar (24.2 per cent), Udham Singh Nagar (26.6 per cent), Champawat (29.0 per cent) and Pithoragarh (30.8 per cent). Dehradun (47.1 per cent), Nainital (40.4 per cent), Garhwal (36.4 per cent), and Almora (31.7 per cent) were districts having this share above average the state average. Wide inter-district inequality on account of mothers who had 4 ANC visits is confirmed in CV Index value of 29. 7 per cent, against only 18.1 per cent in the case of mothers who had ANC in the first trimester (Table 1).

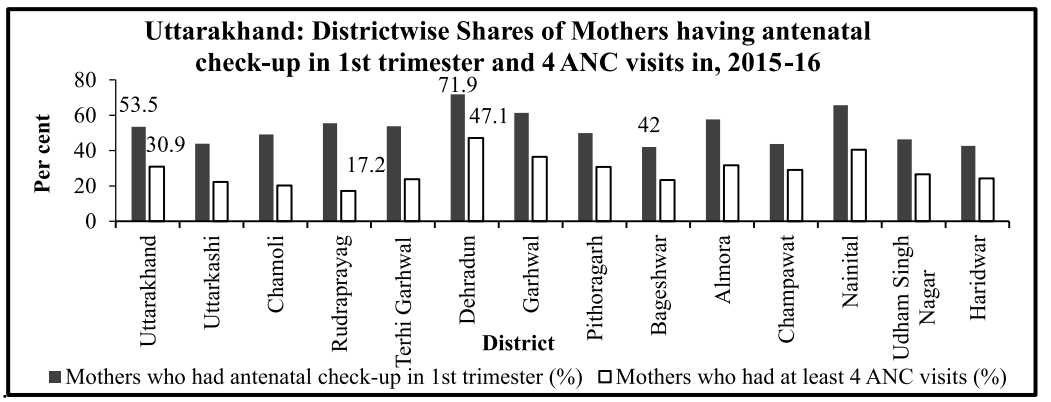



Fig. 1, Source: National Family Health Survey-IV(2015-16)

However, more than nine of each ten mothers in the state received at least one tetanus toxoid (TT) injection during 2015-16. On this count also, Dehradun district topped the list with 97.5 per cent of mothers receiving at least one tetanus toxoid (TT) injection during this period. On the other side of the scale was placed Udham Singh Nagar district with 86.9 per cent. On account of mothers who consumed iron and folic acid (IFA) tablets for 100 days or more during a pregnancy period, the state average being only 26.4 per cent, Nainital district in Kumaon region topped the list with 40.9 per cent. It means that in none of the districts of the state even half of

the mothers had consumed iron and folic acid (IFA) tablets for 100 days or more during a pregnancy period till 2015-16. Interestingly, Udham Singh Nagar district located in the Tarai region and considered an agriculturally most developed district of the state was at the bottom on both the counts (see Fig.2). There were very wide inter-district disparities in the state on account of mothers consuming IFA for 100 days or more. The same is confirmed in CV index value of 25.3 per cent. Against this, inter-district inequality was minimal on account of mothers receiving at least one tetanus toxoid (TT) injection, CV index value was only 3.2 per cent (Table 1).

**Table 1: Consistency and variability between different indicators with descriptive statistics**

| Indicators | Mean | Standard Deviation | Coefficient of Variation (%) |
|---|---|---|---|
| Mothers who had an antenatal check-up in the first trimester (%) | 52.6 | 9.5 | 18.1 |
| Mothers who had at least 4 ANC visits (%) | 28.7 | 8.5 | 29.7 |
| Mothers who received at least one tetanus toxoid (TT) injection (%) | 92.4 | 2.9 | 3.2 |
| Mothers who consumed IFA for 100 days or more (%) | 26.4 | 6.7 | 25.3 |
| Mothers who had full antenatal check-ups (%) | 11.4 | 5.3 | 46.2 |
| Institutional Births (%) | 67.5 | 8.0 | 11.8 |
| Institutional births in public facility (%) | 51.4 | 11.3 | 21.9 |
| Mothers who received postnatal care within 2 days of delivery (%) | 53.4 | 7.1 | 13.2 |

Source: Compiled from National Family Health Survey-IV (2015-16)

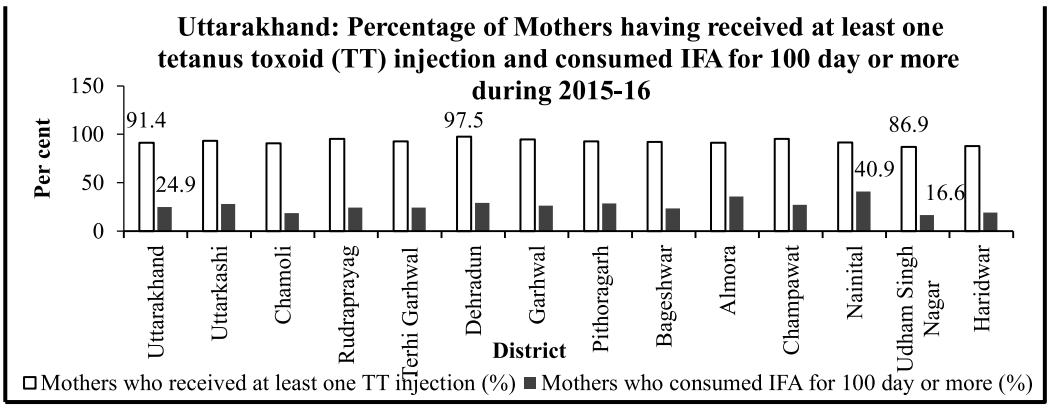
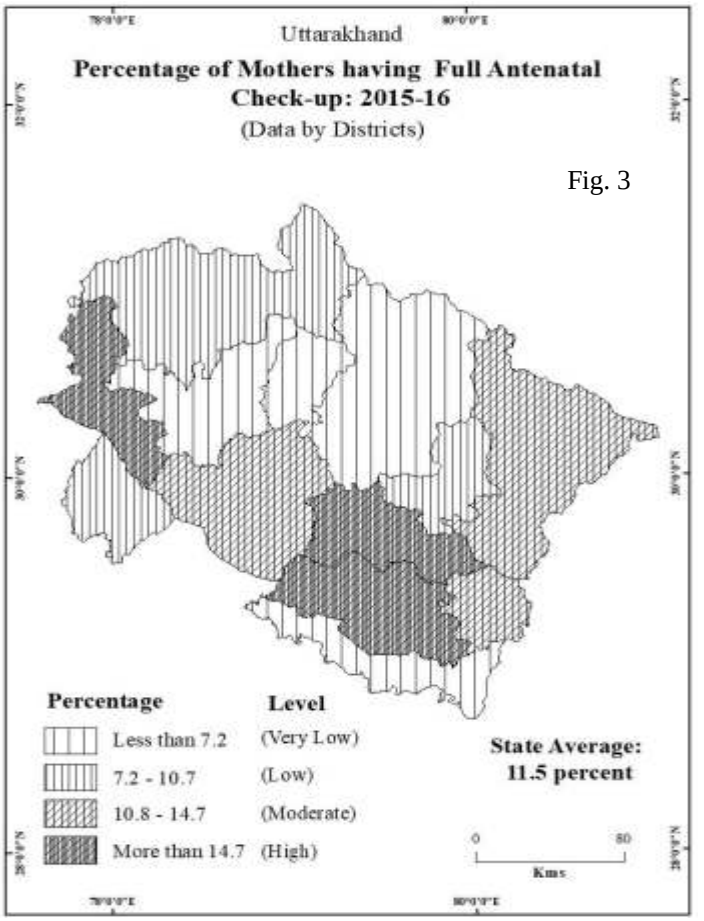



Fig. 2, Source: National Family Health Survey-IV(2015-16)

In the context of full antenatal care, the state average being only 12.7 per cent in 2005-06 the situation was highly unsatisfactory. The most fortunate part was that this share declined to 11.5 per cent by 2015-16. Moreover, there were wide inter-district inequalities on this count. With only 20.5 per cent share, Nainital district was at the top and Rudraprayag district at the bottom with 5.7 per cent in 2015-16 (Fig.3). On the whole, there were only three districts of Nainital, Dehradun, and Almora that had this share above average the state average. As evident from CV index value of 46.2 per cent, inter-district disparities on this count were the widest of all

the indicators used here. This is an example of high inequalities even at the low level of development.




Source: National Family Health Survey-IV(2015-16)

Institutional deliveries in the state made 68.6 per cent in 2015-16. In the highly urbanized district of Dehradun this made 83.7 per cent, against only 53.3 per cent in Chamoli district (Fig.4). On the whole, five districts of Dehradun, Garhwal, Champawat, Pithoragarh, and Tehri Garhwal had this share above the state average. The majority of districts, mostly located in the Kumaon region registered this share below the average. In the context of institution deliveries conducted by public sector facilities, Pithoragarh district was at the top with 65.3 per cent and Haridwar district at the bottom with 23.8 per cent. The latter district had this nearly half of the state average (43.8 per cent) in 2015-16. On the whole, three districts of Haridwar, Udham Singh Nagar, and Nainital fall below the state average (Fig. 4). The state is lagging far behind the nationally fixed target of 80.0 per cent institutional deliveries by 2020.

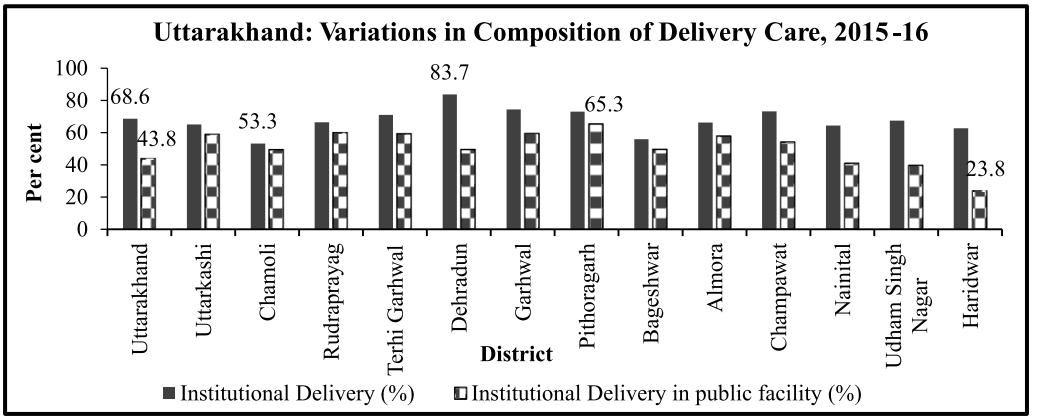



Fig. 4, Source: National Family Health Survey-IV(2015-16)

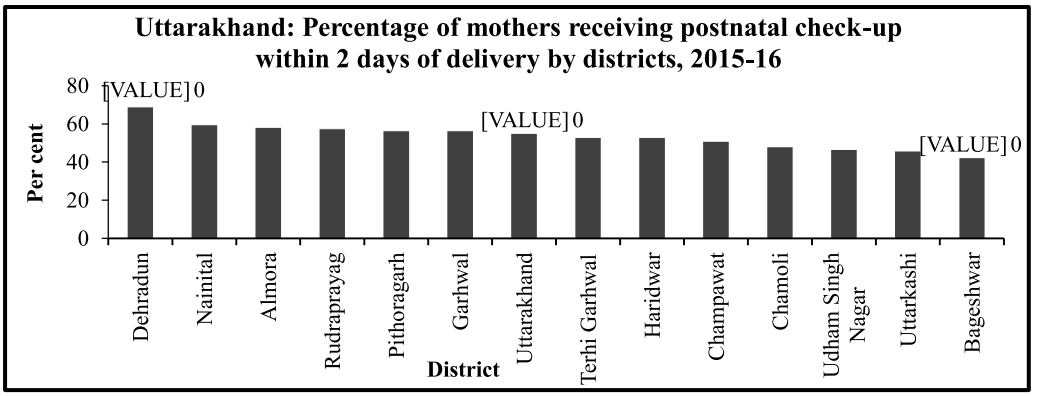



Fig. 5, Source: National Family Health Survey-IV(2015-16)

Post-natal care (PNC) or post-partum is the care given to the mother and her newborn baby immediately after the birth and for the first six weeks or 42 days of life. As per the figures available from the NFHS-IV, about half of the mothers (54.8 per cent) in Uttarakhand had a post-natal check-up within two days of delivery in 2015-16. This share is nearly twice of the coverage recorded (27.7 per cent) in 2005-06. Among districts, it ranged from 68.6 per cent in Dehradun district to only 42.1 per cent in Bageshwar district (Fig.5). On the whole, Dehradun, Nainital, and Almora performed reasonably well. The reverse was true of Uttarkashi, Udham Singh Nagar, Chamoli, Champawat, Haridwar, Tehri Garhwal and Bageshwar districts in 2015-16.

**Levels of maternal health care**

The composite index of maternal health care for individual districts devised on the basis of eight indicators, discussed in the preceding pages, is highly revealing. As stated earlier, the composite index has been computed using the Z-score method. The composite index value ranged from a

high of 1.47 for Dehradun district to a low of -1.0 for Haridwar district. The former district is located in the Garhwal region and the state capital headquarters is located at Dehradun city of the district. It is the most urbanized district in the state. Against this, Haridwar district is located in the Kumaon region of the state and has great religious importance for being located on the bank of the holy Ganges. On the whole, the thirteen districts in the state have been grouped into the four levels of maternal health care (Fig. 6). The three districts of Dehradun, Nainital, and Garhwal, where composite index values ranged from 1.47 to 0.58 have been classified as the districts having a high level of maternal health care in the state. All three districts are high urbanized districts of the state, have relatively plain topography and developed agricultural and industrial economy. Dehradun being the prominent urban centre and the state capital headquarters has a better quality of health infrastructure.

In the next category, termed as having the moderate level of maternal health care, are included another three districts of Almora (0.55), Pithoragarh (0.42), and Champawat (0.09). Almora district has a cantonment town at Almora, known for handicrafts and a tourist centre for scenic beauty, while Pithoragarh is one of the largest towns of the Kumaon region and has an Indian army base for its border location with China. Champawat once formed the capital town of Kumaon Kingdom. Another four districts of Rudraprayag (-0.03), Terhi Garhwal (-0.06), Uttarkashi (-0.28) and Bageshwar (-0.70), where index values ranged between 0.08 and -0.28 have been classified as low category districts in maternal health care. These were located in the Garhwal region of the state. The remaining three districts of Chamoli (-0.86), Udham Singh Nagar (-0.92), and Haridwar (-1.01) having index value below -0.29 are classified as the districts having very low maternal health care in the state. The former two districts were located in the Kumaon region and the latter one in the Garhwal region. Haridwar and Udham Singh Nagar districts located in foothills suffer badly from ecological problems like soil erosion and deforestation, hurting their economy. Nonetheless, economic development especially the per capita income of the people living in these two districts is relatively high in comparison to several other districts in the state. It will be clear from the discussion in the proceeding section, there is an incongruity between economic and social/women development in these two districts of the state.

**Association between HDI and maternal health**

In the following, an attempt will be made to examine the nature of the association between the level of human development and the level of maternal health care at the district level. Data on the human development index (HDI) have been picked up from the Human Development Report of Uttarakhand prepared and published in 2018 by the Institute for Human Development, Delhi, and the levels of maternal health care for individual districts have been prepared for 2015-16 with the help of eight indicators using Z-score technique.

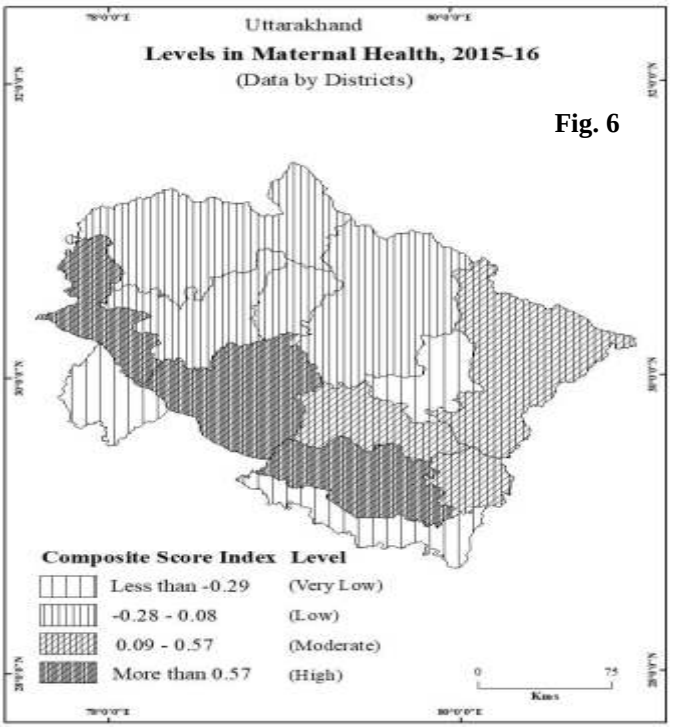



**Fig. 6**

Source: National Family Health Survey-IV (2015-16)

It is interesting to note that the level of human development finds a strong positive association with the level of maternal health care is relatively high urbanized and developed six districts of Dehradun, Nainital, Almora, Garhwal, Pithoragarh and Champawat. In their geographical distribution, these districts were located in Garhwal as well as the Kumaon regions of the state. Dehradun, in the Garhwal, and Nainital, in the Kumaon, are the most urbanized and the nodal centres of the respective regions for their locational advantage and the political patronage these received from time to time. Currently, Dehradun district has the advantage due to the location of the state capital headquarters at its town with the same name. Dehradun district was at the top rank both in human development and maternal health care status.

On the other side of the scale, the two levels have either a weak or negative association with each other in five districts of Haridwar, Udham Singh Nagar, Tehri Garhwal, Bageshwar and Chamoli. For example, Haridwar districts registered in lowest score on maternal health care but stood at second rank in the human development index. Almost the same is the case with Udham Singh Nagar district. However, the opposite is the case with Tehri Garhwal. This district ranked at the bottom among the 13 districts in the state in human development but ranked

seventh in maternal health status (Fig.7). The districts Garhwal, Pithoragarh and Champawat fall in the moderate category both in human development and maternal health status.

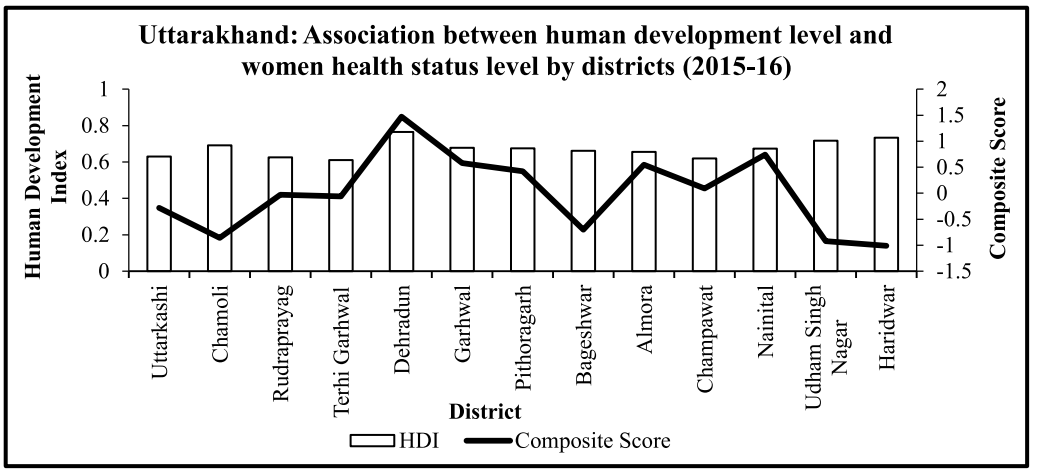



Fig. 7, Source: National Family Health Survey-IV(2015-16) and Uttarakhand Human Development Report (2018)

Now we examine the association among the indicators of human development and maternal health care individually. Per capita income, on one hand, and percentage shares of mothers receiving at least one tetanus toxoid (TT) injection, mothers consuming IFA for 100 days or more, and the institutional births in a public facility, on the other hand, find a significantly strong association (see Table 2). However, the association between per capita income and institutional births in a public facility ($R^2$=.7080) and mothers who consumed IFA for 100 days or more ($R^2$=.1544) was negative. It means that women in high per capita income districts prefer to visit privately owned medical institutions/hospitals. Mothers receiving postnatal care within two days of delivery find a positive but insignificant association with per capita income. Female literacy rate, considered a strong indicator of social transformation, finds a positive association with all the indicators of maternal health care. Its correlation with all but the mothers having at least 4 ANC visits is highly significant.

For obvious reasons, the female work participation rate finds its association significant only with institutional births. However, its correlation with all the indicators of maternal health care was positive but insignificant. Again, the physical availability of primary health centres (PHCs) finds a positive association with all the indicators of maternal health care but this association was found significant positive only with the percentage share of the mothers who had at least four ANC visits during a pregnancy period (see Table 2).

Briefly, per capita income, female education and female work participation rate play an important individually as well as collectively in maternal health care status but the degree of their impact differ widely. There is an urgent need to carry out a detailed research investigation of the nature and degree of their relations with different dimensions of maternal health care in the state.

| Table 2: The Relationships between different Indicators with $R^2$ and level of significance | | | | |
|---|---|---|---|---|
| Independent variables | Dependent variables | Co-efficient of Correlation | $R^2$ | Level of Significance |
| Mothers having at least 4 ANC visits** | Per Capita Income | 0.2895 | 0.0838 | |
| Mothers receiving at least one tetanus toxoid (TT) injection* | DO | 0.4529 | 0.2051 | 5 % |
| Mothers having consumed IFA for 100 day or more* | DO | -0.3929 | 0.1544 | 5 % |
| Institutional births in public facility* | DO | -0.8414 | 0.7080 | 1 % |
| Mothers receiving postnatal care within 2 days of delivery** | DO | 0.1677 | 0.0281 | |
| Mother having antenatal check-up in 1st trimester* | Female Literacy Rate | 0.6874 | 0.4725 | 1 % |
| Mothers having at least 4 ANC visits** | DO | 0.2418 | 0.0585 | |
| Mothers receiving at least one tetanus toxoid (TT) injection* | DO | 0.5998 | 0.3597 | 1 % |
| Mothers consuming IFA for 100 day or more* | DO | 0.4412 | 0.1946 | 5 % |
| Mother having full Ante-Natal Care visits* | DO | 0.4126 | 0.1702 | 5 % |
| Institutional births in public facility* | DO | 0.4557 | 0.2077 | 5 % |
| Mothers receiving postnatal care within 2 days of delivery* | DO | 0.4877 | 0.2378 | 5 % |
| Mother having an antenatal check-up in 1st trimester** | Female work participation rate | 0.2819 | 0.0794 | |
| Mothers having at least 4 ANC visits** | DO | 0.3059 | 0.0936 | |
| Institutional Births* | DO | 0.3462 | 0.1198 | 5 % |
| Institutional births in public facility** | DO | 0.1549 | 0.0240 | |
| Mothers who received postnatal care within 2 days of delivery** | DO | 0.1791 | 0.0320 | |
| Mothers who had at least 4 ANC visits* | Primary Health Centre (PHC) | 0.6467 | 0.4183 | 1 % |
| Mothers who received at least one tetanus toxoid (TT) injection** | DO | 0.1314 | 0.0172 | |
| Institutional births in public facility** | DO | 0.2168 | 0.0470 | |

*Source*: Compiled from NFHS-IV (2015-16), Estimates of District Domestic Product of Uttarakhand (2015-16), Annual Health Survey (2012-13), and Statistical Abstract Uttarakhand (2015-16).

*Note*: *Significant, **Not Significant

## Concluding remarks

Our analysis reveals that Uttarakhand is lagging behind the national average on most of the indicators of maternal health. Of course, female literacy rate, maternal mortality ratio, and mothers receiving at least one tetanus toxoid (TT) injection are a few exceptions.

The state government has formulated several programs to improve maternal health. The state government has initiated the *Gaura Devi Kanya Dhan Yojana* for further education of girls by providing financial assistance through the Department of Women and Child Development. The safe motherhood and child health program, reproductive and child health program and national rural health mission aimed to improve the maternal health services coverage across all regions of the state. The reproductive and child health (RCH) programmes were designed and implemented as discrete but interconnected schemes to improve health service delivery and reduce maternally, infant, and child mortality. Due to the impact of all such efforts, the maternal health indices have improved considerably during the last decade. However, there is an urgent need to accelerate the efforts and accept the challenge through micromanagement. Considering

the hilly terrain, the improvement in physical accessibility of health services is one of the biggest challenges.

The reduction in existing inter and inter-district inequalities in maternal health care services and manpower, which is considerably wide at present, is another big challenge before the politicians and the policy planners in the state. Our findings reveal that more than half of the districts in the state including Haridwar, Udham Singh Nagar, Bageshwar, Uttarkashi, Rudraprayag, Tehri Garhwal and Chamoli need special attention on this count. Yet another attention has to be paid to achieving the Global Sustainable Development Goal, 3.1 by 2030.

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# Child Health Status in Rural West Bengal: A District-Level Analysis

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**Abstract**: The study examines inter-district differentials in child health status in rural West Bengal with the help of data acquired from the National Family Health Survey-IV, conducted during 2015-16. The Choropleth mapping technique has been used to analyze the pattern of child health status at the district level. There were 19 districts in the state in 2011. One of the districts, Kolkata, has been kept out of the analysis for being entirely urban.

The findings of the study reveals that only more than one-fourth; precisely, 27.0 per cent of the newly born children receive primary health checkup from a trained health worker within the two days of birth, more than three of every ten under-five children in the districts located in the western part of the state suffer from nutritional disorders, and more than seven of every ten under-five children in the rural areas suffer from an acute respiratory infection. In the districts located in North West Bengal, seven of each ten under-five children are anaemic. Such a pathetic situation demands immediate corrective measures to check the colossal loss of future generations in the state of West Bengal. The paper suggests some remedial measures for the policy-makers and administrators in the state.

*Keywords*: Acute Respiratory Infection, Anemia, Composite Child Health Index, Diarrhea, Malnutrition, Postnatal Care

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## Introduction

Children are the future citizens and productive resources. Therefore, ensuring a healthy environment of living for them is of paramount importance for their physical, mental and spiritual growth. Geographically speaking, the problem of the poor health status among the children belonging to the lower and lower-middle-income group sections of the society especially in developing countries is much more serious in comparison to developed countries of the world. India, the second most populated country in the world with a population of 1.37 billion persons falls in the group of the lower-middle-income countries (World Bank, 2020). According to UNICEF, one-fifth of the total under-five children in India do not have any legal identity as their births are not registered (NFHS-IV, 2015-2016). Notably, the number of under-five deaths in India is the highest (8.8 lakhs) in the world (WHO, 2018). As far as mortality rate is concerned, nearly 36 children per thousand live births died in our country in the year 2018, the second-highest in South-East Asia. In neighbouring Bangladesh, this number was 28. In terms of under-five nutritional health, India is an important name in the world and deaths of children due to malnutrition holds 3.12 per cent of the total under-five deaths in India (World Health Organisation, 2018).

Healthy children can ensure a healthy adult population, the preliminary gateway to sustainable development. A WHO (2012) report entitled 'Children's Environmental Health' states that the environmental risks have a great impact on the health of the children and a clean environment can give a child a healthy future as environmental risks account for twenty-five per

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cent of the total disease burden in under-five children. In India, a report prepared by Madras School of Economics (2015) claims that the children whose primary caregivers have not completed schooling and those, who have low wealth levels, are at a high magnitude of vulnerability. Children from lower socio-economic backgrounds face higher exposure to diseases due to inadequate sanitation facilities, unprotected drinking water sources and so on. Not only female education and urbanization but also access to mass media, usage of clean cooking fuels, improved sanitation and drinking water are the most vital determinants of child well-being (Striessnig and Bora, 2020).

In some studies, the importance of Integrated Child Development Services (ICDS) has been highlighted to effectively improve the situation (Ramachandran (2007). Nonetheless, the largest food supplementation programme through ICDS being introduced in India at the district level to take care of children and mothers during and after pregnancy failed to have a serious dent in the share of undernourished children in the total child population in India. The percentage of undernourished children continues to be high in India. Low birth weight of newborns and infant morbidity is quite common even after all this.

Within India, there are wide regional, sub-regional, local, and rural-urban differential in child health care. In West Bengal, the under-five mortality rate was 26 during 2016-2018. The national average was 36 and this figure was only 10 for Kerala. Similarly, for rural West Bengal , this rate was 27 against 40 for rural India and only 11 for rural Kerala. Further, for urban West Bengal, this figure was 25 against 26 for urban India and only 9 for urban Kerala. In this way, West Bengal was quite favourably placed in comparison to the national average, but the reverse was true vis-à-vis Kerala on this count. Notably, however, the under-five mortality rate in rural West Bengal was almost the same as the all-India average. Against this, the averages for West Bengal as a whole and urban West Bengal were quite low in comparison to these two averages for the country as a whole. While urban-rural differentials in under-five mortality rates were as low as in Kerala, rural West Bengal fared very poorly on this count. This makes a cause of serious concern that a state which has done relatively well on account of the under-five mortality rate in the national context did perform quite poorly when it comes to rural areas.

**Research problem and questions**

This kind of situation gives birth to a variety of research questions needing an in-depth investigation. Some of these include: Why rural West Bengal suffers so badly in the context of the under-five mortality rate despite doing moderately well overall from the national perspective? What explains the low urban-rural gap in under-five mortality rates in West Bengal that is comparable with Kerala- the top-ranking state on this count? How and why do under-five mortality rates differ across sub-regions and districts in rural West Bengal? What is the nature of the association between the child health status and under-five mortality rates at the district level in rural West Bengal? How do under-five mortality rates and child health differ across different sections of society in rural West Bengal especially in the context of tribal population in the state?

**Data Sources and Methodology**

The present study is based on secondary sources of data including the National Family Health Survey (4th Round, 2015-16), Census of India (2011), Government reports and data available from the Department of Health and Family Welfare, West Bengal website, and reports and data available from World Health Organization website.

Quantum GIS 3.10.8 software has been used for the preparation of the maps. Quantitative technique such as bivariate correlation has been performed for data analysis (using SPSS) and to find an association between and among different parameters relating to child health status. Several indicators relating to child health data have been used to prepare a Composite Child Health Index (CCHI). The weighted index method has been used to prepare this index. The method used to calculate HDI has been used for calculating the indices values for individual districts. The index ranges between 1 and 0. 1 represents the worst condition of child health and 0 represents the best condition of it.

The following dimensions of child health have been taken to understand the overall picture of child health status in rural West Bengal at the district level.

1. Primary health check-ups received by children after birth, essential for a child to get primary health check-ups at least within three days of birth and 35 per cent of total child mortality is caused due to negligence in primary health check-ups;
2. Prevalence of waterborne diarrheal diseases because in the global scenario, as high as 11 per cent of child deaths happen due to diarrhoea (Liu, et al., 2012);
3. Prevalence of ARI (Acute Respiratory Infections), highly communicable disease and 18 per cent children die from Pneumonia (Liu, et al., 2012), which is a part of ARI;
4. Prevalence of symptoms of malnutrition (wasted, stunted and underweight children) and anaemia, as it spread through generations, is one of the main effects of Thalassemia.

For more details on the dimensions selected here, please see Liu, et al., 2012; Sengupta, 2008.

**The Study Area**

West Bengal is one of the major states of India. With a per capita income of Rs. 109,491 in 2018-19 (at current prices), West Bengal ranked eleven among the major states of India after Haryana, Maharashtra, Tamil Nadu, Gujarat, Kerala, Telangana, Punjab, Himachal Pradesh, Karnataka, and Andhra Pradesh, in order. In 2011, West Bengal h ad a total population of 91.3 million persons on 88,752 $km^2$, giving a density of 1028 persons/$km^2$. More than two-thirds (68.0 per cent) of the West Bengal population was living in rural areas on 95.2 per cent of the total area of the state. The state was administratively divided into 19 districts, Kolkata being the entire urban district. Since our study is confined to rural areas, our study shall focus on 18 districts.

**Results and Discussion**

In the following, we shall attempt to study the child mortality in rural West Bengal and the causes behind it, besides looking for district-level differentials. In rural India, less than one-

fourth or only twenty-three per cent of children receive a health checkup within two days of birth from a doctor, nurse or other trained health personnel such as lady health visitors, auxiliary nurse, midwives etc., (NFHS, 2015-16). Hence, neonatal mortality is accelerated due to negligence in the primary health checkup after birth and it is certainly preventable. In rural West Bengal, this figure is about twenty-seven per cent of total newborns get primary checkups within two days after birth. In this way, rural West Bengal is somewhat better placed in comparison to India as a whole.

Within rural West Bengal, Darjeeling and Haora are the only two districts where more than forty per cent of children receive a primary health checkup from trained health personnel within two days of birth. In other words, even in top-ranking districts less than half of the rural children receive post-natal primary health checkups. On the other side of the scale, there are as many as eight districts where this share is below the state average of 26.9. Including in such districts are North 24 Parganas, South 24 Parganas, Purba Medinipur, Maldah, Dakshin Dinajpur, Uttar Dinajpur, Koch Bihar and Murshidabad (see Fig. 1).

Inadequate supply of potable water for drinking in a rural area often leads to diarrhoea and other water-borne diseases. It is estimated that one of every ten deaths of the under-five in India occurred due to diarrheal diseases (WHO, 2017). India's record is quite poor even among the lower and lower-middle-income countries. On this count, West Bengal has relatively better conditions than the country as a whole. In rural West Bengal, about 6.0 per cent of children have reported diarrhoea against about 10.0 per cent in rural India.

Of course, there are wide inter-district differentials in West Bengal. The majority of the districts located in North Bengal have recorded diarrheal prevalence above the state average. Barddhaman, Nadia, and Darjeeling are the three districts in the state to have reported cases of diarrhoea among rural children below four per cent, which may be considered as the low (see Fig. 2). The supply of safe drinking water in rural areas is a challenging issue for the poor financial situation of rural local bodies in the state.

Child death due to respiratory infections is yet another factor behind child mortality in India. According to WHO (2017), in India, almost 0.15 million under-five deaths take place due to acute lower respiratory infections, accounting for 14.3 per cent of total under-five deaths in the world. In rural West Bengal, about 4.0 per cent of children suffer from Acute Respiratory Infection (ARI), against about 3.0 per cent in rural India. Within rural West Bengal, there are wide inter-district differentials. In rural Haora (an urban-industrial district), Jalpaiguri, Koch Bihar and Uttar Dinajpur (three districts from North Bengal) more than 6 per cent of children are diagnosed with ARI (see Fig. 3). On the whole, the districts located in the central parts of the state have a moderate share and those in the southern part have a relatively low percentage share of children suffering from this problem (see Fig.3).


Fig.1: Children receiving proper health check within two days of birth

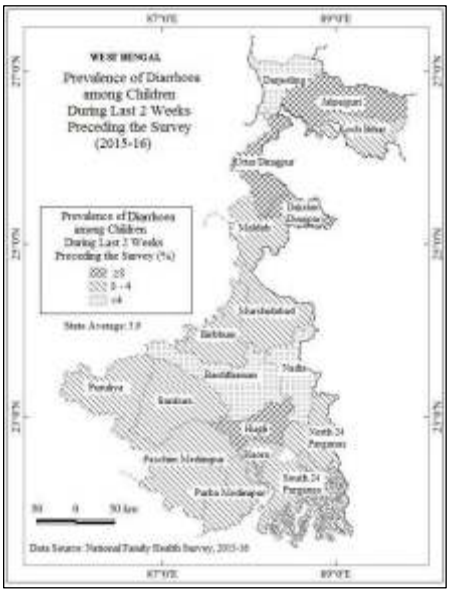


Fig. 2: Children having diarrhoea during last two weeks preceding the survey


Fig.3: Children showing symptoms of ARI in the last two weeks preceding the survey

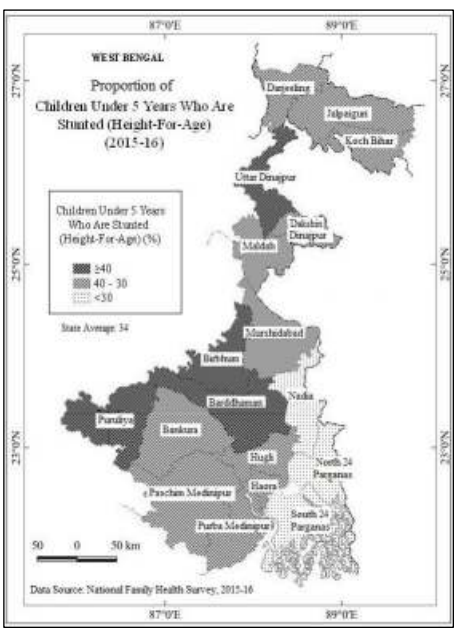


Fig.4: Stunted children under-five years (Height-for-age)

Child mortality due to malnutrition is one of the serious issues leading to an increase in under-five mortality. The UNICEF (2018) reported that India has the highest number of under-five deaths due to malnutrition. An article, published in *The Lancet* claims two out of three children in India died due to malnutrition (India: State-Level Disease Burden Initiative Malnutrition Collaborators, 2019). Malnutrition can be caused by an imbalance in the intake of nutrients. It can be caused by deficiency and excess both. In a lower-middle-income group country like India, where the hunger index value according to the global hunger index (2020) is 27.2, the deficiency of nutrients creates imbalances in the diet.

The ratios of height, weight and age are the three parameters to measure malnutrition among children. Stunted are those children, who do not have the appropriate height for age. Similarly, wasted children do not have proper weight for height and under-weight children have less weight according to height. In the present study, only the children, whose appropriate height-weight-age ratio are lower than two standard deviations (three standard deviations in case of severely wasted children) from the standard height for a particular age group, as demarcated by WHO (2006), has been considered. About 35.0 per cent of children in rural West Bengal are stunted. However, in five districts of Puruliya, Bankura, Barddhaman, Birbhum, and Uttar Dinajpur this share was more than 40.0 per cent (see Fig. 4). The majority of them belong to the western part of the state. Against this, the majority of districts in eastern rural West Bengal displayed a low level of stunting among the children. Further, nearly one-fourth of the rural children in West Bengal have wasted children. However, this share was one-third in two districts of Puruliya and Birbhum. Against this, the share of such children was low in Darjeeling, Uttar Dinajpur and Nadia districts (see Fig. 5). The state average of severely wasted rural children was less than 7.0 per cent. The proportional share of such children higher than 8.0 per cent in Paschim Medinipur, Puruliya, Bankura, Birbhum, Maldah and Jalpaiguri districts, may be termed as high share (see Fig. 6). Interestingly the same trend of the previous results can be found in the case of underweight children. As high as forty per cent of children in three districts (Puruliya, Bankura and Birbhum) from the western part of West Bengal, are underweight (see Fig. 7).

Another very important cause of child mortality in India is the genetic tendency of Indians to be anaemic, mostly indicative of the effects of thalassemia. It is a genetic disorder of having a lower number of healthy RBCs in the blood (<11.0 g/dl) to carry fresh oxygen to tissues. As per NFHS (2015-16), about three-fifths (59.5 per cent) of the children (6-59 months) in rural India are anaemic.

In West Bengal, the majority of children in the countryside are anaemic. There are, however, wide inter-district differentials in the state. According to the data available in district fact sheets of the NFHS-IV, in six districts more than three-fifths or 60.0 per cent of children (in the 6-59 months age group) are anaemic, which may be termed as high anaemic level. Jalpaiguri, Koch Bihar, Uttar Dinajpur, Dakshin Dinajpur, Puruliya, and South 24 Parganas are districts falling in this category. Most of these districts are located in North Bengal (see Fig. 8).

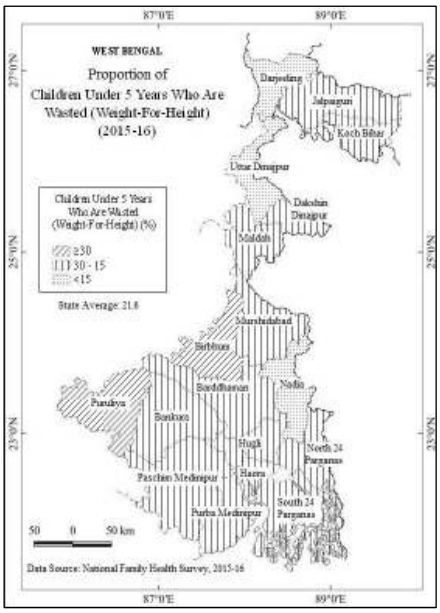


Fig.5: Wasted children under-five years (Weight-for-height)

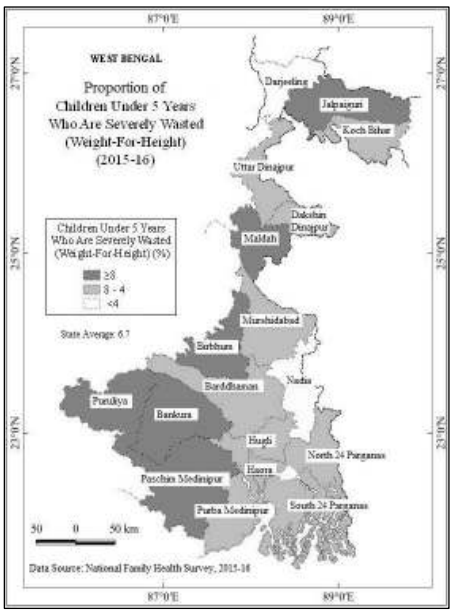


Fig.6: Severely wasted children under-five years (Weight-for-age)

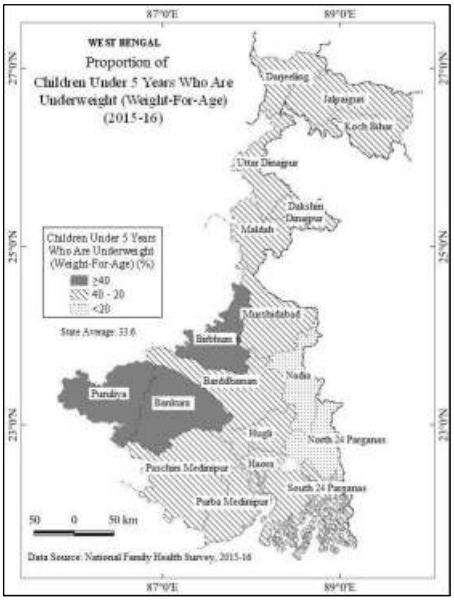


Fig.7: Underweight children under-five years (Weight-for-age)

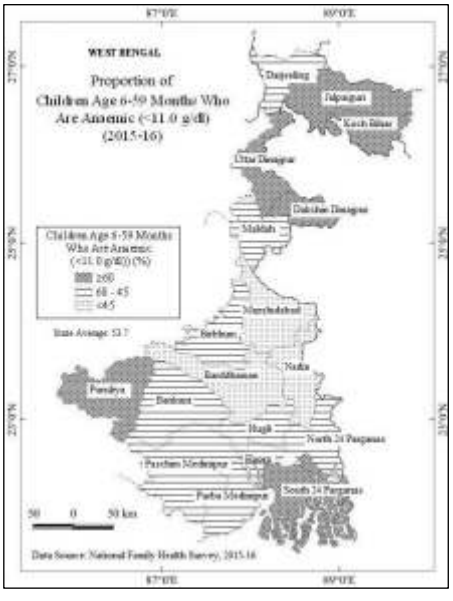


Fig.8: Anaemic children (6-59 months age) (<11.0g/dl)

The Composite Child Health Index (CCHI), prepared to understand the overall health status of the rural children at the district level in the state makes interesting reading. The index value varies widely across the districts. Based on the index value, the districts have been classified into the three categories of low, moderate and high child health status. As it can seem from figure 9, lower the index value higher the child health status in a district and vice versa. Nadia and Darjeeling are the only two of 18 districts in the state, where the health status of children in rural areas can be termed as high. Against this, in six districts of Puruliya, Maldah, Dakshin Dinajpur, Uttar Dinajpur and Jalpaiguri this may be termed as poor or low (see Fig. 9). The remaining ten districts fall in the moderate category. The dominant majority of such districts fall in the central and southern parts of the state.

Briefly, rural West Bengal has performed not only low on various indicators of child health care and its overall status but also there are very wide inter-district differentials on this count.

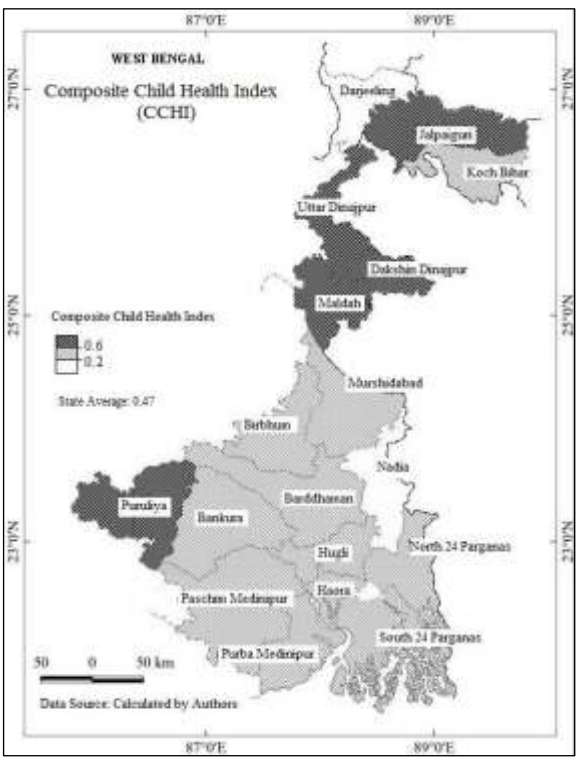


Fig. 9: Association between child health and socio-economic characteristics of the population

The health status of children is impacted not only by the availability of physical and human infrastructure related to public and medical health services but also several other factors associated with the socio-economic conditions of the places and people living there. In the following, an attempt has been made to throw some light on some socio-economic attributes of the rural population in West Bengal. The main source of data on socio-economic characteristics

of the rural populations has been the Census of India (2011).

Nearly one-third of total rural workers (31.5 per cent) in West Bengal has been categorized as marginal workers. In other words, more than three of every ten workers in rural West Bengal are either unemployed or working below their full working potentiality. This happens mainly due to the non-availability of full-time employment. This is bound to harm the incomes/earnings of rural households in the state. This is supported by the fact that 38.2 per cent of the rural population in West Bengal was living below the poverty line (BPL) (Reserve Bank of India, 2015). This prevents many rural households to spend money on mother and child health care. A strong positive correlation coefficient between CCHI and the percentage of marginal workers (r=0.338) supports this (See Table 1). In other words, the higher the percentage share of marginal workers in total workers in an area lower will be the child health status. Similarly, literacy rate especially female literacy finds a negative association with CCHI (General Literacy rate (r= -0.407) and female literacy rate (r=-0.441).

**Table 1: West Bengal: Correlations between Composite Child Health Index (CCHI) and Socio-economic characteristics of the rural population (by authors using SPSS)**

| | | CCHI | ST_P | LR | FLR | MW | CF | DRT | OPEN_L |
|---|---|---|---|---|---|---|---|---|---|
| CCHI | Pearson Correlation | 1 | 0.032 | -0.407 | -0.441 | 0.338 | -.614** | -0.185 | 0.46 |
| | Sig. (2-tailed) | | 0.9 | 0.094 | 0.067 | 0.17 | 0.007 | 0.463 | 0.055 |
| ST_P | Pearson Correlation | 0.032 | 1 | -0.222 | -0.364 | 0.298 | 0.333 | -0.014 | 0.428 |
| | Sig. (2-tailed) | 0.9 | | 0.376 | 0.138 | 0.23 | 0.177 | 0.955 | 0.077 |
| LR | Pearson Correlation | -0.407 | -0.222 | 1 | .957** | -0.003 | 0.349 | 0.429 | -.794** |
| | Sig. (2-tailed) | 0.094 | 0.376 | | 0 | 0.991 | 0.156 | 0.076 | 0 |
| FLR | Pearson Correlation | -0.441 | -0.364 | .957** | 1 | -0.222 | 0.332 | 0.407 | -.874** |
| | Sig. (2-tailed) | 0.067 | 0.138 | 0 | | 0.377 | 0.178 | 0.094 | 0 |
| MW | Pearson Correlation | 0.338 | 0.298 | -0.003 | -0.222 | 1 | -0.276 | -0.232 | .645** |
| | Sig. (2-tailed) | 0.17 | 0.23 | 0.991 | 0.377 | | 0.268 | 0.354 | 0.004 |
| CF | Pearson Correlation | -.614** | 0.333 | 0.349 | 0.332 | -0.276 | 1 | 0.343 | 0.401 |
| | Sig. (2-tailed) | 0.007 | 0.177 | 0.156 | 0.178 | 0.268 | | 0.163 | 0.099 |
| DRT | Pearson Correlation | -0.185 | -0.014 | 0.429 | 0.407 | 0.01 | 0.343 | 1 | -0.384 |
| | Sig. (2-tailed) | 0.463 | 0.955 | 0.076 | 0.094 | 0.969 | 0.163 | | 0.115 |
| OPEN_L | Pearson Correlation | 0.46 | 0.428 | -.794** | -.874** | 0.401 | -0.329 | -0.384 | 1 |
| | Sig. (2-tailed) | 0.055 | 0.077 | 0 | 0 | 0.099 | 0.182 | 0.115 | |

**Correlation is significant at the 0.01 level (2-tailed). N=18

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

CCHI- Composite Child Health Index, ST_P- Percentage of ST Population, LR- Literacy Rate, FLR- Female Literacy Rate, FWPR- Female Work Participation Rate, MW- Percentage of Marginal Workers, CF- Percentage of Households Use Clean Fuel, DRT- Percentage of households who can have drinking water from treated sources, OPEN_L- Percentage of Households who dispose of the waste material in the open areas such as open fields, bush, river, stream, railway tracks, etc. as they have no latrine within premises.

***Source***: Census of India, 2011, National Family Health Survey 2015-16, Index is calculated by authors.

The education and reasoning power of the mother is vital to take care of her children properly. Only 57.2 per cent of rural women are literate in West Bengal (Census of India, 2011). The female literacy rate in rural areas of the state is not only low but also quite lower than the male literacy rate. The rural male literacy rate is 11.0 per cent higher than that of the female counterpart. Another interesting fact about rural women in West Bengal is that 47.3 per cent of women (20-24 years) get married before their 18th birthday and 26.6 per cent of women in the age group of 15-19 years conceived or became a mother (NFHS, 2015-16). In most cases, mothers are not healthy and suffer from malnutrition, leading to the birth of an underweight child. Gender discrimination is also a cause of malnutrition.

According to information available from the Census of India (2011), only less than 8.0 per cent of rural households in West Bengal get treated water for drinking. It means the overwhelming majority of rural households collect drinking water from untreated sources. As a result, there is a high prevalence of water-borne diseases like diarrhoea, the prime cause of water-borne diseases among children. This is supported by the negative correlation between the CCHI and the percentage of households taking drinking water from treated sources (r=-0.1855). Further, a proper sanitation system is a key to the prevention of communicable and water-borne diseases. But more than half of the total rural households in West Bengal defecate in open (Census of India, 2011). In this way, they get exposed to different communicable diseases. A positive correlation relationship between CCHI and open latrine use (r=0.46) confirms this.

Against this, a negative relationship has been found between the percentage of households using clean fuel and CCHI (r=-0.614), significant at a 99.0 per cent confidence level. It indicates that a clean environment is conducive to better health conditions among children.

Finally, we examine the association between the higher prevalence of tribal population in the total rural population and child health status. Our analysis suggests a positive relation between CCHI and the percentage of the ST population (r=0.032). The negative relationship between the percentage of ST population and literacy rate (r=-0.222), female literacy rate (r=-0.364) and use of treated sources for drinking water (r=-0.014) also added another dimension to the existing positive relationship between CCHI and percentage of ST population. Again, there is a positive relationship between the share of the ST population and the share of marginal workers (r = 0.298) and also the percentage of households using open latrines (r=0.428). All this supports, child health status is quite poor in districts having a higher percentage share of tribal population in their total rural population. They are the marginalized section of society.

**Conclusion**

The findings of the study reveal that child health care in rural West Bengal is not only quite low in the national context but also differ very widely at the district level. The majority of the districts falling in the western part of the state heavily suffer in terms of malnutrition among children below five years of age. On the whole, five districts in the state, namely Puruliya, Jalpaiguri, Uttar Dinajpur, Dakshin Dinajpur and Maldah recorded quite a poor child health status. Against this, Nadia and Darjeeling districts registered top-ranking status on the child health index

The low level of public and medical health care facilities coupled with poverty level, presence of marginal workers in the total working population, female education and literacy level, quality of drinking water, sanitation conditions, use of fuel for cooking purposes, open defecation, and presence of tribal population in total rural population have played a significant role in inter-district differentials in child health state. In future, the ICDS programme must address all such issues for better and effective results.

The budget allocation and governmental initiatives alone can't solve this problem. To bring up a child with proper physical and mental requirements, the role of society is extremely vital. Society needed to be even more liberal to bring up a child properly without discrimination between male and female children.

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# Rural Population in East Medinipur District, West Bengal: A Study of Select Population Characteristics

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**Abstract:** The paper examines physical (distribution and density), demographic (growth) and social (sex ratio and literacy) characteristics rural population of East (Purba) Medinipur district, one of the least developed districts of India located in West Bengal. The study conducted at the community development block level picked up data from the Census of India for the year 2011. Among the twenty-five blocks in the district, the population distribution and density varied widely due to sharp differentials in topographic and economic factors. Densely populated areas have plain topography, well-drained irrigated soils, and an excellent agricultural base than flood-prone riverine parts. The population grew slowly in the first part of the twentieth century but registered an explosive growth in the post-Independence period, especially during 1950 and 1980. It has been growing at a slow pace in recent decades due to the decline in birth rate and rural outmigration to urban areas within the state and outside the state. There are, however, wide differentials in rural population growth at the development block level.

The male population outnumbers the female population in the rural population of the district. In 23 of 25 development blocks, the sex ratio was less than 950 females/1000 males. However, the sex ratio of the child population has been improving during the last two census decades. The literacy rate was low, and male-female literacy rates differed widely. In almost all the development blocks, female literacy rates were lower than males.

Further, literacy rates differed widely among development blocks and across social groups. Female literacy rates were the lowest among the tribals, followed by the scheduled caste population. However, it has been noticed that male-female, inter-social groups and inter-development block literacy differentials are narrowing down with time. Rural literacy rates are negatively correlated with the rural population density that means when the rate of rural literacy increases, population density decreases. In contrast, the literacy rate is positively associated with the general sex ratio and child sex ratio, which means that when literacy increases, the sex ratio also increases.

**Keywords:** Demography, rural population, literacy, sex ratio, gender disparity

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## Introduction

A geographic investigation of demographic characteristics of a region's population or its sub-regions provides us with an opportunity to understand the pace of social development and inter and intra-regional disparities and understand the size, composition, and distribution of the population.

In a country like India, where an overwhelming majority of the population is still residing in the countryside to an understanding of the rural population in terms of size, fertility, mortality, mobility, age-sex and occupational composition, and literacy and education level are of prime importance to plan for facilities, amenities and job requirements.

There are not only wide inter-state but also intra-state differentials in demographic characteristics of the rural population in India, affecting the quality of life and the status of rural development.

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For example, the sex ratio is one of the best indicators to understand the status of women in society. In some parts of the country, the declining rural sex ratio is painful and is a matter of grave concern in recent times (Sangwan and Sangwan, 2009). The child sex ratio is highly imbalanced in many areas of our country. Child sex ratio, in turn, is influenced by female literacy rate, level of urbanization, the sex ratio at birth, female age at marriage (Zutshi and Mondal, 2017). Literacy is the critical factor for socio-economic progress in society. Gender discrimination in literacy is widespread in our community (Kaushik et al., 2011). The literacy rate reflects any region's social, political, and economic status. Male-female and urban-rural differentials in literacy rates are prevalent in different states and their sub-regions (see Mundhe et al., 2017). West Bengal is one of the states where the demographic characteristics of the rural population differ widely across districts. In addition, there are wide differentials among different sections of society. Demographic characteristics of tribal and scheduled caste populations vary widely from other social groups in rural communities.

Taking a cue from the above statement, the present paper attempts to study the demographic characteristics of the rural population of East (Purbi) Medinipur district of West Bengal in the light of the following objectives.

**Research objectives**

The main objective of the present study is to map and analyze the select demographic characteristics such as population growth, distribution and density, age-sex composition, occupational structure and literacy level of the rural population in East Medinipur district from spatial and social perspectives.

**Research questions**

1. What have been the growth trends in the rural population of Purba Medinipur district in comparison to that of rural West Bengal during 1901-2011?
2. How do the population distribution and density vary at the Community Development (CD) Blocks level in 2011, and what factors are responsible for the population distribution and density pattern?
3. What is the literacy level of the rural population in the districts, and how does it compare with the total rural population of West Bengal and how it differs across 25 CD blocks in the district? and
4. Do the literacy rates differ between male-female and scheduled and non-scheduled caste populations in the districts, and what explains such differentials?

**Data sources and methodology:**

The study is based on secondary sources of data. Data on demographic attributes of the population has been picked up from **Primary Census Abstract: West Bengal** and **District Census Handbook, Purba Medinipur District**, available from the website of the Census of India, Registrar General and Census Commissioner of India, New Delhi for 2011 Census decade. We calculated population growth, density/$km^2$, sex ratio (female/1000 male), child sex-ratio, and literacy rate (per cent) for rural population.

For measuring disparities in population distribution, the Gini coefficient has been calculated. Further, Sopher's disparity index (1980), modified by Kundu and Rao (1986), has been pressed into service for measuring urban-rural, male-female, and scheduled-nonscheduled castes disparities in literacy rates. Karl Pearson's coefficient of correlation method has been used to understand the association between literacy rates and other demographic characteristics. The Choropleth mapping technique has been used to map the population's demographic characteristics at the block level. In 2011, there were 25 development blocks in the East Medinipur district.

**The Study Area**

East (or Purba) Medinipur district, located in the south of the state, was one of the 19 districts in West Bengal in 2011. The entire district area comes under the riverine and coastal plain region. The area is known for the fertile riverine and coastal alluvial soil suitable for cultivation. The district's climate is hot and humid during the summers, dry during winters, and receives monsoonal rainfall during the rainy season. Tropical deciduous and coastal vegetation are the typical vegetative covers in the entire geographical area.

Further, agriculture and allied activities are the primary sources of the economy. In cropping patterns, paddy cultivation is widely grown. A small percentage of the rural population is also engaged in aquaculture, floriculture, betel leaf and betel nut production.

East Medinipur is one of the most highly rural districts in West Bengal. In 2011, 4.5 million of the total 5.1 million population making 88.4 per cent of the total population, was rural by residence. The percentage of rural people in the total population in the district is 88.37. In 2011, the percentage of Scheduled Caste (SC) population in the district was not only much low (15.0 per cent) in comparison to the state average (23.5 per cent) but also below the national average (16.6 per cent). Similarly, Scheduled Tribe (ST) population in the district was also relatively low. The share of the ST population in the district made only 0.53 per cent, against the state average of 5.8 per cent and the national average of 8.6 per cent. Among 19 districts in the state, East Medinipur district ranked 14$^{th}$ in SC population and 16$^{th}$ in ST population.

East Medinipur is among the least urbanized districts of West Bengal. The percentage share of the urban population (11.7 per cent) was almost thrice lower than the state average of 32.0 per cent in 2011. There are five municipal towns and 20 Census towns in the district.

Road transport is the primary mode of transportation in the district. Besides the national Highway 41 and 116 B, South-eastern and Howrah-Mumbai railway lines pass through the northern part of the district. The rural transport system is not adequately developed in the western part of the district. Availability of all-weather roads in rural areas is lacking. In 2006, the Government of India had declared East Medinipur as one of the 250 most backward districts of India, covered under the Backward Regions Grant Fund Programme of the Central Government.

**Discussions and results**

In the following, an attempt has been made to discuss different demographic and socioeconomic aspects of the rural population of Purba Medinipur (West Bengal) in order.

**(i) Population growth**

Population growth, which is an outcome of fertility, mortality and migration, speaks of the changes in the population of a place or region. As for the country, the rural population of East Medinipur district grew at a plodding pace till Independence in 1951. After that, the population snowballed, especially during 1951-1981, a period of explosive population growth. There has been a sharp decline in mortality rate, but the fertility rate is hanging high due to socio-cultural factors. During the last census decade (2001-11), there has been a declining trend in the rural population growth of the district. Fertility decline and rural-urban migration are considered responsible for the latest phenomenon.

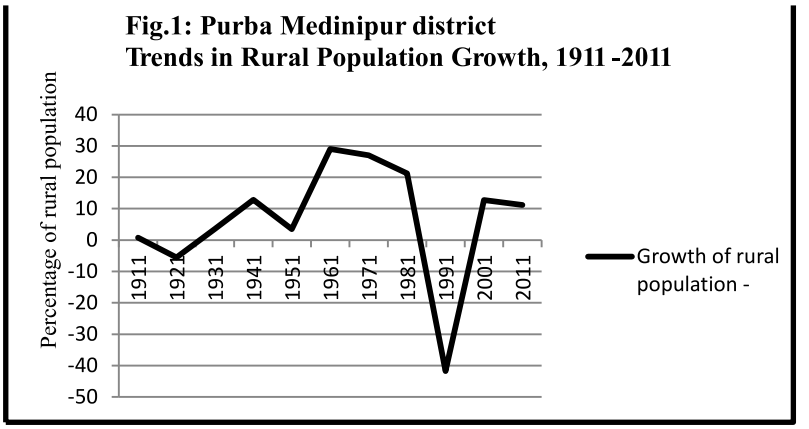



Table 1: East Medinipur District: Decadal change in population, 1901-2011

| Census decade | East Medinipur (Total) | East Medinipur (Rural) | West Bengal (Rural) |
|---|---|---|---|
| 1901-11 | 1.15 | 0.74 | 5.22 |
| 1911-21 | - 5.48 | - 5.50 | -4.43 |
| 1921-31 | 4.97 | 3.53 | 6.99 |
| 1931-41 | 10.42 | 12.86 | 15.54 |
| 1941-51 | 5.28 | 3.45 | 8.28 |
| 1951-61 | 29.26 | 29.02 | 31.81 |
| 1961-71 | 24.11 | 26.99 | 26.37 |
| 1971-81 | 22.39 | 21.24 | 20.36 |
| 1981-91 | -34.07 | -41.78 | 23.02 |
| 1991-01 | 14.87 | 12.78 | 16.98 |
| 2001-11 | 15.36 | 11.16 | 7.65 |

Source: Census of India (2011). *District Census Handbook, Purba Medinipur, 2011*

Like the country, the rural population in the district registered a sharp decline during 1911-21. This phenomenon occurred mainly due to widespread pandemic diseases like cholera, smallpox, diarrhoea, and famine. Population growth peaked in the next decade (1921-31) to reach

double digits during 1931-41 (Table 1 and Fig. 1). However, the rural population in the East Medinipur district grew slowly in the next decade. It was mainly due to widespread famine in the then Bengal province of British India. The farmers were forced to divert land from food crops to indigo cultivation to boost the cotton textile industry. During the famine, people died due to starvation, especially in rural areas of Bengal.

In the decade following Independence, there has been a sharp increase in the rural population of East Medinipur districts. The rural population increased by 29.0 per cent during 1951-61 compared to 3.4 per cent during the earlier decade (1941-51). Such a phenomenon occurred mainly because of a natural increase in the rural population. There has been a sharp decline in mortality rate and fertility rate remaining high. There has been a slight decline in rural population increase in the district, yet it was a pretty high increase. The same trend continued in the next decade. However, the 1981-91 decade registered a sharp negative change in the rural population of the district. There has been a negative change of about 42.0 per cent during this period. This happened for two reasons: (i) decline in the birth rate due to increased awareness, literacy rate and government efforts to make family planning campaign successful, and (ii) incorporation of several villages into municipal limits. During the latest census decade (2001-11), there was a further decline in rural population growth compared to the earlier decade. Rural population growth has been 11.2 per cent during this decade. Increasing awareness about the family size and rural-urban migration in search of better health, education and employment opportunities are mainly responsible for this.

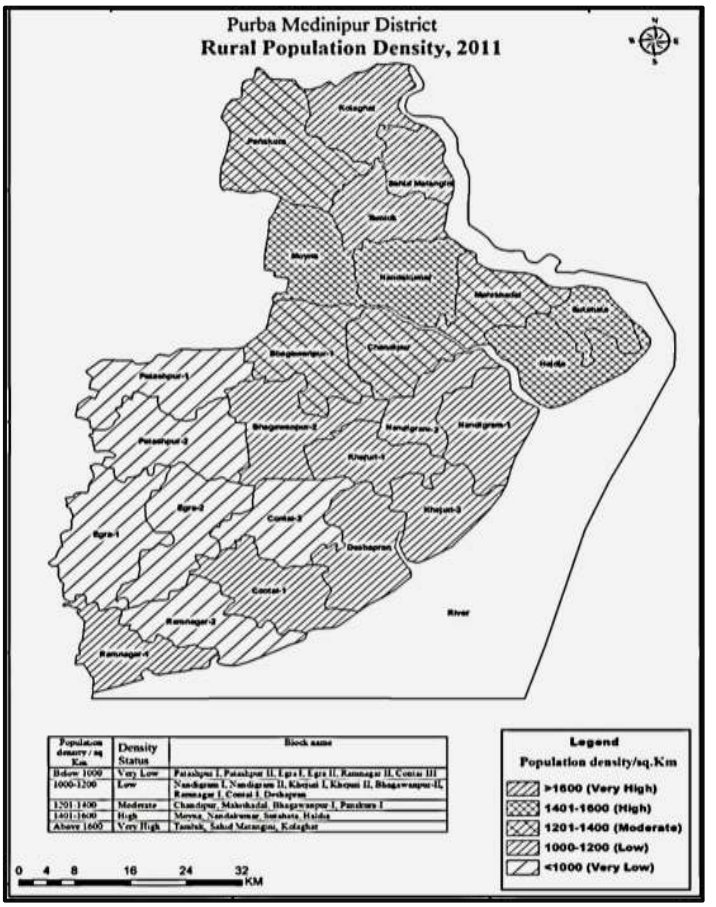
**(ii) Population distribution and density**

As stated before, 5.1 million persons, making 5.6 per cent of West Bengal's total population, resided in Purba Medinipur district in 2011. Of this population, 4.5 million or 88.4 per cent of the population, making 7.2 per cent of the total rural population of West Bengal, was living in rural areas of the district. In other words, Purba Medinipur district had less than 6.0 per cent of West Bengal's total population against 7.2 per cent of the total rural population of the state. Evidently, the East (Purba) Medinipur district was among the most rural districts of the state.

The rural population of the district was distributed in 2997 villages of different population sizes and socioeconomic characteristics. These villages were further organized into 25 CD Blacks for rural development. In addition, 20 Census Towns were also located in the CD Blocks.[1] The twenty 'Census Towns' were distributed in 13 CD Blocks, with 146, 275 persons. Kalaghat CD Block had the largest urban population of 50,478 persons. In the following, rural population distribution in the district has been examined at the CD Block level.

[1] The Census of India has evolved a criterion to declare a settlement as urban area, accordingly 20 rural settlements were declared as towns in 2011 Census. However, the Government of West Bengal treats the villages declared as 'Census Towns' by the Census of India as the rural settlements. The State Governments in India treat only settlements having an urban local body for their administration and development as the towns. In most of the States of India, it is a general practice with the Directorates of Census Operations to include population figures of 'Census Towns' with municipal towns, but the Direct orate of Census Operations, Wet Bengal provides it with the population of CD Blocks.

The rural population was unevenly distributed among 25 CD Blocks in the district. In absolute numbers, the population ranged from a high of 283, 303 persons in Panskura CD Block to a low of only 97,992 persons in Haldia CD Block, differing roughly three times. The seven top-ranking CD Blocks had a population size of more than two lakh persons each. These CD Blocks, in the combine, contributed more than one-third (36. 4 per cent) of the total rural population of the districts distributed in 25 CD Blocks. This category of CD Blocks includes Panskura, Nandakumar, Kolaghat, Bhagawanpur-I, Moyna, Tamluk, and Nandigram-I. On the other side of the scale, seven CD Blocks, each having less than 1.60 lakh persons, had, in the combine, only one-fifth (20.4 per cent) of the total rural population in the district. This category includes CD Block such as Contia-III, Ramnagar-II, Khejuri-II, Khejuri-I, Sutahana, Nandigram-II, and Haldia. On the whole, ten of the 25 CD Blocks had, in the combine, had nearly half the total rural population in the districts, located primarily on the upland plain of Hooghly River in the northern and eastern parts of the district.




| Population density / sq Km | Density Status | Block name |
|---|---|---|
| Below 1000 | Very Low | Patashpur I, Patashpur II, Egra I, Egra II, Ramnagar II, Contai III |
| 1000-1200 | Low | Nandigram I, Nandigram II, Khejuri I, Khejuri II, Bhagawanpur-II, Ramnagar I, Contai I, Deshapran |
| 1201-1400 | Moderate | Chandipur, Mahishadal, Bhagawanpur I, Panskura I |
| 1401-1600 | High | Moyna, Nandakumar, Sutahata, Haldia |
| Above 1600 | Very High | Tamluk, Sahid Matangini, Kolaghat |

Like population size, the rural population density also varied widely among CD Blocks. It ranged from a high of 1881 persons/km$^2$ in Sahid Matangini block to a low of 845 persons/km$^2$ in the Egra-I block. On the whole, rural population density is high to very high, five-CD Blocks,

namely Kolaghat, Sahid Matangini, Tamluk, Nandakumar, and Sutahata. The reverse is true of nine CD Blocks, namely Patashpur I and II, Egra I and II, Contai III, Deshapran, Khejuri I and II, and Ramnagar II. The remaining blocks fall in the moderate category of rural population density. Locational advantage, high soil fertility, location of rural industry, nearness to the rural market centre, and availability of employment opportunity are responsible for differentials in rural population density at the CD Block level.

**(iii) Distribution of scheduled population**

More than 7.0 lakh population making 15.6 per cent of the total rural population of Purba Medinipur District constituted scheduled population (castes and tribes). Within this population, 6.77 lakh persons, making 15.0 per cent total rural population and 96.6 per cent in the entire rural scheduled population of the district belonged to the scheduled castes population and remaining 24,028 persons making half a per cent in total rural population and 3.4 per cent in total scheduled population in rural Purba Medinipur district. More or less, the scheduled population means the scheduled caste population in the district.

**Table 2: Distribution of rural population by CD Blocks, 2011**

| Sl no | Community development blocks | Total population | Total SC population | SCs in total population (%) | Total ST population | STs in total population (%) |
|---|---|---|---|---|---|---|
| 1 | Tamluk | 207,064 | 21145 | 10.21 | 67 | 0.03 |
| 2 | Sahid Matangini | 183,987 | 11239 | 6.11 | 246 | 0.13 |
| 3 | Kolaghat | 239,646 | 24593 | 10.26 | 945 | 0.68 |
| 4 | Panskura | 283,303 | 29183 | 10.30 | 12531 | 4.42 |
| 5 | Moyna | 220,330 | 56820 | 25.79 | 316 | 0.14 |
| 6 | Nandakumar | 262,998 | 37366 | 14.21 | 633 | 0.24 |
| 7 | Chandipur | 176,704 | 19095 | 10.81 | 200 | 0.11 |
| 8 | Mahishadal | 199,613 | 23201 | 11.62 | 193 | 0.10 |
| 9 | Nandigram-I | 202,032 | 38619 | 19.12 | 139 | 0.07 |
| 10 | Nandigram-II | 117,945 | 15884 | 13.47 | 196 | 0.17 |
| 11 | Sutahata | 118,629 | 37826 | 31.89 | 47 | 0.04 |
| 12 | Haldia | 97,992 | 7477 | 7.63 | 288 | 0.29 |
| 13 | Potashpur-I | 166,977 | 24341 | 14.58 | 1124 | 0.67 |
| 14 | Potashpur-II | 175,056 | 21077 | 12.04 | 1388 | 0.79 |
| 15 | Bhagawanpur-I | 222,677 | 33435 | 15.02 | 411 | 0.18 |
| 16 | Egra-I | 167,163 | 15461 | 9.25 | 2617 | 1.57 |
| 17 | Egra-II | 178,763 | 36376 | 20.35 | 428 | 0.24 |
| 18 | Khejuri-I | 132,992 | 17744 | 13.34 | 169 | 0.13 |
| 19 | Khejuri-II | 139,463 | 79149 | 56.75 | 900 | 0.65 |
| 20 | Bhagawanpur-II | 192,162 | 33911 | 17.65 | 147 | 0.08 |
| 21 | Ramnagar-I | 161,986 | 22047 | 13.61 | 766 | 0.47 |
| 22 | Ramnagar-II | 156,054 | 21787 | 13.96 | 299 | 0.19 |
| 23 | Contai-I | 170,894 | 23562 | 13.79 | 92 | 0.05 |
| 24 | Deshapran | 170,938 | 17432 | 10.20 | 111 | 0.06 |
| 25 | Contai-III | 157,793 | 20832 | 13.20 | 144 | 0.09 |
| | **Total** | **4,503,161** | **677,263** | **15.04** | **24,028** | **0.53** |

Source: Census of India (2011), *District Census Handbook, Purba Medinipur*, Registrar General and Census Commissioner, New Delhi; and computed by authors

Against the district average of 15.0 per cent, the share of the SC population ranged from a high of about 57.0 per cent in Khejuri-II to only 6.1 per cent in Sahid Matangini CD Block, differing by more than 50.0 per cent. In other words, more than half of the total rural population in Khejuri-II CD Block is composed of the SC population, while only less than one among every ten persons of Sahid Matangini CD Block (Table 2). In other CD Blocks, namely Haldia and Egra-I, SC population share was less than 10.0 per cent. On the whole, in 19 of 25 CD Blocks, the SC population share was less than the district average (15.0 per cent). On the other side, in four CD Blocks, namely Moyna, Sutahata, Egra-II, and Khejuri-II, this share was more than 20.0 per cent. In all, such CD Blocks agriculture base was quite good.

As far as the distribution of the Scheduled Tribe (ST) population is considered, it was highly skewed. More than half of the total population was distributed in a single CD Block of Panskura. In 20 of 25 CD Blocks, ST population share was less than average for the district (0.53 per cent). The highly uneven distribution of the ST population among CD Blocks is supported by Gini's Coefficient value of 0.68. Against the Gini's Co-Efficient value for the distribution of SC population was only 0.22, speaking out of relatively even distribution of SC population at the Block level.

**Sex ratio**

The rural sex ratio in the entire study area is very low. The average sex ratio for the rural population of Purba Medinipur district was only 939 females/1000 males in 2011. In as many as 23 blocks of the district, the female population is less than 950 females/1000 males. Ramnagar I and Khejuri II are the only CD Blocks where the number of females per 1000 males is more than 950. Among CD Blocks, it ranged from a low of 928 females/1000 males in Kolaghat to a high of 964 females/1000 males in Ramnagar I CD Block.

Happily, in several CD blocks of the district, the child sex ratio is relatively better, i.e. more than 950 females/1000 males. It means that the adult sex ratio is relatively poor. Such a phenomenon is attributed to male selective outmigration searching for employment opportunities.

**Literacy: rates and gender differentials**

Literacy is an important variable to measure the population's socioeconomic status in society. The total literacy rate in the district is 86.81 per cent (male literacy rate being 92.24 per cent and that of females being 81.03 per cent). The gap in male and female literacy rates in the district is 11.21 per cent. As expected, in all the CD blocks of the district, the male literacy rate is much higher than the female literacy rate. The most literate block in the district is Bhagawanpur II (90.98 per cent), and the least block one is Egra I (82.83 per cent).

In the following, an attempt has been made to study the gender disparity in literacy rates at the CD block level with the help of the disparity index. Based on the disparity index value, 25 CD blocks have been grouped into three categories: high, moderate, and low disparity.

**A. Areas of high gender disparity in literacy (Index value above 0.1000)**

The disparity in male-female literacy rate is high in the 11 blocks, namely Tamluk, Sahid Matangini, Kolaghat, Panskura I, Moyna, Patashpur I and II, Egra I and II, Ramnagar I and II (Table 3). Lack of accessibility of primary and high schools for girls, early marriage, lack of social consciousness, engagement of the female child in the household work, poor attitude of elders towards female members in the society, lack of distribution of girls schools, illiteracy of mothers are responsible for the high gender disparity in those blocks of the district.

**Table 3: East Medinipur district: Total, Male, Female literacy rates and gender disparity by CD Blocks 2011**

| Sl no. | Community development block | Literacy rate (per cent) | | | Disparity index |
|---|---|---|---|---|---|
| | | Total | Male | Female | |
| 1 | Tamluk | 86.90 | 92.39 | 81.02 | 0.1006 |
| 2 | Sahid Matangini | 86.85 | 92.54 | 80.70 | 0.1047 |
| 3 | Kolaghat | 84.54 | 90.92 | 77.65 | 0.1183 |
| 4 | Panskura-1 | 83.65 | 90.54 | 76.37 | 0.1267 |
| 5 | Moyna | 86.42 | 92.09 | 80.26 | 0.1048 |
| 6 | Nandakumar | 85.56 | 90.71 | 80.07 | 0.0944 |
| 7 | Chandipur | 87.91 | 92.46 | 83.05 | 0.083 |
| 8 | Mahishadal | 86.09 | 91.17 | 80.67 | 0.0931 |
| 9 | Nandigram-I | 84.78 | 88.79 | 80.55 | 0.0732 |
| 10 | Nandigram-II | 89.13 | 93.25 | 84.80 | 0.0742 |
| 11 | Sutahata | 85.25 | 90.26 | 79.94 | 0.0917 |
| 12 | Haldia | 85.96 | 91.02 | 80.58 | 0.0926 |
| 13 | Potashpur-I | 86.34 | 92.24 | 80.03 | 0.1082 |
| 14 | Potashpur-II | 86.50 | 92.10 | 80.53 | 0.1025 |
| 15 | Bhagawanpur-I | 88.38 | 93.62 | 82.77 | 0.0955 |
| 16 | Egra-I | 82.83 | 89.78 | 75.40 | 0.129 |
| 17 | Egra-II | 86.47 | 92.99 | 79.45 | 0.12 |
| 18 | Khejuri-I | 88.90 | 93.19 | 84.36 | 0.0776 |
| 19 | Khejuri-II | 85.37 | 90.68 | 79.80 | 0.0967 |
| 20 | Bhagawanpur-II | 90.98 | 95.37 | 86.29 | 0.0795 |
| 21 | Ramnagar-I | 87.92 | 93.89 | 81.76 | 0.107 |
| 22 | Ramnagar-II | 89.38 | 95.02 | 83.37 | 0.1025 |
| 23 | Contai-I | 89.32 | 94.57 | 83.73 | 0.0953 |
| 24 | Deshapran | 88.63 | 93.53 | 83.41 | 0.0891 |
| 25 | Contai-III | 89.89 | 94.57 | 84.75 | 0.0862 |
| Total | | 86.81 | 92.24 | 81.03 | 0.0991 |

Source: Census of India (2011). District Census Handbook, Purba Medinipur, Directorate of Census Operations, West Bengal, Kolkata.
Note: Gender disparity in literacy was calculated using Kundu and Rao (1986) disparity index.

**B. Areas of moderate gender disparity in literacy (Index value between 0.1000 and 0.0900)**

Medium gender disparity in literacy is found in the Nandakumar, Mahishadal, Sutahata, Haldia, Bhagawanpur I, Khejuri II, and Contai I blocks. Among these seven blocks, namely Sutahata, Haldia come under an industrial area, and one municipality is also located in the Contai I block, yet gender disparity in literacy is quite prevalent in the rural areas of these blocks.

**C. Areas of low gender disparity in literacy (0.0900 to 0.000)**

The disparity in male-female literacy rate is low in the seven blocks, namely Chandipur, Nandigram I and II, Khejuri I, Bhagawanpur II, Deshapran, and Contai III. The overall literacy

rate is also better in those blocks. Adequate numbers of girls' schools in society and the consciousness of elders regarding girls' education in the family are favourable for low gender disparity in literacy in the area.

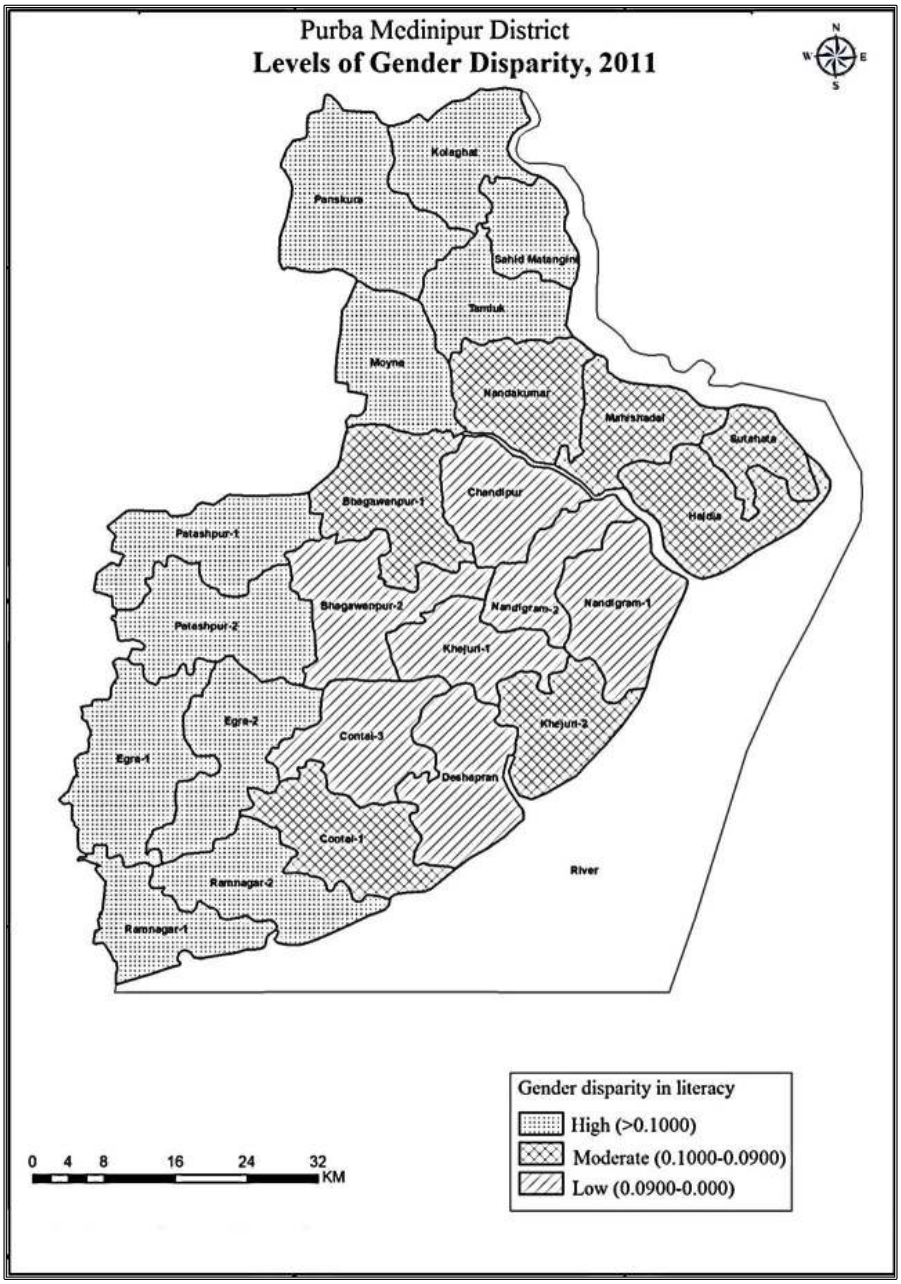



***Fig.3***, Source: Prepared from Table 3

**Disparity in literacy rates by social groups**

Gender disparity in rural literacy rates differs across social groups in the district. Scheduled tribes (ST) literacy rate is the lowest (61.9 per cent) of all the social groups. Moreover, there is a wide gap in STs' male and female literacy rates. Only 51.3 per cent of ST females are literate, against 72.3 per cent of the ST male population. The disparity index value of 0.2144 was the highest of all the three social groups in the district (see Table 4). Further, the literacy rate of the SC population is though higher than the ST population but much lower than the non-SC/ST population literacy rate in the district. Moreover, gender disparity in literacy rate of rural non-SC/ST population was the lowest of all the three social groups in rural East Medinipur district.

**Table 4: Literacy rates and gender disparity by social groups in rural Medinipur, 2011**

| Social group | Literacy rate in per cent | | | Disparity index value |
|---|---|---|---|---|
| | Male | Female | Total | |
| Scheduled castes (SC) | 89.10 | 74.84 | 82.18 | 0.1282 |
| Scheduled Tribes (ST) | 72.27 | 51.34 | 61.88 | 0.2144 |
| Non-SC/ST population | 92.91 | 81.80 | 87.78 | 0.0981 |
| Total population | 92.24 | 81.03 | 86.81 | 0.0992 |

**Association between literacy and other demographic variables:**

Simple bivariate relation has been put in service to measure the relationship of literacy rates with other demographic aspects of the rural population. The literacy rate in society is an essential component, and the development status of the society depends on the literacy rate. The rate of literacy also, directly and indirectly, controls the different demographic aspects of human beings. Rural literacy rates are negatively correlated with a rural population density that means when the rate of rural literacy increases, population density decreases. In contrast, the literacy rate is positively associated with the general sex ratio and child sex ratio, which means that when literacy increases, the sex ratio also increases. Gender disparity in literacy rates has been recorded high in more than two-fifths of CD Blocks in the district. This indicated the poor social status of female folks in such blocks.

On the contrary, gender disparity in male-female literacy rates was recorded low in little higher than one-fourths of the CD Blocks. There is a high general literacy rate, low to moderate population density, and higher adult and child sex ratio in the latter type of CD Blocks. This speaks of a better social status of the population in such CD Blocks.

**Table 5: East Medinipur district: Demographic characteristics of rural population 2011**

| Sl no. | CD Block | Rural Literacy in per cent ($X_1$) | Population density/sq. Km. ($X_2$) | Sex-ratio (female/1000 male) ($X_3$) | Child sex ratio (female/ 1000 male) ($X_4$) |
|---|---|---|---|---|---|
| 1 | Tamluk | 86.90 | 1677 | 946 | 972 |
| 2 | Sahid Matangini | 86.85 | 1881 | 928 | 941 |
| 3 | Kolaghat | 84.54 | 1620 | 937 | 972 |
| 4 | Panskura-1 | 83.65 | 1227 | 930 | 954 |
| 5 | Moyna | 86.42 | 1426 | 938 | 940 |
| 6 | Nandakumar | 85.56 | 1587 | 938 | 947 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Chandipur | 87.91 | 1284 | 923 | 939 |
| 8 | Mahishadal | 86.09 | 1363 | 935 | 932 |
| 9 | Nandigram-I | 84.78 | 1111 | 938 | 943 |
| 10 | Nandigram-II | 89.13 | 1115 | 940 | 948 |
| 11 | Sutahata | 85.25 | 1491 | 932 | 934 |
| 12 | Haldia | 85.96 | 1497 | 935 | 925 |
| 13 | Potashpur-I | 86.34 | 969 | 948 | 974 |
| 14 | Potashpur-II | 86.50 | 913 | 939 | 923 |
| 15 | Bhagawanpur-I | 88.38 | 1278 | 945 | 921 |
| 16 | Egra-I | 82.83 | 845 | 946 | 932 |
| 17 | Egra-II | 86.47 | 968 | 942 | 924 |
| 18 | Khejuri-I | 88.90 | 1019 | 956 | 976 |
| 19 | Khejuri-II | 85.37 | 1015 | 940 | 955 |
| 20 | Bhagawanpur-II | 90.98 | 1066 | 940 | 949 |
| 21 | Ramnagar-I | 87.92 | 1162 | 945 | 947 |
| 22 | Ramnagar-II | 89.38 | 956 | 933 | 926 |
| 23 | Contai-I | 89.32 | 1101 | 931 | 952 |
| 24 | Deshapran | 88.63 | 1004 | 964 | 929 |
| 25 | Contai-III | 89.89 | 983 | 942 | 981 |

Source: Census of India (2011), District Census Handbook, Purba Medinipur, Directorate of Census Operations, Kolkata.

**Table 6: Correlation matrix among variables listed in Table 5**

| Variable | $X_1$ | $X_2$ | $X_3$ | $X_4$ |
|---|---|---|---|---|
| $X_1$ | 1 | -0.23347 | 0.1798 | 0.1041 |
| $X_2$ | | 1 | -0.3995* | 0.0641 |
| $X_3$ | | | 1 | 0.1811 |
| $X_4$ | | | | 1 |

** Correlation is significant at 0.01 levels (2-Tailed), * Correlation is significant at 0.05 levels (2-Tailed)

## Conclusions

The study reveals that the distribution and density of rural population differ widely in different parts of the East Medinipur district of West Bengal. Topographic and economic differentials have played a vital role in this context. The densely populated areas had plain topography, well drained irrigated soils, and an excellent agricultural base compared to flood-prone riverine areas. The population grew slowly in the first part of the twentieth century but registered an explosive growth in the post-Independence period, especially during 1950 and 1980. It has been growing at a slow pace in recent decades due to a decline in birth rate and rural outmigration to urban areas within the state and outside the state. There are, however, wide differentials in rural population growth at the development block level.

The male population outnumbers the female population in the rural population of the district. In 23 of 25 development blocks, the sex ratio was less than 950 females/1000 males. However, the sex ratio of the child population has been improving during the last two census decades. The literacy rate was low, and male-female literacy rates differed widely. In almost all the development blocks, female literacy rates were lower than males.

Further, literacy rates differed widely among development blocks and across social groups. Female literacy rates were the lowest among the tribal, followed by the scheduled caste population. However, it has been noticed that male-female, inter-social groups and inter-development block literacy differentials are narrowing down with time.

Rural literacy rates are negatively correlated with a rural population density that means when the rate of rural literacy increases, population density decreases. In contrast, the literacy rate is positively associated with the general sex ratio and child sex ratio, which means that when literacy increases, the sex ratio also increases. Gender disparity in literacy rates has been recorded high in more than two-fifths of CD Blocks in the district. This indicated the poor social status of female folks in such blocks. On the contrary, gender disparity in male-female literacy rates was recorded low in little higher than one-fourths of the CD Blocks. There is a high general literacy rate, low to moderate population density, and higher adult and child sex ratio in the latter type of CD Blocks. This speaks of a better social status of the population in such CD Blocks.

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# Changing Perception of Son Preference in a Region Notorious for Female Feticide: A Case of Mahendragarh District, Haryana

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**Abstract:** The paper analyzes the perception of different individuals on the gender preferences of their kids by making the Mahendragarh district of Haryana a case study. For this purpose, using the interview method, a primary survey was conducted with the help of a predesigned semi-structured questionnaire to collect data from ninety married women distributed in three sampled villages of the district. In the selection of sample size, the age of the respondents and family type, social category, education, occupation and income levels of their households were taken into consideration as the independent parameters.

The mean age of marriage was 18.78± 0.087 years; more than two-fifths of the respondents were in the 30-40 years age group. The study reveals that more than one-third of the women don't have any gender preference for the kids born to them, and more than one-fourth recorded their choice for the baby girl. Only the remaining more than one-third have a preference for baby boy.

The study noted that the overall baby boy preference index is 1.2. No predictable connection could be established between socio-demographic factors and the inclination for sexual orientation. The study reveals that the preferred family size is 2.26±0.052, and more than seven of each ten respondents showed their preference for a balanced sex ratio among the kids in the family. On the one hand, the association between age group, family type, occupational, education and income levels, and the baby boy preference, on the other, was not statistically significant. The study found that cultural factors play an essential role in the thought process behind the son preference. With the process of modernization, urbanization, and the spread of female education, the craze for baby boys is gradually receding significantly in nuclear households, and newly married, well-educated women belonging to families having relatively higher income levels and mainly employed in tertiary sector jobs. Against this, women in the higher age groups with informal or low educational levels and belonging to scheduled castes households engaged in the farm sector as labourers with low income registered their preference for the baby boy.

*Keywords:* Gender preferences, family type, Occupations, Education and Income, Socio-economic and Cultural factors

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## Introduction

Women make about half of the world's total population, but their contribution to the development process is generally ignored, leaving them socially, politically, and economically backward (Malhotra et al.,1995). Any healthy and stable human society needs a balanced gender ratio (Kumar et al., 2015). Nonetheless, the preference for a son over a daughter is reported in several countries (Arnold, Choe and Roy 1998). In most parts of India, a strong preference for a male child is a significant factor behind the imbalanced child sex ratio or sex ratio (Yasmin et al., 2013; Clark, 2000; Mallika and Bhagyalaxmi 2009). In India, the child sex ratio has declined in the last five decades (Pande and Yazbeck, 2003). The son preference leads not only to unbalanced sex ratios, but it is also highly harmful to the health and welfare of women.

The issue of child sex ratio has significant social, cultural and demographic consequences (Pande et al. 2007). Several studies explain that multiple socio-economic and cultural factors control the relative benefits of the male and female child that eventually affect parents' gender

preferences (Bardhan, 1982). Many factors, including socio-economic and cultural advantages of the male child, security in old age, law of inheritance, financial liability linked with female child marriage, act as barriers against daughter preference (Dyson and Moore, 1983). High levels of gender discrimination against females are reported from northern and western Indian states. Son preference in India is frequently associated with the neglect and death of millions of female infants through infanticide, sex-selective abortions, improper nutrition, and lack of medical care (Mitra, 2014). As per the 2011 Census, the bordering states such as Haryana, Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Madhya Pradesh also exhibit adverse sex ratios (Kumar and Sathyanarayana, 2012). The most disturbing is that India has one of the lowest child (0-6 years) sex ratios globally. The average sex ratio has recently declined from 927 in 2001 to 919 females per thousand males in 2011 (Kumar et al., 2015).

Haryana, along with neighbouring Punjab, is notoriously known for female feticide. Its sex ratio of 879 in 2011 was the lowest among all the states. Within Haryana, four districts of Jhajjar (783), Mahendragarh (789), Rewari (788) and Sonipat (790) are characterized by a meagre child sex ratio. That is below 800 females per 1000 males. According to 2011 Census data, all these districts fall into the lowest sex ratio districts in India (Paul and Saha, 2015). All this shows the dark side of Haryana's demography. The son preference results in gender-based inequality within the household manifesting into discrimination against daughters in food, health care, education, property rights and occupations, all adding to the vulnerability of the girl child (Singh, 2012).

**Research objective**

In the light of the above discussions, the present paper has undertaken a study of peoples' perception of their son preference with the help of data collected through the fieldwork. The study's primary objective is to capture the ground realities about the son preference. Could the modernization, awareness, education, state government programmes, and the impact of innovations outflowing from the National Capital of Delhi in its close periphery make a dent in old socio-cultural traditions of perceiving son as a route to heaven? For conducting such a study, Mahendragarh district, located in southwestern Haryana falling under the National Capital Region, has been picked up. In 2011, the district had the second-lowest child sex ratio after Jhajjar district in Haryana. The study selected the age, nature of family, mode of occupations, and education and income levels as the independent parameters to correlate with the respondents' perception of son preference.

**Materials and method**

The main source of the study is primary data collected through a predesigned semi-structured questionnaire during November-December 2019. For determining the sample's size, it was assumed that there was no significant difference in socio-economic variables and gender preferences among the participants. It was calculated using the formulae $z^2*p*(1-p)/e^2$, where z=1.96 stands for a confidence le!el (α) of "5%, p=0.06 for a proportion (expressed as a decimal) and e=0.05 for a margin of error, respectively.

Mahendergarh district has 370 villages, which are further grouped into the five-CD blocks in the following manner: Ateli (77), Kanina (59), Mahendergarh (90), Nangal Chaudhary (77) and Narnaul (67). All the 370 villages in the district were categorized into three groups based on Child Sex Ratio: Low (<750), Moderate (750-1000) and High (>1000). After that, we picked up one village each from the three different categories as a representative. In this way, the three villages that had been selected included Aadalpur, Pali (both from Mahendergarh CD Block), and Sehlang (Kanina CD Block), representing high, moderate and low child sex ratios, respectively.

The estimated sample size was composed of 90 married women, representing equally the Scheduled Castes (SC), Other Backward Classes (OBC) and Upper Castes (UC) households. For the selection of ninety married women, the purposive sampling method was used to select these ninety women. The interview technique was adopted to conduct a door-to-door survey to collect data through a semi-structured questionnaire. The married women chosen in the sample size were in the age group of 15 to 49 years and responded voluntarily. Notably, our study is confined only to the rural areas of the district.

SPSS (version 11.5) was pressed into service for data analysis, and the results obtained were expressed in proportions. The Chi-square test was run to test the statistical significance of the results. Son Preference Index (SPI) was calculated as SPI= number of women preferring the next child to be male/number of women who desired the next child to be female (see El-Gilany and Shady, 2007).

**The Study Area**

Mahendragarh district, located in the southwestern part of the state of Haryana, lies between latitude 27°47'50" N - 28°28'N longitude 75° 54'E - 76 ° 22'11" E. Administratively, it has been divided into five subdivisions of Narnaul, Ateli, Kanina, Nangal Choudhary and Mahendergarh. According to the 2011 Census, Mahendragarh district has a population of 922,088 persons, ranking at 16th place among 22 districts in the state Haryana in 2011. The district has an area of 1899 km2, giving a population density of 485 persons/km2. Its population growth rate during 2001-2011 has been 13.43 per cent. The district has a sex ratio of 895 females for every 1000 males and a literacy rate of 77.72 per cent. The sampled villages that have been selected for primary data collection for the present study were located in the north part of the district in Mahendragarh and Kanina sub-divisions (See Fig.1).

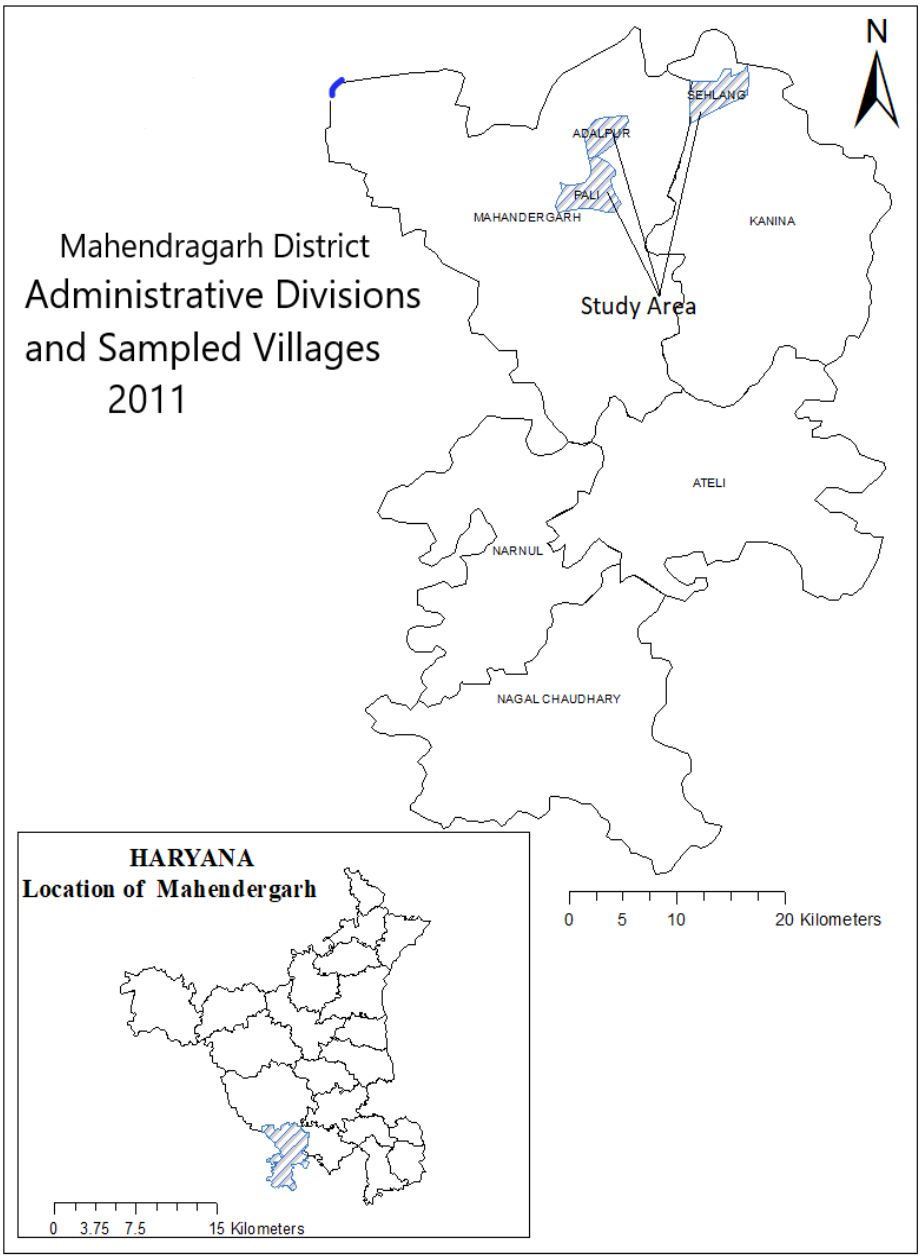


**Fig. 1**

The district had a child sex ratio of 778 in 2011. Earlier in 2001, this figure was 818, registering a decline of 43 during the decade. As per 2011 Census figures, Mahendragarh district was included among India's ten lowest child sex ratios (CSR). Its CSR of 778 places the district second after Jhajjar district from the same state (see Table 1). In 2006, the Ministry of Panchayati

Raj included Mahendragarh and Mewat districts of Haryana, among India's 250 most backward districts. Mahendragarh has a male work participation rate of about 48.0 per cent against only 24.3 per cent for women, indicating a wide gap in male-female work participation rates.

Table- 1: Ten districts with the lowest child sex ratio (Age group- 0-6 years)

| Census, 2001 | | | Census, 2011 | | |
|---|---|---|---|---|---|
| District | State | CSR (0-6) | District | State | CSR (0-6) |
| Fatehgarh Sahib | Punjab | 766 | Jhajjar | Haryana | 774 |
| Kurukshetra | Haryana | 771 | Mahendergarh | Haryana | 778 |
| Patiala | Punjab | 777 | Rewari | Haryana | 784 |
| Ambala | Haryana | 782 | Sambha | J & K | 787 |
| Mansa | Punjab | 782 | Sonipat | Haryana | 790 |
| Bathinda | Punjab | 785 | Jammu | J & K | 795 |
| Kapurthala | Punjab | 785 | Bid | Maharashtra | 801 |
| Sangrur | Punjab | 786 | Ambala | Haryana | 807 |
| Sonipat | Haryana | 788 | Rohtak | Haryana | 807 |
| Gurdaspur | Punjab | 789 | Pithoragarh | Uttarakhand | 812 |

Source: Census of India, 2001 & 2011; CSR- Child Sex Ratio

**Results and discussion**

Table 2 depicts the socio-economic characteristics and gender preferences of the respondents. Seven of each ten women respondents were in the age group of 20-40 years. The age group of 30-40 years has more than two-fifths of all respondents. One-third of the respondents had done schooling up to the tenth standard or above. Against this, less than one-fourth of the respondents had no formal education.

Further, nearly nine-tenths of the respondents belonged to nuclear households, and the identical share of the respondent women were house-makers. In addition, as discussed before, the 90 respondents were equally divided among the general, OBC and SC categories. All such characteristics of the respondents are bound to have a considerable impact on their perceptions of son preferences.

Starting with the age groups of the respondents, more than one-third (36.7 per cent, n=33) of respondents of all age groups registered their preference for the son. Against this, almost an equal number (n=32) of the respondents indicated no gender preference for the baby in the family. The remaining, more than one-fourth (27.8 per cent, n=25), preferred the baby girl. In other words, more than three-fifths (63.3 per cent) of the respondents preferred either a baby girl or no gender preference for the baby born in their family (Table 2). Interestingly, in the age group of below 20 years, where there was only one respondent, preference was for the baby girl. In the 20-30 years, the respondents were equally divided (40.0 per cent each) between the son preference and no gender preference of the child. The remaining one-fifth of entire respondents registered their choice for the baby girl. The next age group (30-40 years) with the largest number of respondents was almost equally divided among three preferences: son, daughter, and

no. By default, the dominant majority of those do not have son preference. Of the respondents falling in the fourth and final age group (40 plus), a relatively higher share than the earlier age group registered their choice for baby boy. On the whole, son preference and no gender preference go hand-in-hand for all age groups except 40 plus age-group of women respondents.

Table 2: Socio-demographic/economic profile and gender preferences among the participants

| | Variables | Gender preference | | | | | | | | (SPI) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total (n=90) | | Son(N=33) | | Daughter(N=25) | | No (N=32) | | |
| | | No. | %age | No. | %age | No. | %age | No. | %age | |
| 1.1 | Age groups | | | | | | | | | |
| | <20 | 01 | 01.1 | 0 | 0 | 01 | 100.0 | 0 | 0 | 0 |
| | 20-30 | 25 | 27.8 | 10 | 40.0 | 05 | 20.0 | 10 | 40.0 | 2.0 |
| | 30-40 | 38 | 42.2 | 13 | 34.2 | 12 | 31.6 | 13 | 34.2 | 1.1 |
| | >40 | 26 | 28.9 | 10 | 38.5 | 07 | 26.9 | 09 | 34.6 | 1.4 |
| 1.2 | Social Category | | | | | | | | | |
| | General castes | 30 | 33.3 | 11 | 36.7 | 07 | 23.3 | 12 | 40.0 | 1.6 |
| | Other Backward class | 30 | 33.3 | 07 | 23.3 | 13 | 43.3 | 10 | 33.3 | 1.0 |
| | Schedule castes | 30 | 33.3 | 15 | 50.0 | 05 | 16.7 | 10 | 33.3 | 2.1 |
| 1.3 | Family Type | | | | | | | | | |
| | Nuclear | 80 | 88.9 | 28 | 35.0 | 23 | 28.8 | 29 | 36.3 | 1.2 |
| | Joint | 10 | 11.1 | 05 | 50.0 | 02 | 20.0 | 03 | 30.0 | 0.7 |
| 1.4 | Occupational status | | | | | | | | | |
| | Govt. Service | 1 | 1.1 | 1 | 100.0 | 00 | 0.0 | 00 | 0.0 | 1.0 |
| | Private Service | 4 | 4.4 | 1 | 25.0 | 01 | 25.0 | 02 | 50.0 | 1.0 |
| | Agriculture Labourer | 2 | 2.2 | 1 | 50.0 | 00 | 0.0 | 01 | 50.0 | 1.0 |
| | Self employed | 3 | 3.3 | 0 | 0.0 | 01 | 33.3 | 02 | 66.7 | 0 |
| | Housewife | 80 | 88.9 | 30 | 37.5 | 23 | 28.8 | 27 | 33.8 | 1.3 |
| 1.5 | Educational level | | | | | | | | | |
| | No formal education | 22 | 24.4 | 10 | 45.5 | 06 | 27.3 | 06 | 27.3 | 1.4 |
| | Schooling up to 5$^{th}$ | 15 | 16.7 | 6 | 40.0 | 03 | 20.0 | 06 | 40.0 | 0.9 |
| | Schooling up to 8$^{th}$ | 24 | 26.7 | 10 | 41.7 | 05 | 20.8 | 09 | 37.5 | 1.4 |
| | Schooling up to 10$^{th}$ | 19 | 21.1 | 5 | 26.3 | 09 | 47.4 | 05 | 26.3 | 0.7 |
| | Schooling up to 12$^{th}$ | 6 | 06.7 | 1 | 16.7 | 01 | 16.7 | 04 | 66.7 | 0.1 |
| | Graduation | 1 | 01.1 | 1 | 100.0 | 00 | 0.0 | 00 | 0.0 | 0.1 |
| | Post-graduation | 3 | 03.3 | 0 | 0.0 | 01 | 33.3 | 02 | 66.7 | 0 |
| 1.6 | Income (in Rupees) | | | | | | | | | |
| | Below 10,000 | 55 | 61.1 | 22 | 40.0 | 14 | 25.5 | 19 | 34.5 | 3.1 |
| | 10001-50000 | 32 | 35.6 | 10 | 31.3 | 10 | 31.3 | 12 | 37.5 | 1.4 |
| | 50001-100000 | 2 | 2.2 | 1 | 50.0 | 01 | 50.0 | 0 | 0.0 | 0.1 |
| | Above 100000 | 1 | 1.1 | 0 | 0.0 | 0 | 0.0 | 1 | 100.0 | 0 |

Source: Based on Field Survey conducted during 2018-19; [N=90]; *SPI: Son Preference Index*

Gender preference of the baby in the family by social groups of the respondents makes an exciting story. While half of the respondent women from SC households registered their choice for a son, this share was less than one-fourth for OBC households. For women respondents belonging to the general category of families, this share was somewhat higher than one-third (see Table 2). On the other side of the scale, two-fifths of respondents from the general category stated no gender preference, and one-third from OBC and SC households stated the same. So far as the preference for a girl child is considered, the OBC category of respondents outnumbered the general and the SC category.

Interestingly, half of the respondents belonging to the joint category of households stated their preference for the son. At the same time, this share made only 35.0 per cent of the respondents coming from nuclear families. In nuclear households, where the voice of women matters in decision-making, son preference is not a kind of taboo as it happens to be in the joint households, where the elderly have the upper hand in decision-making. This becomes clearer when we classify the respondents' baby preferences vis-à-vis their occupational categories. Only less than two-fifths of homemakers registered their preference for the baby boy. Those belonging to households engaged in services (government or private) or self-employed showed little or no preference for the baby boy. Only the households where agriculture labour is the primary occupation, son preference is relatively high.

Women's education plays a significant role in limiting the size of the family and the gender preference for the baby born in the family. That is why only the nine (or 24.0 per cent) of 37 women respondents who have no formal education or have schooling up to the fifth standard registered their preference for the baby girl. Against this, eleven making 38.0 per cent of 29 women respondents, who had educational level to the $10^{th}$ standard or above, recorded such kind of inclination. Similarly, only the twelve, making less than one-third of total respondents having either no formal education or being educated up to primary level, stated that they have no gender preference for the baby born in their household. Against this, the eleven, making nearly two-fifths in total women respondents educated up to $10^{th}$ standard and above, stated that they have no preference for the gender of the baby born in their family. Statistically also, respondents' son preference and education level did not find any significant association ($X_2$=5.889, p>0.4357).

Also, we tried to understand the role of resources/income of the household in son preference. Firstly, the majority of the women respondents stated their family income below Rs.10000/-, and on the whole, more than 96.0 per cent indicated their income level below Rs. 50, 000/-. We believe that most of the respondents underestimated their income level, and we are not sure why. The responses of different respondents reveal that the families in higher-income slabs are not crazy for the son. However, there has been a craze for the son in the lower income groups, especially in below Rs.10000/- income slab groups. While two-fifths of the respondents in the below Rs.10000/- income group stated their preference for the son, this share came down to less than one-third in the case of subsequent income group respondents (Rs.10,000-Rs.50,000). About 38.0 per cent of respondents of the latter income group registered no gender preference for the babies in their families.

Briefly, the responses of women respondents included in our sample size divided in terms of their age, social categories, type of family, occupation status, educational and income levels a receding trend so far as the son preference is concerned. The respondents, especially those belonging to nuclear households and younger age groups, are a little crazy for the son liking. It seems that modernization, urbanization, and female education have played a catalytic role in turning the tide against the son preference. However, it will take more time to set a definite trend in this direction.

**Perfect number and gender composition of children**

Also, we made an effort to understand the respondents' perception about the ideal number and the gender of children in their families. The mean preferred family size of our respondents was 2.26±0.052. Happily, the perfect number is two for the most significant number of respondents (n=37). That is also our national motto. If we add another 19 respondents, who consider one as the ideal number of children in the family, their combined share come up to more than 60.0 per cent (Table 3). Against this, only one in every ten respondents considers more than three as the ideal number of children in the family. For more than one-fourth of respondents, three is the perfect number of children.

Table 3: Preference for the number of children and their gender composition among the respondents [N=90]

| S.no | Number of children | Frequency |
|---|---|---|
| 1.1 | One | 19 (21.1) |
| | Two | 37 (41.1) |
| | Three | 26 (28.9) |
| | More than three | 8 (8.9) |
| 1.2 | Gender composition | Response |
| | only boy | 2 (2.2) |
| | only girl | 1 (1.1) |
| | One girl and one boy | 63 (70) |
| | Two girls and one boy | 1 (1.1) |
| | Two boys and one girl | 15 (16.7) |
| | As per God's desire | 8 (8.9) |
| | Total | 90 (100) |

Source: Field survey conducted in Mahendergarh districts during 2018-19

Further, for more than three-fifths of the respondents, the ideal sex composition children are one boy and one girl. That is equal to the replacement rate. However, for one-sixth of the respondents, two bays and one girl is the ideal composition (Table 3), showing that the dominant majority of the respondents think in line with the national mainstream about the number and sex composition of children in the family.

**Respondents and gender equality**

The respondents were also asked to express their views on various questions linked with gender equality. Their response to multiple questions has been contradictory but confirms the changing attitude about the care and concern for the girl child. At the same time, an overwhelming majority of the respondents believed that at least one baby boy is a must in the family. Hence, they expressed the desire to conceive further to give a son to the family, but at the same time said for giving equal treatment to baby boys and girls in the family in terms of their bringing up, schooling, higher education, inheritance to parental property, and the decisions regarding their matrimonial matters.

Table 4: Respondents' views on gender equality and its consequences [N=90]

| S. No | Social issues linked with gender equality | Responses related to gender equality | | | |
|---|---|---|---|---|---|
| | | Yes | | No | |
| | | No. | % | No. | % |
| 1.1 | Is it necessary to have at least one son? | 85 | 94.4 | 5 | 5.6 |
| 1.2 | Is it necessary to have at least one girl child? | 28 | 31.1 | 62 | 68.9 |
| 1.3 | If your first and second child is the baby girl, would you conceive further to give a son to the family? | 82 | 91.1 | 8 | 8.9 |
| 1.4 | If your first child and the second child are the baby son, would you go for the third to have a girl child in the family? | 26 | 28.9 | 64 | 71.1 |
| 1.5 | Do you perform 'kua pujan' to celebrate the birth of a girl child in the family? | 17 | 18.9 | 73 | 81.1 |
| 1.6 | Do you think boys and girls are treated equally in your home? | 88 | 97.8 | 2 | 2.2 |
| 1.7 | Did your family admit girls and boys to the same school for education? | 89 | 98.9 | 1 | 1.1 |
| 1.8 | Are girls in your household allowed to pursue higher education? | 87 | 96.7 | 3 | 3.3 |
| 1.9 | Do girls' views matter in decision making about their marriages in your household? | 75 | 83.3 | 15 | 16.7 |
| 1.10 | Do you agree with the daughters' right to parental property? | 65 | 72.2 | 25 | 27.8 |
| 1.11 | If yes, do you have any property in the name of women/girls in your family? | 16 | 17.8 | 74 | 82.2 |

Source: Field survey conducted during 2018-19.

For example, more than nine of ten respondents stated that at least one son is needed in the family; against this, only three of ten respondents expressed that at least one baby girl is also a requirement (see Table 4). At the same time, more than nine of ten respondents expressed the desire to conceive again if the first two issues in the family were a baby girl. Only three among ten will conceive again for the baby girl if the first two children in the family happen to be the baby boys. In addition, only less than two of each ten respondents performed or would perform '*kua pujan*' to celebrate the birth of a girl child in their family. In north India, *Kua pujan* or 'worshipping the well', is a traditional ceremony held to celebrate the birth of a newly born, especially the baby boy in the family.

On the other side of the scale, 88 of the total 90 respondents stated that they do not differentiate between their male and female children. Eighty-nine of them said that they admit their male and female children in the same school for education and 87 stated that allow their daughters to go for higher education. In addition, four-fifths of total respondents value the opinion of their daughters in deciding about their matrimonial matters and more than two-thirds

favour giving the right to their girl children in inherited properties as the Law of Inheritance. However, less than two of ten respondents stated that women own inherited property in their name. Also, the respondents expressed that traditional social values and the centuries-old dowry system are to be blamed mainly for the low social status of the girl children and women in general in north Indian patriarchal society. Briefly, the responses from the respondents speak of voices animating out of a society that is gradually unfolding it to modern values after emerging out the solid patriarchal traditions spanning over centuries.

## Conclusion

The study's findings reveal that the craze for baby boys is gradually receding with modernization, urbanization and the spread of female education. The majority of married women respondents belonging to different age-groups, social categories, type of family, educational level, occupational status, and family income have either no general preference or preferred baby girl for their households. However, the women belonging to upper age-groups belonging to scheduled caste households engaged in the farm sector as labourers, having informal or low educational level and poor income registered their preference for the son.

Against this, the newly married women respondents belonging to nuclear households engaged in tertiary services or working as self-employed, having education level up to $10^{th}$ standard or above, and coming from high-income households recorded their preference either for baby girl or no gender preference for the kids born to them. However, the overwhelming majority of the women respondents want a least one son in their family and would prefer to conceive further to give a baby boy to the family if the sex of the first two children to them is female. However, the dominant majority of the respondents claim that they hardly differentiate between their sons and daughters when it comes to their upbringing, schooling and high education, division of inherited property and making family decisions about their life partners. In sum, the responses from the respondents speak of voices animating out of a society that is gradually unfolding it to modern values after emerging out the solid patriarchal traditions spanning over centuries.

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# Dynamics of Wular Lake (Kashmir Valley) and Their Impact on Water Quality and Human Health

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**Abstract:** Wular Lake, the largest freshwater wetland of India, located at about fifty km NW of Srinagar city at an altitude of 1570 metres, plays a significant role in hydrogeomorphology and the biological, social and economic life of the Kashmir Valley. It was declared a Ramsar Site in 1990 for its immense values and functions. However, the entire catchment area of this wetland is highly degraded, contributing to a heavy load of silt. The lake area is shrinking, and water level and quality are declining. The present study attempts to examine the nature and morphological structure of Wular Lake to understand its cumulative effect on the water chemistry of this wetland, impacting human health. For this purpose, both primary and secondary data sources were used. A sample survey was conducted to collect data on various socio-economic characteristics of the population living in the nine sampled habitations located in Wular Lake's peripheral area. Data were collected from the Office of the Wular and Manasbal Development Authority (WUMDA) to supplement this.

The study reveals that apart from the unconsolidated material of its catchment area, the Lake is surrounded by settlements living in poor conditions and discharging untreated sewage and other effluents in large quantities. Hence, there is a question mark on its long-term survival and the people's health living in its surroundings. Finally, the study made some recommendations not only to halt the deterioration process but also to save the life and livelihood of the people living in its peripheral area.

*Keywords*: Wetland, Catchment area, Morphometry, Water chemistry, Human health

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## Introduction

The chemical and physical properties of water of any lake happen to be the cumulative reflection of geological, denudational and anthropogenic activities in its catchment area. Several lakes are enriched with nutrients, sediments, and associated heavy metals all over the globe due to the sinks of agricultural runoff and municipal and industrial wastewater discharges (Koussouris and Diapoulis, 1989).

Wular-lake, which acts as a colossal absorption basin for the annual floodwaters of river Jhelum, plays a vital role in the hydrographic system of Kashmir valley. Besides being a natural habitat for wildlife, it is a critical fish reservoir, accounting for about 60.0 per cent of the total fish production in the Valley. Moreover, the Lake and its associated wetlands are an essential habitat for migratory waterbirds that flyway within the Central Asian flyway and maintain rich biodiversity.

In 1986, the Ministry of Environment and Forestry, Govt. of India declared Wular Lake as the wetland of national importance under the wetlands program based on its hydrological, biological and socio-economic significance; and subsequently announced it as a Ramsar Site (Site No. 461) on 23rd March 1990 by according to the status of a wetland of International importance.

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Notwithstanding, Wular Lake is on the verge of extinction. The lack of understanding of the values and functions and its associated wetlands led to the conversion of its large area for plantation, agriculture, settlements and other developmental activities (Wetlands International South Asia, 2007). Resultantly, its size was reduced, and water quality was severely affected with implications to human health and livelihood.

**Research objective**

In light of the above statements, the present study attempts to examine the changing nature of the catchment area and morphological dynamics of Wular Lake, focusing on their impact on water quality and the health and livelihood of the people living in its periphery. An attempt will also be made to identify the factors operating behind all this and make suggestions to halt the current process of degradation set in and improve the quality of living and livelihood of the people, especially the poor living in its proximity.

**Database and Methodology**

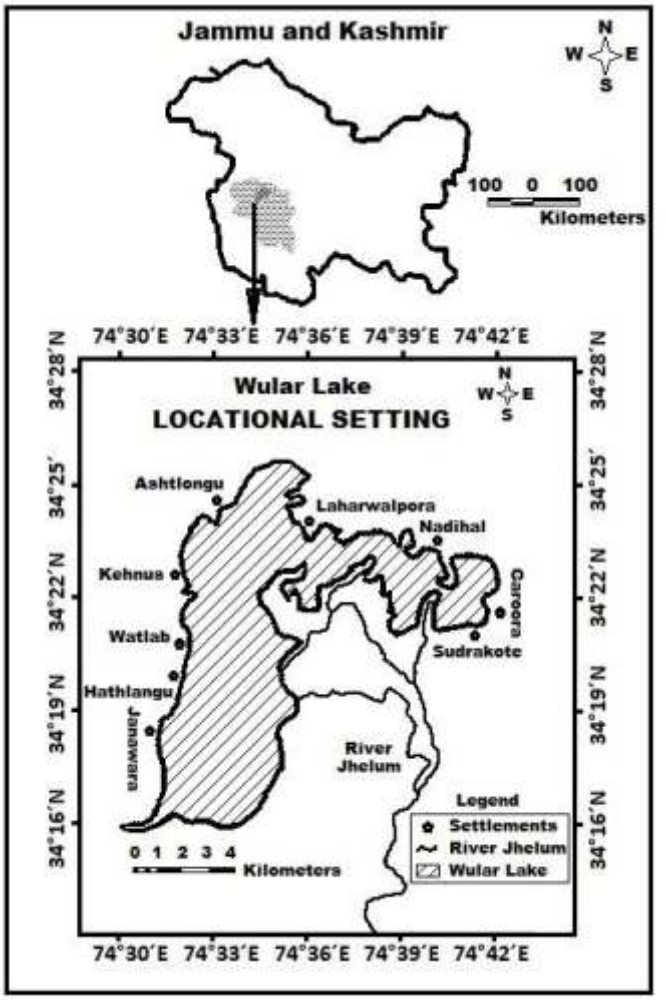
Primary and secondary data sources have been used for conducting the present study. For collecting the primary data, a sampled survey was conducted in nine villages to know the socio-economic conditions of the people living in the rural settlements around Wular Lake. Administratively, sampled villages fall in two districts of Bandipora and Baramulla in Kashmir Valley. For the secondary data on various parameters Wular Lake catchment area, water quality and human health, the present researchers visited the Office of the Wular and Manasbal Development Authority (WUMDA).

The location and dependency on the Lake were taken as the criteria for selecting sampled villages. In selecting sampled villages, the parameters used included the distance of a settlement from the Lake, the economic contribution of the Wular Lake in the livelihood of the rural households, and the intensity of pollution, causing the health hazard to peoples' lives in the villages.

**Study Area**

Wular-lake, situated at about 50 km in the northwest of Srinagar city at an altitude of 1,570 meters above mean sea level, is India's largest freshwater wetland. It falls between $34^{o}16'$-$34^{o}25$ North latitude and $74^{o}29$-$74^{o}40$ East longitude. The Lake has a balloon shape (Fig. 1) with a maximum length of 16 Km and a width of 7.6 Km. The water temperature varies between $2^{o}$ and $29.5^{o}$c, and the average depth of water is 5.8 meters which remains calm and placid almost around the year (http://www.discoverindia.com).

The origin of Wular Lake may be attributed to a Kashmiri word, 'Wul', which refers to a gap or a fissure, pointing out its origin to a fissure or crack created by some natural phenomena. However, Wular for 'Wul' possibly became common around the $12^{th}$ century. Wular Lake is drained by three major rivers, Madhumati, Erin and Jhelum. The river Jhelum enters it at Banyari (40 Km from Srinagar) to separate at Ningli. The deepest portion of the Lake is called "Mota Khon" or 'Gulf of corpses'.




*Source: Prepared by the Researcher from Topo -sheets of Kashmir Valley*

**Fig. 1**

RESULTS AND DISCUSSION

## 1. Wular Lake Catchment Area

Wular Lake forms a part of the river Jhelum basin, a sub-division of Indus-Basin. The entire Jhelum basin is spread over an area of 12,777 Kms$^2$. The six watersheds, consisting of 1,444 kms$^{2,}$ drains directly into the Wular Lake, forming an immediate catchment area of the Lake (Fig. 2). In other words, the Wular lake area makes only a tiny segment (11.3 per cent) of the entire Jhelum basin.

The Lake is surrounded by the high mountain ranges on its northeastern and northwestern sides, draining their runoff into the Wular Lake through different *Nullahs* (drains). Erin and Madhumati are prominent among such drains. The watersheds of these two drains, located on the

northern periphery of the Wular Lake area, make, in the combine, more than half of the entire catchment area of the Wular Lake, separately accounting for 20.0 per cent and 32.0 per cent, respectively. The Madhumati (*Bod Kol*), which arises from the northern slopes of the Harmukh glacier and passes through Kalusa Bridge, drains into Wular Lake near Dacchigam. The Erin, which appears from 'Shir-Sar' and 'SukhaSar' and moves through Chitrar, Titwan Kain, and Kubnai-nar drains, meets at Isrur tar to drain into the drain the Lake.

There are as many as thirty-one villages located on the periphery of the Wular Lake. All such villages fall under Baramulla and Bandipora districts. In these 31 villages, as many as 10,964 households with an estimated population of 55,000 persons were residing in 2001 (Census of India, 2001). Besides, twenty-six villages with nomadic origin populations were located in the hills around this wetland.

On its eastern and western sides, the low lying areas of Sonawari surround the Lake. They are low-lying areas; hence, they were inundated almost every year before constructing numerous crisscrossing embankments along river Jhelum. The wetland area thus reclaimed has been brought under paddy cultivation and plantation agriculture of willow, poplar and fruits, recently. On the western side, low lying areas, in the Sopore-Watlab section, have also been brought under paddy cultivation, and the eastern side of the wetland is an island, developed by Zainual Abideen (1420-1470 A.D), a famous ruler of Kashmir. The Ningli and Gundar watersheds encircle the southern tip of Wular Lake. The former drains highly erodible Karewas, and the latter Apharwat and Tangmarg - the famous alpine pastures of Kashmir valley.

Moreover, the Wular Lake is flanked by short and flashy drains on its right and left, forming extensive marshy land on both sides of river Jhelum. The marshy land plays a vital role in controlling the hydrological regimes apart from sustaining its rich biodiversity.

The catchment area of this wetland supports coniferous forests, alpine pastures and orchards, adding to the natural grandeur of the swamp. However, the entire Jhelum basin, including the direct catchment of Wular Lake, is highly degraded, contributing to a heavy load of silt into it. This has resulted in the shrinking and reduction in the Lake's water level.

**Morphology of the Lake**

For having a basic understanding of hydro-geomorphological dynamics of the watershed, morphometric analysis constitutes an essential step. Wular Lake, which has a vast catchment area, accounts for 7.6 per cent of Kashmir Valley's total area (Kanth and Hasan, 2012). Its altitudinal height ranges from 1,580 meters, near the Wular Lake, to about 4,500 meters near the Hurmukh range. In the present study, morphometric analysis of the Wular lake has been done by selecting linear and shape parameters.

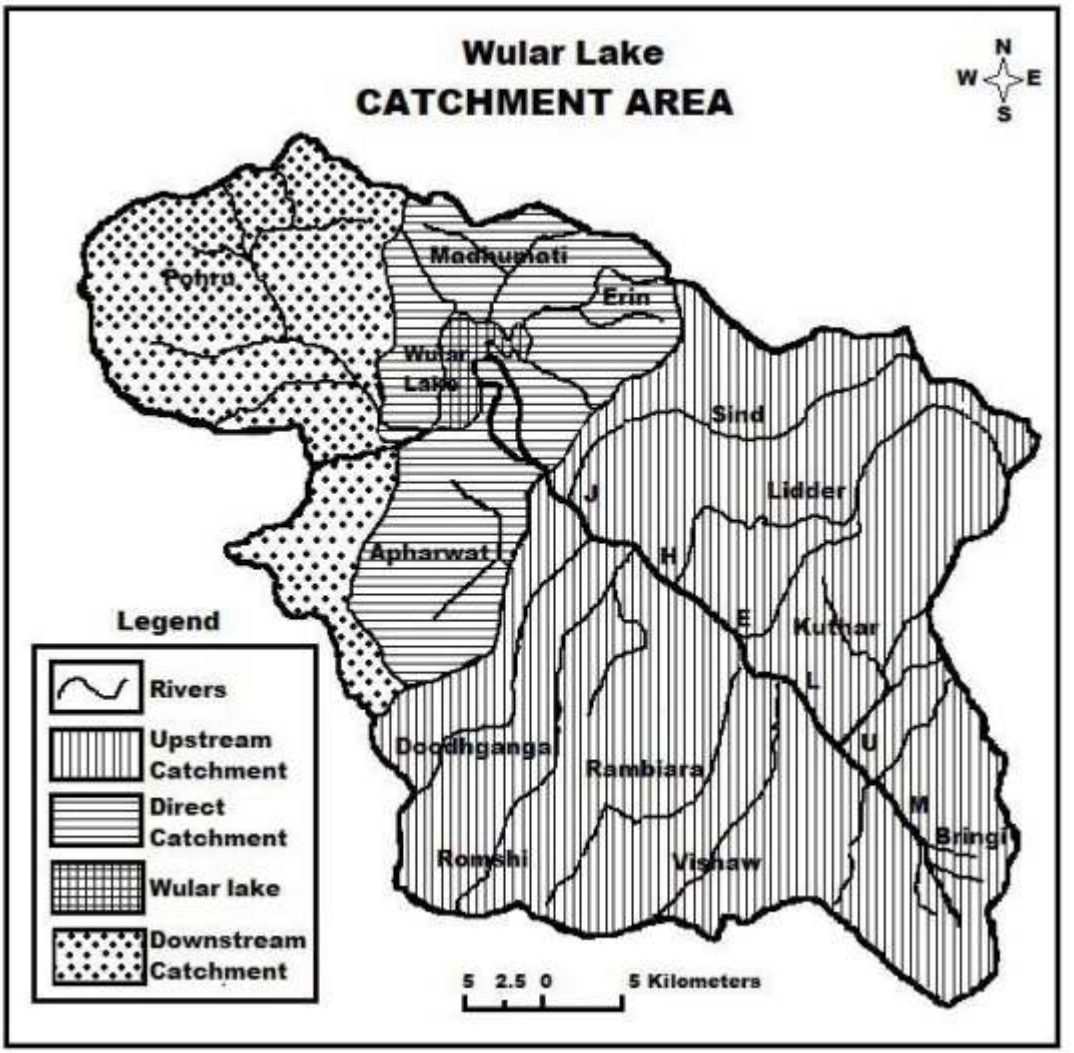


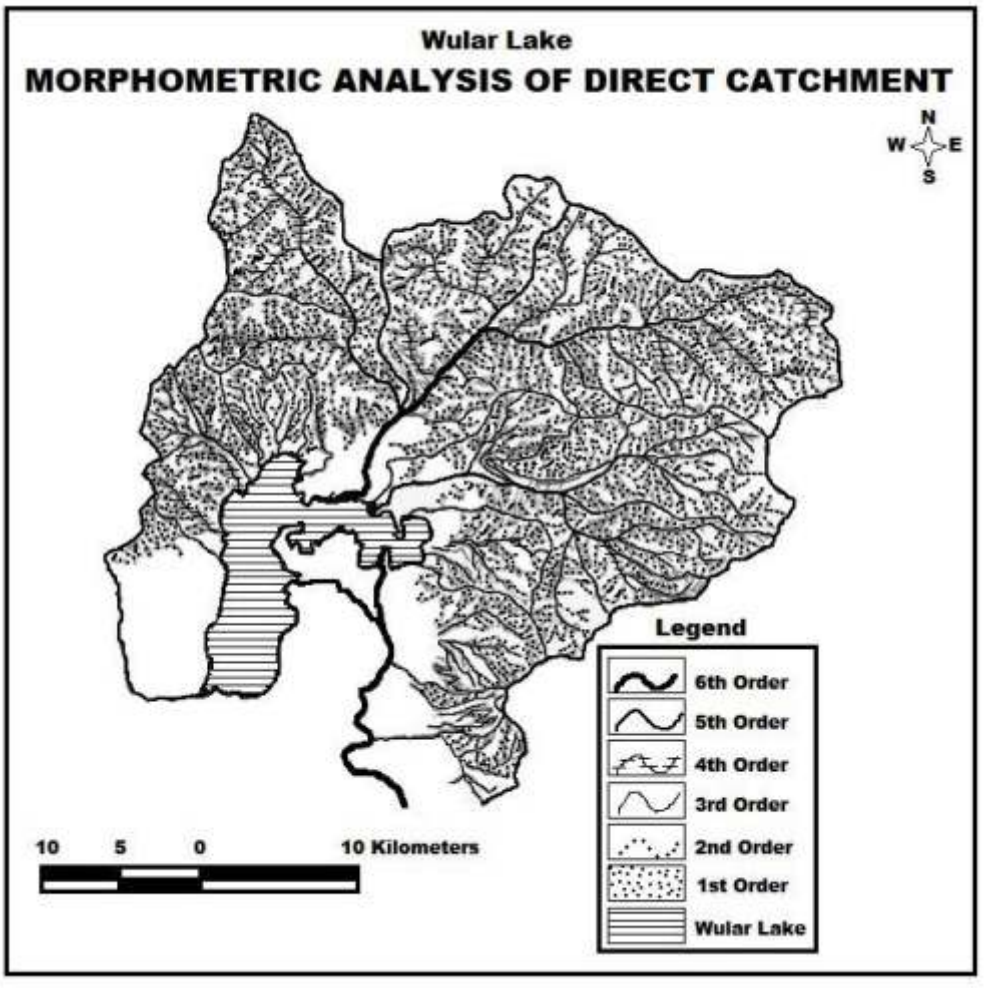

**Fig. 2**

*Source: Comprehensive Management Action Plan for Wular Lake (2007). Wetlands International, South Asia.*

(i) **Linear parameters** included stream order, number, drainage, density, stream frequency, bifurcation ratio, drainage texture and length of overland flow. All such parameters have a direct relationship with the erosional process. The higher the value, the more is the probability of erosion. The first and the foremost important parameter in the drainage basin analysis are ordering the streams hierarchically. Based on Strahler's scheme, the total number of streams in Wular catchment is calculated 2,708, distributed in the following order: 2,158 (1st order), 427 ( 2nd order), 94 (3rd order), 25 (4th order), three (5th order) and one (6th order). The entire length of Wular's drainage network is 2317.8 Km.

The mean value (2.39) of drainage density indicates that the region comprises impermeable sub-surface materials, sparse vegetation and high mountainous terrain.

The mean value of stream frequency is 2.8. The higher value of stream frequency indicates the bedrock's high relief and low infiltration capacity. The mean bifurcation ratio of the Wular catchment is 4.93. A low bifurcation ratio means less structural disturbance, and a high bifurcation ratio stands for high structural complexity and low permeability of terrain. The drainage texture ranges from highly coarse to coarse for values between 1.05 and 7.85. Similarly, the length of the overland flow of the Wular catchment is 0.84, ranging from 0.61 to 4.39. The higher value of overland flow represents low relief and vice versa.




*Source: Adapted from Kanth, T. A., & Hassan, Z. (2012). Morphometric analysis and prioritizing watershed for soil and water Resource Management in the Wular catchment using Geo-spatial tools. International Journal of Geology, Earth and Environmental Science, 2 (1), 30-41.*

**Fig. 3**

(ii) **Shape parameters** include form and shape factors, circulatory and elongation ratios and compactness coefficient. All of them show an inverse relationship with the probability of erosion (Nooka Ratnam et al., 2005). Lower the value, the higher the likelihood of erosion.

Wular catchment has the mean form factor of 0.23, varying from 0.29 to 0.40. Based on these values, we can say that it has a longer duration of elongated shape and flatter peak flow. The shape factor ranges from 2.50 to 3.45, and its mean value is 4.38. Similarly, the elongation ratio varies from 0.61-0.71, and its mean value is 0.45, indicating high relief and steep ground slope (see Table 1).

Table 1- Wular Lake: Morphometric analysis of catchment area

| S.No. | Parameter | Value | S.No. | Parameter | Value |
|---|---|---|---|---|---|
| 1 | Area (A) $Km^2$ | 961.8 | 7 | Elongation ratio (Re) | 0.54 |
| 2 | Perimeter (P) Km | 208 | 8 | Mean Bifurcation Ratio (Rb) | 4.03 |
| 3 | Length of Basin (LB) Km | 64.91 | 9 | Drainage Texture (T) | 13.02 |
| 4 | Stream frequency (Fs) $Km/Km^2$ | 2.82 | 10 | Length of overland flow (Lg) | 0.84 |
| 5 | Drainage density (Dd) | 2.39 | 11 | Compactness coefficient (Ce) | 1.89 |
| 6 | Form factor (Rf) | 0.23 | 12 | Shape factor (Bs) | 4.38 |

Source: Kanth, T.A. And Hassan, Z. (2012). Morphometric analysis and prioritization of watersheds for soil and water resource Management in Wular catchment using geo-spatial tools, *International Journal of Geology, Earth and Environmental Sciences. 2(1)*

**Association between Wular lake dynamics and water quality**

Wular Lake and other wetlands of Kashmir Valley are generally alkaline with relatively higher amounts of magnesium, calcium and other ions; hence categorized as hard water. The valley lakes are essentially shallow basined, profusely covered by aquatic vegetation. Most of the lakes are eutrophic, with high concentrations of biologically essential nutrients. (Wetlands International South Asia, 2007).

Wular Lake, located at the terminus of the drainage system, acts as a receptacle for pollutants flowing downstream from the highly urbanized area of Srinagar City. Discharge of solid, liquid and other wastes from human settlements all along Jhelum River are finally deposited in the Wular Lake. Besides, heavy doses of fertilizers and pesticides used in agricultural fields and spraying chemicals in orchards for pest control are ultimately washed into Jhelum to reach the Wular Lake finally. Municipal bodies have not framed any regulations for the disposal of solid wastes, including carcasses throughout the area wherefrom the river Jhelum passes. The sewerage system does not exist throughout the Valley, except in some parts of Srinagar City. All the streams, channels and aquatic bodies low directly or indirectly into river Jhelum, depositing the heavy load of pollutants into Wular Lake, harming the water quality with considerable implications in human, animal and aquatic life in and around the like.

Water temperature has considerably increased between 1992 and 2006. There has been a progressive increase in specific conductivity, orthophosphates and total phosphates with a decline in transparency and dissolved oxygen. The lower water temperature limit has more than doubled,

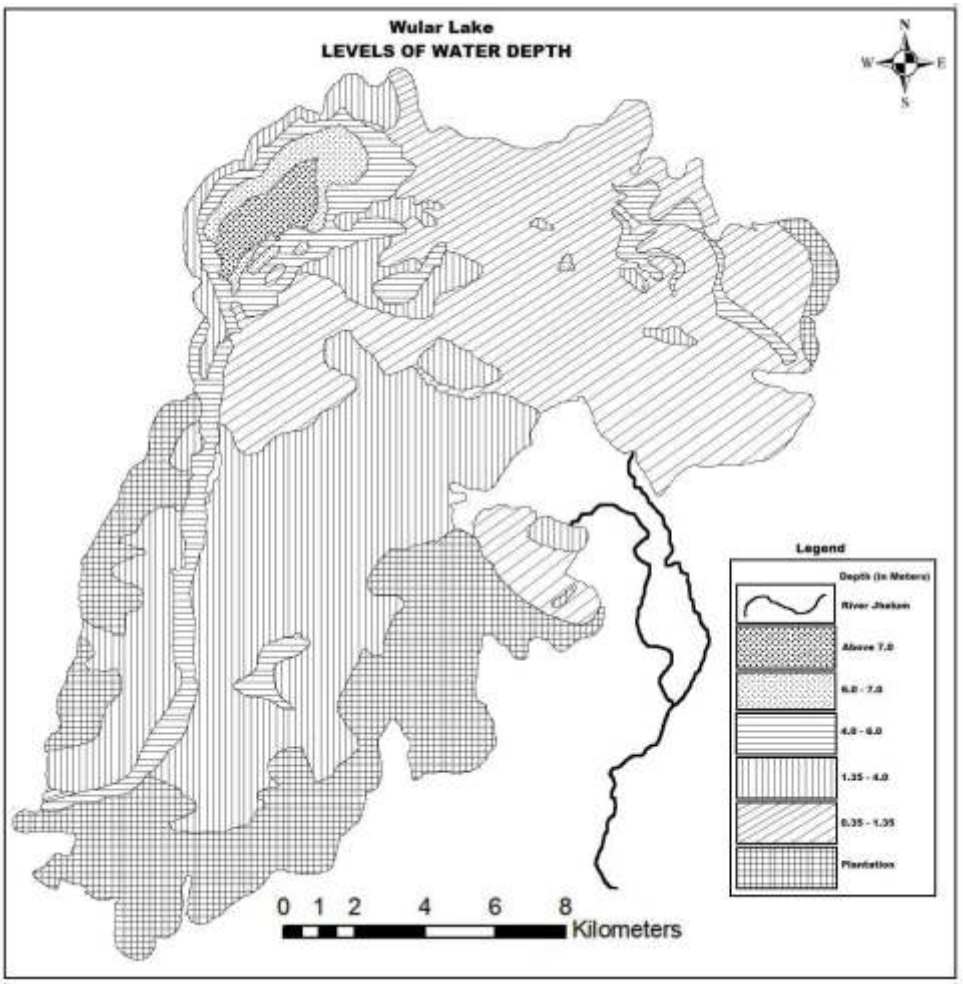
and the transparency level has gone down during this period. The lower limit of ammonia registered a phenomenal increase from just 1.0 µg/l to 64.0 µg/l. Similarly, chloride, nitrate nitrogen and orthophosphate have reported tremendous increases during the same period. Indeed, the water has been badly polluted, making it unfit for birds, animals, aquatic life and domestic uses. We used the criteria laid down by the Central Pollution Control Board (CPCB) to analyze Wular Lake water. Our water quality analysis reveals that Wular Lake falls under the 'C' category. The water is utterly unfit for drinking use. Unfortunately, however, nearly one-fourth (23.8 per cent) of the population living in the surveyed villages still depend upon the Lake for drinking water. Our survey further reveals that more than half of the people in such villages suffer from water-borne diseases such as cholera, giardiasis, amoebic dysentery and amoebiasis.

**Table 2: Wular Lake: Changes in chemical properties of water, 1992-2006**

| Parameters | Units | 1992 | 2006 |
|---|---|---|---|
| Water Temperature | $^{o}$C | 3.1-25 | 6.3-27.3 |
| Transparency | M | 0.1-1.3 | 0.16-0.73 |
| pH | --- | 7.1-9.8 | 7.2-7.7 |
| Conductivity | µs/cm | 57.0-350 | 118-429 |
| Dissolved Oxygen | mg/l | 1.3-15.2 | 4.5-8.0 |
| Chloride | mg/l | 11.0-81.0 | 11.8-28.0 |
| Calcium | mg/l | 4.6-73.8 | 20.5-62.3 |
| Magnesium | mg/l | 0.8-35.6 | 12.2-30.1 |
| Ammonia | µg/l | 1.0-205 | 64.0-101 |
| Nitrate Nitrogen | µg/l | 9.0-580 | 205-419 |
| Ortho Phosphate | µg/l | 0.0-31.0 | 79-131.7 |
| Total Phosphorus | µg/l | 0.0-103 | 180.0-292.5 |

*Source: Wular and Manasbal Development Authority*

The survey reveals that most of the population living in the villages located in the vicinity of the Lake are socio-economically poor. A sample of 3,534 persons surveyed in nine sampled settlements around Wular Lake revealed that the dependency ratio was very high. Slightly higher than one-third (36.3 per cent) of the population was working, and the rest are the dependents. The average household size was more than seven persons, and only less than two-fifths (38.0 per cent) of the population was literate. More than one-third (34.40 per cent) of the sampled households lived in *kutcha* houses. Nearly one-third (32.1 per cent) of the total sampled population dispose of their solid waste directly/indirectly into the Lake. All this speaks of a pathetic situation with severe implications for the human health and livelihood of the population living in surveyed villages. It was representative of general conditions in the study area.




*Source: Adapted from Comprehensive Management Action Plan for Wular Lake, Kashmir. (2007). Final Report prepared for the Department of Wildlife Protection, Govt. of J&K, Wetlands International, South Asia. Retrieved from http://www.wetlands.org*

**Fig. 4**

All this is a cumulative effect of three factors: (i) poverty and ignorance of the people living in the villages located in the close vicinity of the Lake, (ii) criminal negligence on the part of the government and its officials, and (iii) geophysical processes in and around the lake area. The catchment area of Wular Lake is highly prone to erosional activities. The lake area's morphometric parameters indicate  The lake area is shrinking, water extends, the lake level is declining, and the degradation process is on. Low paying capacity, lack of awareness, low educational level of the population living in villages located around the Lake, coupled with sheer negligence on the part of local bodies and apathy of the state government are playing havoc with the human health and livelihood of the people living in the surroundings of the Lake.

## Conclusion

Wular Lake, the largest freshwater wetland in India and a vital source of water and livelihood for the larger population residing in villages in the surrounding area of this Lake in the Kashmir Valley, is inflicted by a variety of geophysical and anthropogenic factors. The unconsolidated nature lake material that is highly prone to erosion has made the Lake vulnerable and fragile. Morphometric analysis of its various hydrogeomorphic parameters revealed that physical vulnerabilities in collision with human activities have been responsible for polluting the Lake water. The intensive commercial agriculture, uninterrupted flow of urban solid waste material, and the criminal indifference of state government and its officials to check the discharge of untreated wastewater in the Lake have created havoc. The Lake water has been rendered unfit even for domestic and animal use, what to talk of human consumption. About one-fourth (23.8 per cent) of the population living in the surveyed villages still depend upon the Lake for drinking water. It is also revealed that more than half of the people in such villages suffer from water-borne diseases such as cholera, giardiasis, amoebic dysentery and amoebiasis.

The study recommends that the Wular catchment area be afforested with community participation to check the erosion and runoff of loosely bound sediments during the rainy season. The Sewage Treatment Plants (STP's) be installed to prevent the inflow of untreated urban solid into the rivers/drains such as Jhelum, Madhumati, and Erin. Suitable weirs must be constructed at the mouths of inflow channels to reduce the sediment load into Wular Lake. Excessive weeds must be removed periodically from within and peripheral sites of the Wular Lake. The government agencies must make all possible efforts to increase the depth and quality of the lake water. Occasionally, the government and NGOs must organize awareness programs to educate the people living in the Wular Lake catchment areas.

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# Geographic Research on COVID-19 Pandemic: A Review

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**Abstract:** The novel Coronavirus (SARS-CoV-2), presently a global public health emergency, has infected millions causing fatalities across the globe. Geographers, too, have contributed to its combating in various ways. This study reviews geographers' contributions since 2020 into the emerging spaces of COVID-19 pandemic effects. The research articles demonstrate the diversity of the themes engaged in understanding the geography of the COVID-19 pandemic. The studies expose the global vulnerabilities, risks, and hazards and point towards a pandemic driven hastening of the emergence of a New World Order.

Keywords: COVID-19 pandemic, Geography, New World Order, Geopolitical

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## Introduction

The contagion pandemic coronavirus, alias COVID-19[2], caused by SARS-CoV-2 and originated in Wuhan in China, poses a unique and overwhelming challenge (Liang, 2021) globally for its rapid spread and high death rate. Moreover, except for the Spanish flu of 1918-20, and unlike most pandemics that affected a few countries and a small share of the world population, it is an all-pervasive "boundless contagion" (Castree et al., 2020). Resultantly, it has become a global public health emergency (Chatterjee et al., 2020).

The threat is 'really anything outside the home', as the pathogens spread from person to person. Therefore, we can no longer talk of the danger lurking elsewhere as we could not think of other places as disconnected from our geography and lives. After all, we all live right here on the planet earth together. It is seen that afflicted people, human mobility and mismanagement in administrative policies have been its superspreaders (Kumar, 2020).

The pandemic has played havoc with peoples' lives and livelihoods. With 335 million cases registered and suffering more than five million deaths worldwide and still counting—people have lost loved ones, economies upended, migrants losing jobs and stranded, heightened pre-existing inequalities, and unemployment skyrocketed. COVID-19 is aptly considered the century's greatest cataclysmic global disaster. Its breadth and depth are immeasurable. Each of the world's 7.8 billion inhabitants is at risk of this public health catastrophe. The financial and economic crises may have a more significant impact than the Great Recession of 2008-2009. Each crisis can destabilise the established international order and power balance.

The truism is that due to highly inequitable and underdeveloped health service provision, a lack of trustworthy reporting, and insufficient testing and tracing capability, the full impact on

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[2] See World Health Organization, March 11, 2020

the global poor gets frequently obscured. Additionally, its non-human risks to our geopolitical map are concerning. Globalisation vs nationalism is a point of contention.

No wonder millions of words about the epidemic have occupied space in the news, print, media, blogs, and elsewhere (Castree et al., 2020) on the COVID-19 pandemic. Geography and other spatial scientists have contributed their bit. Throughout history, there is evidence of the entry of viruses into the human population via contact with wild animals, wherein geographic patterns and processes also work at various spatial scales (Malanson, 2020) in multiple forms of their (virus) manifestation.

**The Objective**

Geography and geographers have a critical role in the global fight against COVID-19. The geographers can map the virus's presence, its spatial distribution and diffusion, along with identification of factors contributing to its growth/decline and fatality rates (Abulibdeh and Mansour, 2021). Johns Hopkins University COVID-19 tracking website has used geographical knowledge and geospatial data that have already proven vital for understanding the pandemic's reach. In turn, the pandemic occurrence made geographers revisit their indulgence with place and space, leading to the production and reproduction of knowledge.

In light of the above submissions, the study reviews articles geographers and socio-spatial scientists have published on the emerging spaces of the effects of the COVID-19 pandemic since its emergence in 2019. However, we do not claim comprehensive coverage, as many may have been left due to ignorance, lack of access, or oversight. At best, it can be taken as an exploratory study.

Before moving further to deal with the main task of highlighting different dimensions of Covid-19 examined by geographers and socio-spatial scientists focusing on tracking, mapping, analysing, spreading awareness of the problem, we think there is a need to relook a few concepts.

**Revisit Concepts**

To recall, William Cronon, in his book published 1992 titled *Nature's Metropolis,* had mentioned that places have lost their "particularity and became functional abstractions". This statement needs a fresh look. The pandemic brought back the idea of "real-world proximity" that had been "receding gradually from our consciousness". Space and place became essential. We began to think about it (the pandemic) at different spatial scales—local, regional, national, and global. We shall cite a few examples of all four spatial scales to elaborate on this. At the local level, essential issues include identification and earmarking of containment zones, locating make-shift recovery centres, navigation of crowd gathering places like malls, or converting a room at home into a serviceable home office or online classroom. At the regional/national scale, monitoring the movement of people across administrative boundaries or medical equipment and or vaccines from surplus to deficit areas/places/countries are essential issues. At the global level, epidemiologists precisely comprehend how a virus could travel so far, so fast and cause such devastation. It altered our way of looking at geography and again showed that geography matters.

The coronavirus pandemic also raises critical sociopolitical questions about "what the virus signifies: how will its legacy be framed, what lessons will be learned, how will they be acted on (and by whom), and on whose authority?" (Castree et al., 2020: 411). Again, these questions have geopolitical dimensions. These vary depending on where we examine them, framing what is stated and why and which authorities are implicated.

Apart from the biomedical aspects of the pandemic, such as the rate of spread, the origin of the pathogen, and lethality, it is critical to rethink the concepts of epidemics and pandemics in light of a slew of other Anthropocene phenomena increasingly impacted by human activities, such as fires, floods, and droughts. According to Jon Cloke (2020), epidemics and pandemics are man-made occurrences. Additionally, expand research to include pandemics within the Foucauldian canon of biopower because human socio-political dispositifs, cultures, and consumption transportation networks are sufficiently important to the origins and spread of biomedical illness to warrant a more inclusive designation, anthropandemic. This article discusses why this is the case and suggests strategies for conducting holistic research utilising appropriate analysis approaches such as biopower and ANT.

Travis Klingberg (2020) argues that the COVID-19 pandemic necessitates a virus-focused approach to intervention as well as a more-than-viral response to think relationally about the systems and dependencies that make the globe prone to racist and xenophobic reactions.

Furthermore, the pandemic may erase and create new local geographies. Finally, Carl Grundy-Warr and Shaun Lin (2020) demonstrate for Cambodia and Myanmar that pre-existing and ongoing political-economy linkages with China shape their critical responses to COVID-19 characterised by inevitable silences and erasures to their local geographies.

Carl Grundy-Warr and Shaun Lin (2020) comment that COVID-19 is unquestionably a lethal epidemic, placing millions of lives at risk due to its rapid spread. Naturally, the world focuses on public health risks, strategies for preventing and responding to outbreaks, and the immense institutional and organisational challenges that this entails. It does, however, have geopolitical consequences, particularly those related to security, international relations, and human rights. Human (in)security and other forms of violence, which may be exacerbated or reinforced during a significant health crisis, have the potential to destabilise all manner of political, economic, and social connections and should be evaluated from a grounded geopolitical perspective.

The pandemic exposed global frailties, exposed systemic faultlines, disrupted social and economic activities, and exacerbated capitalist societies' deeply unequal geographies, exposing the most vulnerable and weakest members to multiple setbacks of livelihood insecurity, low immunity, growing debt, and disease. According to Harvey, COVID 19 possesses "all the hallmarks of a class, gender, and racially pandemic" (2020:10). When it comes to developed countries, this is as true as it gets. Morbidity and mortality data in the United States indicate "profoundly entrenched social, racial, and economic inequality in health" (van Dorn, Cooney, and Sabin, 2020:1244). Due to the concurrent "systemic condensation of financial, political,

ecological, social, and health crises," this pandemic creates what Pulignano and Marà (2020:1) refer to as a "crisis society," characterised by pre-existing but unabated institutional and administrative fragility.

Last but not least, and perhaps most significantly, the global order was in flux for some time prior to the COVID-19 crisis. However, on the other hand, coronavirus has accelerated three significant geopolitical trends that will shape our post-pandemic international order. These are: (i) deglobalisation—the logistical difficulties exposed by the current crisis regarding global just-in-time supply chains; (ii) rising populism and nationalism—the inevitable rise of nationalism and "my nation first" politics, which will force businesses to localise operations that favour national, regional, and local supply chains; and (iii) China's geopolitical rise, as Ian Bremmer puts it (2020).

**Geography, Geographic Inputs and COVID-19 Pandemic**

A striking feature of the COVID-19 pandemic is an uneven distribution across and within countries that raises inherently geographic questions and offers an opportunity for analysis through geographic insights. J. Marshall Shepherd, Forbes Magazine's contributor and Professor in Meteorology at the University of Georgia, making a case for Geography, wrote an op-ed titled 'Why Geography is a key part of fighting the COVID-19 Coronavirus outbreak' in early March 2020. Likewise, David Wolman (2020) discussed how the pandemic redefines our relationship with space in an essay for Wired titled 'Amid a Pandemic, Geography Returns with a Vengeance.'

The coronavirus clarifies w*here* matters—absolutely and why *where* is so fundamental to our experience. Suddenly, we cannot stop thinking about the *where*-our relationship with space, the physical space: hot spots, distance, spread, scale, proximity. In a word: geography. Nevertheless, geographers' challenge in the COVID-19 crisis remains to explain 'how, what, why, when and significance' in the space-time context (Castree et al., 2020).

The overwhelming response of geographers and socio-spatial scientists led to 26 reviewed articles in the special virtual issue of *Tijdschrift voor Economische en Sociale Geografie*, Vol. 111 (2020), No. 3 focused on the emerging spaces of the effects of the COVID-19 pandemic sectioned thematically into six parts: the production of knowledge, the geopolitical governance, the social geographies, the financial geographies, the urban and regional geographies, the economic geographies of the covid-19 pandemic. The papers in this special issue cover a diverse geographic range (including case studies from Asia, Europe, and North America) and employ a range of analytical approaches to help readers better understand the pandemic's geographical manifestations and varying worldwide impact. Similarly, Taylor & Francis' online journal Eurasian Geography and Economics published ten papers in its 61st volume in 2020.

COVID-19 (coronavirus) is a virus capable of infecting everyone and has been termed by some as the "great equaliser." Nonetheless, it will disproportionately affect the most vulnerable people and exacerbate existing imbalances between countries, communities, households, and individuals according to a World Bank analysis on *COVID-19 Crisis Through a Migration Lens (2020). Migration and Development Brief*

(https://openknowledge.worldbank.org/handle/10986/34016) anticipates the impact of these events on global and regional migration and remittance trends in 2020 and 2021. Another essay addresses present gender disparities in Sub-Saharan Africa's economic sector and discusses how the COVID-19 (coronavirus) pandemic may disproportionately affect women and girls. Finally, it focuses on impact evaluation studies to provide policy options to increase women's economic resilience and avoid any negative repercussions throughout the epidemic and recovery (Copley et al., 2020).

According to The Lancet (2020), migrants and refugees living in unclean, congested camps are among the most vulnerable populations. "Already, these settings have weak healthcare systems, scarce protective equipment, and poor testing and treatment capacity . . . Moreover, this virus disregards all borders. Therefore, COVID-19 responses must not overlook refugees and migrants". Migrants suffer a double whammy: the availability of migrant labour in several industries, such as health and agriculture, might pose significant difficulties for host countries. In addition to the risk of infection, migrants are also losing their jobs, salaries, and health insurance. The World Labour Organization points out that more than 80 per cent of illegal workers are already severely affected, and geographical relocation will exacerbate this. Given the nature and magnitude of the problem of COVID-19, the World Health Organisation (WHO) has called humans to work together to protect the vulnerable across the globe (Uden et al., 2020).

COVID-19 resulted in a more severe and extensive economic disaster than any other pandemic-related calamity since the early 1900s (World Bank, 2020). Due to the epidemic's tremendous economic impact on the global economy, its geopolitical consequences require careful and critical thought. Additionally, it is worth highlighting that the disparate outcomes are not exclusively the result of danger, risk, or susceptibility. As a result of how authorities respond to the epidemic, new geographies develop. For example, Ren (2020) demonstrates how lockdowns are imposed inequitably and exacerbate inequality.

Many studies conducted worldwide reflect the Covid-19 and migration issues at a national and international level. Fielding and Ishikawa (2021) studied COVID-19's impact on Japanese internal migration rates and patterns. Wang et al. (2020) built a model for COVID-19 risk evaluations in Guangdong Province, China. The study found that pandemic risk varies by region. There are many variables, including importation risk, susceptibility risk, and the ability to stop the spread. Therefore, the government should implement regional prevention and control measures based on risk classification to ensure smooth functioning. Liang et al. (2020) used the geographically weighted regression (GWR) model to investigate the regional heterogeneity of the connection between COVID-19 incidence and population movement in China.

Shi and Liu (2020) argue that internal migrants are not to blame for the first spread of COVID-19, as the first impacted cities are megacities linked to Wuhan more by commerce and tourism than by migration. Furthermore, internal migration only partially explains the epidemic's scale. While COVID-19 affected some cities remote from the epicentre, the main contributors are not job seekers but business people. Therefore, internal migrants are not entirely to blame for the rapid, large-scale, and widespread spread of COVD-19. Lu et al. (2021) explained the patterns

and factors influencing human migration networks and stated that the main determinants of mass migration are income and culture. Finally, Suhardiman et al. (2020) conducted interviews with international and domestic labour migrants from Bangladesh, India, Laos, Myanmar, China, Singapore, and Thailand to examine migration risks, problems, and possibilities. They emphasised that COVID-19 has revealed migrant labour hardship.

In a telephone survey to examine stranded migrant workers' COVID-19 risk and livelihood concerns, Rahman et al. (2021) attributed its spread to poor housing, co-morbidities, poor hygiene, and lack of COVID-19 safeguards. The shutdown caused an economic crisis, and migrant workers faced ration shortages, financial trouble, wage cuts, job losses. The government's aid to stranded migrant workers during the lockdown was subpar. India must formulate a long-term and effective programme for workers' social security, especially in emergencies.

COVID-19 lost jobs for an estimated 30–50 million migrant workers in China in March 2020 (Che et al., 2020). In addition, the impact was adverse on those with less education and fewer skills, increased the disparity between those covered by the social safety net and those in need, and worsened existing inequities and the household registration system, both within and outside the migratory community. To protect migrant workers in the next crisis, they demand a more comprehensive plan. Narwaria (2021) highlights migration and livelihood during the COVID pandemic in India. He attempts to identify the problems to address the challenges so that the effect of pandemics in future can be better tackled and build surge capacity to deal with a crisis.

**Socioeconomic, urban and regional issues and COVID-19**

The COVID-19 pandemic has aggravated the global health crisis with political, economic and social issues that worsen current inequities and disproportionately affect the most vulnerable groups in society (Redwood et al., 2020). Kallio et al. (2020) claimed that Covid-19 reveals unequal geographies by referencing the study of twelve researchers published in Fennia Journal about pandemics in Brazil, California/US, Finland, Portugal/Italy, the UK, and Greece. They concluded that Covid-19 disproportionately affects the most vulnerable and underprivileged poor people who do not receive appropriate public assistance. Ascani et al. (2020) analysed the devastating impact of the spread of the Coronavirus in Italy and its spatial unevenness on the financial sector, using an economic geography prospect. The pandemic's dramatic spatial unevenness reveals that the infection has wreaked havoc on the financial centre. Furthermore, they demonstrate a link between the disease's subnational geography and the regional economy.

Asongu et al. (2020) investigated the economic impact of the Covid-19 epidemic on 186 nations in four major regions: Asia-Pacific and the Middle East, Europe, Africa, and America. The statistics show that the Covid-19 combatting measures effectiveness and implications varied by region. They observed that global lockdown efforts failed to prevent the outbreak, but Covid-19 measures favoured European countries. Movement restrictions have prevented disease transmission across the American continent. Enforcing social division has benefited Europe but

has harmed Africa. In general, public health measures have failed to flatten the infection curve since most underlying policies focus on raising awareness or treating sick people.

Hass and Arsanjani (2021) stated that the COVID-19 pandemic utilised our geographical conditions to accelerate its spread. They emphasised a data-driven approach to studying pandemic tendencies across Europe. The data suggest that population density, cafes and bars, and pollution levels are the most important explanatory variables.

Adler et al. (2020) stated that mega-regions in the US that are intensely connected nationally and internally are more vulnerable to diseases early in pandemics. Finally, Mendes (2020) examines how activists and social movements responded to Covid-19 in Lisbon. He points to the search for alternatives to solve the current housing crisis that is costly, commodified, and financialised.

Willi et al. (2020) examine how COVID-19 shaped Swiss governance. Hesse and Rafferty (2020) analyse the COVID-19 outbreak's impact and responses in Dublin and Luxembourg City. Finally, Brinks and Ibert (2020) describe the regional dimensions of the "corona issue," its perception and handling in Germany.

Eom and Ji (2021) investigate the changes in human mobility and their influencing factors using big mobile data by applying a machine learning method to Seoul Metropolitan City, Korea. The findings showed that strategies like social separation vary depending on socio-demographic characteristics. The districts with the most real estate, government, and healthcare employees recovered quickly and posed a risk of spreading the disease by resuming economic operations.

Studies on the geography of COVID 19 conducted at the regional level include Sweden (Florida and Mellander, 2021), Denmark (Holmager et al., 2021), Italy (Bertuzzo et al., 2020), England (Davenport et al., 2020), Latin America and the United States (Finn et al., 2020; Wheaton and Thompson, 2020).

A wide range of themes have been associated and discussed in urban perspective like; urban public transport systems (Nurse and Dunning, 2020 Gutiérrez et al., 2020), the nature of urban health globally (Gatzweiler et al., 2020), governing urban infrastructures under pandemic conditions (Enright and Ward, 2021), public realm and local level responses (Wray et al., 2020). rural-urban polarisation in the context of COVID-19 (Boterman, 2020).

Imdad et al. (2020) trace the COVID-19 pandemic's imprints across India's districts. They identified main epicentres and outbreaks in India through climatic, demographic and socioeconomic parameters in several lockdown stages. In addition, they identify hotspots and major clusters and predict areas for the last pandemic.

Joshi and Mishra (2021) highlight the socioeconomic linkages of the COVID-19 Pandemic in India and highlight the overexploitation of the earth resources and spread of the COVID-19 pandemic worldwide. Singh (2021) studied Covid-19 and the restructuring of economic space: emerging research frontiers in economic geography in context to India. The

article sketches the outlines for re-examining the economic area due to the COVID-19 pandemic under five themes: revisiting economic globalisation, workers, inequality, neoliberal economic policies, and development. Yadav and Bhattacharjee (2021) describe city-level research of more than 46 million cities in India that used a multivariate regression model to identify the primary determinants of COVID-19 infection and related mortality during the different lockdown and unlock phases. They found that these factors significantly explain the variation in the COVID-19 associated infections and deaths. Finally, Pandey et al. (2021) analysed the first wave of Covid-19 spatio-temporal pattern of highland and lowland regions of India in a geographical context. The study indicates that place-based effects are significant for addressing health questions.

**Tourism geography and COVID-19**

Many geographers have documented the impact of COVID-19 on the tourism industry and its prospects and relate to different dimensions like; international travel restrictions: the geopolitics of health and tourism (2020), global consciousness and the sustainability of travel and tourism (Galvani et al., 2020), opportunities for sustainable and proximity tourism (Romagosa, 2020), visions of travel and tourism after the global COVID-19 (Lew et al., 2020), socioeconomic differences in travel demand (Kar et al., 2021) travel discontinues and alternative leisure travel futures (Jacobsen, 2021), adoption of robotics and artificial intelligence in travel and tourism (Zeng et al., 2020), tourism matters in the new normal post-COVID-19 (Brouder et al., 2020), adventure travel and tourism after COVID-19 (Nepal, 2020).

Some of the studies connect COVID-19 to geopolitics and globalisation like; transnational labour and geopolitics (Creţan and Light, 2020), interconnections, inequalities, and the geopolitics of disease (Chan et al., 2020), the geopolitical aspect of state power (Moisio, 2020), globalisation, population flow and the spatial diffusion (Shen, 2021), pandemopolitics (Mionel et al., 2020), human rights violations and informal livelihoods (Anazonwu et al., 2021), the right to public space during the COVID-19 (Apostolopoulou and Liodaki, 2021). In addition, some studies highlight issues like; excess deaths from various causes (Kumar et al., 2021), compliance and containment in social distancing (Chen, 2021), pandemic and protest (Aitken, 2021), lonely pandemic (Hartt, 2020), social media and public engagement (Chen, 2020), inequality, decent work and curriculum (Puttick, 2020), Covid-19's cracks, the climate crisis, and academia's role in bringing about an ontological shift (Mullings, 2020), children and Covid-19 (Holt and Murray, 2021), social geographies of COVID-19, plastic waste, and obesity (Cloke, 2020).

**Air quality and Covid-19**

Globally, strict lockdown regulations have improved air quality, which is a positive aspect of COVID-19. A significant reduction in air pollution and a significant improvement in ambient air quality have undoubtedly resulted in substantial short-term health benefits. In addition, the shorter-term lockdown resulted in a considerable increase in environmental quality, providing a

solid evidentiary basis for larger-scale policy action to improve air quality. Generally, cities are the centres of air pollution, and during Covid-19, the air quality improved in urban areas worldwide. In this connection, several studies have been conducted worldwide and observed a positive change in air quality from global to local. For example, Delhi, Mumbai, Kolkata, Chennai, Bangalore, and Hyderabad (Parida et al., 2021, Banerji and Mitra, 2021), Mexico City, London and Delhi (Vega et al., 2021 and Mahato et al., 2020), United Arab Emirates (Alqasemi et al., 2021), South and Southeast and East Asia (Roy et al., 2021 and Ghahremanloo et al., 2021), fell in the world's fifty most polluted capital cities (Rodríguez-Urrego, D. and L. Rodríguez-Urrego, 2020).

**Administrative geography and COVID-19**

Administrative geography has played an essential role in managing the territorial organisation of public administration/space during COVID-19. Countries worldwide implemented "lockdowns" on movement and activity to curb the spread of coronavirus (Maji et al., 2021). In addition, the governments of all countries have adopted various administrative actions to deal with the COVID-19 scenario according to local conditions, such as total lockdown, night curfew, and creation of containment zone. The pandemic will bolster the government's legitimacy and strengthen nationalism. Governments of all types have taken emergency steps to address the crisis, and many will be reluctant to cede these expanded powers once the crisis has passed.

The government's relative effectiveness in containing the virus and mitigating its economic implications may exacerbate security concerns and recent social division. In any case, the government has re-established its authority. Additionally, experience has demonstrated that authoritarians and populists are equally unable of containing the pandemic. Indeed, countries like Korea and Taiwan, which responded effectively and fast, are democracies, not populist or authoritarian governments.

While the rest of the world is attempting to contain COVID-19, China has implemented stringent lockdown measures to expeditiously and effectively manage the pandemic. Unfortunately, COVID-19 will accelerate the shift of power and influence from the West to the East. South Korea and Singapore have responded most effectively, while China has recovered well from its early gaffes. In comparison, Europe and America's response has been slow and chaotic, thereby undermining the Western "brand."

In March 2020, President Macron declared war on COVID-19 and initiated Operation Resilience. Europe's response to the pandemic has been to call in the military. They compared the spatiality of military actions in France to other European countries (Opillard et al., 2020). The Kalaallit Nunaat (Greenland) governments have also banned internal and external travel (Grydehoj et al., 2020).

Some countries, like Sweden, South Korea, and Tajikistan, did not impose mandatory lockdowns during the first wave. However, restrictions are more stringent for elderly individuals to keep social distance, avoid using public transportation, and not travel unless necessary, almost at the global level.

Florida and Mellander (2020) compare place-based metrics such as density, age structures, and socioeconomic aspects to COVID-19 spread/diffusion factors across locations. When it comes to identifying the geographic distribution of COVID-19 in Sweden, diffusion-related factors take precedence over place-based factors and are associated with high-risk nursing institutions. On the other hand, density, population size, wealth, and other socioeconomic variables are less significant.

The geography of the initial contamination of COVID-19 was uneven. However, the ubiquitous infrastructure and modes of transportation of the twenty-first century have made this feasible. The second phase of contamination was hard-wired into daily space-time patterns of everyday life in highly urbanised countries such as China, Italy, Spain, the United States, and the United Kingdom after imposed long-distance travel restrictions (Castree et al., 2020).

Social media platforms were widely used for administration and public information during the pandemic. For example, the US state governor has used Twitter to curb the spread of the virus. Their Twitter activities reflect state governments' responses to the COVID-19 problem, both geographically and socially. This study can help other agencies and officials design future crisis communication plans using social media for good (Gong and Ye, 2020).

**Geospatial modelling and web-based mapping of COVID-19**

Geographers understand the connections between people and places and the processes that shape those connections (Bissell, 2021). Therefore, they use many tools and techniques to understand our complex world. Nowadays, geospatial techniques are becoming very important and can assist in decision-making, planning and community action (Pardo et al., 2020; Shepherd, 2020).

The web-based maps demonstrate various aspects of COVID-19 spread and provide a better solution and understanding. A dedicated portal on COVID-19 is available on the ESRI website that provides the overview, response, business continuity, reopening, global map gallery and resources. In addition, it provides a trend, future prediction and potential impact on the community and public health. The Johns Hopkins University COVID-19 tracking website is the most acceptable illustration of the link between geographical knowledge and geospatial data, already shown to be critical in comprehending the pandemic's spread.

In the same context, Boulos and Geraghty (2020) have conducted a study on the geographical tracking and mapping of COVID-19 and the application of GIS technologies to fight against outbreaks and epidemics. This study provides a variety of functional online/mobile GIS and mapping dashboards and applications for tracking the COVID-19 outbreak and related events globally. It also shows how individual users (in China) can utilise one of several dashboards or apps to see if they have recently had close contact with someone confirmed or suspected of having COVID-19.

Pardo et al. (2020) analysed 63 scholarly publications on health and social geography, spatiotemporal analysis, environmental factors and data mining, disease, and web-based mapping for the COVID-19 pandemic using geospatial and spatial statistical analysis. This study can

better understand the evolution of techniques used to manage the 21st century's major worldwide pandemic.

Geospatial modelling was used to study socio-demographic determinants of COVID-19 incidence rates. The purpose was to develop preventative actions to decrease the community incidence rate (Scarpone et al., 2020; Mansour et al., 2021).

**Health geography and Covid-19**

The COVID-19 outbreak directly hinders the attainment of SDG 3.3, specific goals for health and economic and social development goals (Zhou et al., 2020). It is the most serious global health threat humanity has faced since World War II, with estimates ranging from 40 to 60 per cent of the world's population contracting the virus. It has caused health issues and challenges in countries around the globe. (Rodríguez-Urrego, D. and L. Rodríguez-Urrego, 2020). COVID-19 research is already attracting scientists from various domains, including geographers, in addition to health and biological sciences. Geography and health are intrinsically linked (Dummer, 2008). It highlights the estimation of disease spreading and the possibility of new outbreaks and helps predict scientific responses (Pardo et al., 2020). Fortaleza (2021) applied health geography modelling to explain COVID-19's early spread in Sao Paulo. He highlights the use of geographic models of population mobility to track the spread of Covid-19 infection and give real-time reactions to enhance public health measures.

Desjardins et al. (2020) studied the COVID-19 fast surveillance in the US to detect and analyse new clusters using a prospective space-time scan statistic. This quick data can help public health officials and decision-makers better allocate resources, test places, and enforce quarantines and travel bans.

To increase access to healthcare, Kang et al. (2020) compared COVID-19 patients' spatial accessibility to the population at risk. The outcomes also help identify places at risk of COVID-19-induced healthcare resource shortages. This study also highlighted vulnerable people in Chicago's low-access zones. The findings can assist policymakers, and public health practitioners allocate current and future healthcare resources to ensure full access.

Ribeiro and Santos (2020) summarise the critical challenges for the spatial analysis of the COVID-19 pandemic and possible solutions. Yue and Hu (2021) and Jackson et al. (2021) investigated the potential risk factors and disparities in COVID-19 cases and deaths in the United States. They found that high levels of social vulnerability and the lack of mitigation policies were significantly linked to higher death rates. In South Carolina, Huang et al. (2021) found that COVID-19 case and fatality rates are correlated with pre-existing socioeconomic vulnerability. Cases and deaths varied significantly across urban and rural counties. They partly attributed the timing of verified cases and fatalities and state and municipal mitigations deployment.

A similar study was conducted by Pose and Burlina (2021), and they examined the unequal geography of COVID-19-related deaths in 206 regions across 23 European countries. Findings highlighted that excess mortality was largest in corresponding locations with colder and dryer temperatures, significant air pollution, and under-resourced health systems. The first wave

struck the worst regions with weak formal and informal institutions. Regional excess mortality was driven by ineffective national administration, inadequate bridge societal divides, and frequent social gatherings.

Geospatial approaches were commonly employed in modelling and mapping for disease pattern detection during the pandemic. They examined a synthesis of the methodologies and their regional, environmental, and socio-demographic aspects. For example, Covid-19 was analysed geographically using clustering, hotspot analysis, space-time scan statistics, and regression modelling (Fatima et al., 2021).

**Concluding Remarks**

The COVID-19 pandemic has created a new normal taking the world through its perilous and tumultuous stride and impacting the human, environment and non-human aspects of life. It is different from the 9/11 and the 2008 financial crises. While previous ones posed the threat of severe economic disruption and population displacement, the global order was not in question. However, unfortunately, it very much is at the moment.

The circumstances of this crisis have compelled a reassessment of several assumptions, with long-term ramifications for the economy and society. These effects are numerous, ranging from attitudes toward efficiency versus resilience, the future of capitalism, densification of economic activity and living, industrial policy, and our approach to global and collective action-required problems—such as pandemics and climate change—to the role of government and institutions. All of this indicates a sustained retreat from globalisation, the most profound structural change in world politics since the post-war period began. Could a coronavirus pandemic be the deciding factor in the progress of economic globalisation? Only time will reveal whether or not this is true. COVID-19 exerts pressure on governments, businesses, and society to strengthen their capacity to withstand prolonged economic isolation. Due to rising public and governmental pressure to meet carbon reduction targets, numerous firms' reliance on long-distance supply chains had already come into question.

It looks highly implausible that the world will revert to the paradigm of mutually beneficial globalisation prevalent in the early twenty-first century. Additionally, without a motivation to protect the shared benefits of global economic integration, twentieth-century global economic governance architecture will rapidly erode. Is a new type of pragmatic internationalism on the horizon, one that is protective as well as pragmatic? Political leaders will require extraordinary self-control to avoid retreating into an open geopolitical competition.

All this will impact the grouping and re-grouping of nation-states. In other words, a new global or world order may be in the offing. As Arundhati Roy in 'The pandemic is a portal' writes: "Historically, pandemics have forced humans to break with the past and imagine their world anew. This one is no different. It is a portal, a gateway between one world and the next" (https://www.ft.com/content/10d8f5e8-74eb-11ea-95fe-fcd274e920ca).

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**Geo-Reflections Series-3**

# Reading Urban Theories and Texts: Reflections from a Small Town of the Global South

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## Introduction

I started reading texts and theories of urban geography as part of the curriculum of what was then called the 'optional paper' of my Master's degree programme in a large provincial university in the early 1990s. This was where I first encountered the knowledge domain of urban studies as it is taught in India. The urban world prescribed for us in that course seemed vastly different from the urban world I had experienced thus far. For an aspiring student of geography like me, whose lived experience was rooted in small towns of India and the occasional forays into the nearby metropolis, Calcutta (now Kolkata), the texts and the theories were alien to me. At that time, we did not even have access to view the world's big cities through television. The black and white photographs of skyscrapers and spaghetti junctions of highways printed on the pages of the textbooks published in the 1970s offered us glimpses into the urbanscapes discussed in those books. It was challenging for us to conceptualize and make sense of urban theories and models that assumed universality- as though they were the reality or what the truth should be. In contrast, the urban world we lived in was the unreal, subordinate one. Visualizing big cities of the Global North, in the sense of what they looked like, was a big challenge not only for me but for most students of urban geography in the early 1990s in Indian state universities.

The scholars from the Global North had authored those major urban studies textbooks based on their knowledge of large cities of the United States of America and Western Europe . As young Indian geographers, we faced problems understanding these concepts and theories on two fronts: (i) neither had an understanding of this world, (ii) nor the experience of living in the urbanscapes of the Global North. Even our exposure to the metropolitan or big cities of India was limited. Often, these courses made us wonder, "*Whose cities, whose experiences and whose knowledge are we trying to understand?*"

The curriculum taught us urban land use and morphology models as proposed by E.W. Burgess, Homer Hoyt, and others of the Chicago School. When these theories were discussed in the class, we always had trouble visualizing the circular morphological zones as discussed in theory. The only tool we had for imagining the CBD was a photo of the CBD of Chicago as portrayed in the book. We would try to fit that CBD model to the Curzon Gate and BC Road area of Burdwan, a market town, the size and nature of commercial activities comparable to that of Chicago, an old industrial city of the USA. Further, nothing in the range of our experiences was similar to the broad morphological patterns of cities and their land use as discussed in Burgess's model. Residential segregation as portrayed in American cities was based on race: Black and

White. The residential segregation in the cities of the Global South was sometimes not very prominent, and when visible, it occurred on many fronts, such as religion, caste, occupation and class. Many other theories, such as Christaller's and Losch's location theories, the growth pole theory, and the core-periphery model, were all rooted in the Global North's cities, having very little relevance to our urbanscape of the Global South.

Another vital point of mismatch was the concept of the 'neighbourhood', essentially explained with a view of American cities. The western concept of neighbourhood, a more organized arrangement of localized space, was in no way close to the idea of *para* or *mohalla* or *Kampung* in the cities of the Global South. In Indian cities, a *para* or *mohalla* is more of an organic and social organization, a description of which was absent in those texts. In contrast, the neighbourhood concept and its social bond, as explained in the texts, was more of a planned and organized locality in the cities of the North. Delimiting the *para* in Indian cities was an arduous task, as any demarcation lines like streets never bound it.

In comparison, the neighbourhood in cities of the Global North was an easily defined urban territory. Thus, we realized that this micro-urban space's social and cultural contexts vary between the cities of the Global North and South. This difference was of such a degree that it challenged our comprehension to an impossible level.

The theory of primate city[1] was a similar departure from the Indian case, where four metro cities were parallel as representative metropolitan centres of the four regions of India. Similarly, the rank-size rule was almost inappropriate in describing India's distribution of urban centres. The rank of cities was never in complete sync with the size of the expected population following the rank-size rule. Thus, two explicit models of thought emerged in urban studies: universality and binary. In the model of the universality of theories, we had to use a Northern lens to analyze the Southern cities. In the binary model, the Southern cities were represented as chaotic/unplanned and underdeveloped/backward compared to Northern cities, which meant order/plan and modern development.

This process of 'othering' with all sorts of negative characteristics imposed on Third World urbanization was another problem for us to digest, especially as it made us feel the presence of a hierarchy of colonizers and colonized within the knowledge domain. For instance, there were theories constructed mainly by Northern scholars claiming that the cities of the Global South are structurally weak and completely disconnected from their rural surroundings, having apparent rural-urban disjunction. We had to read many such examples and books since they were available in our university library. The widely-read titles were *The Study of Urban Geography* by Harold Carter (1972) and *Urban Geography* by R.M. Northam (1979). I prefer to call this othering originated from the binary approach, a problem of representation of urbanization and cities in urban geography biased by colonial legacy.

For these reasons, reading theories not explaining our world of small cities in India was quite frustrating. Moreover, using those theories as a structure or lens to explain our urban

[1] Jefferson, Mark. "The Law of the Primate City", *Geographical Review,* 29 (April 1939)

phenomena was extremely difficult for us. With my limited understanding, I had no idea that the subject of urban geography in my Master's degree class was laden with colonial baggage. That was epistemic, telling us what knowledge was and how it is produced.

This epistemic problem was further aggravated and became more complex when I started working on my PhD thesis on Urban Geography. I started my doctoral research to examine whether the theory of rural-urban disjunction, as claimed by the Northern scholars, to be expected in the case of the then 'third world' is relevant to the case of small-town Burdwan located in West Bengal, India. As I expected with my ground knowledge , the findings came out to be opposite to the theory as claimed in urban studies conducted by Northern scholars. My PhD research[2] noted a well-integrated rural-urban relationship is facilitating both the growth and expansion of the town and the development of surrounding rural areas. After a few years, I returned to the same university and started teaching urban geography in the same department. By that time, we had got a few more books, but the good journals of urban studies, where the most relevant current debates occur, were not accessible to us. This access to existing knowledge is still a problem we face in our day to day teaching in a provincial university under the State government, having limited financial resources to buy those journals. I dedicate this popular article to the Master's students of other such locations to give them a simplified idea about the epistemological challenges of urban studies and their ongoing debate.

**Postcolonial Urbanism: The pathfinder**

When I was a researcher in urban studies, Gautam Bhadra edited one book in the Bengali language entitled *Nimnoborger Itihas* (*Subaltern History*), published in 1998. It was a collection of works by several famous subaltern historians. Fortunately, the subaltern historian group comprised leading Bengali academics based in Calcutta (India), America, and Europe. This book helped me grasp the subject quickly, introducing me to the subaltern turn of knowledge production in history. But there was no such trend observed in urban studies. Another interesting point to note here is that subaltern historians mainly were scholars from the South and were primarily located in the institutions of the Global North. To raise a fruitful debate, the Southern scholars always need a platform in the North to draw scholarly attention on a global scale.

Although there was no 'subaltern' turn in urban studies, the knowledge production on cities, urban process, and theory building started being questioned and countered by the end of the 20th century. Influenced by subaltern history studies, there was an intense debate on the universal application of models and theories based on Northern cities by the turn of the new century. These debates collectively paved the path for postcolonial urbanism, following the postcolonial thought and theory in humanities and social sciences. Postcolonial urbanism is explicitly a kind of intervention into how urban research and theory are generated.[3] The postcolonial urban debate offered us a lens through to analyze the culture of knowledge production in urban studies. After reading this theoretical argument, I started getting answers to

[2] Samanta, Gopa (2002). Rural urban interaction: A study of Burdwan town and surrounding rural areas http://hdl.handle.net/10603/66030

[3] https://www.oxfordbibliographies.com/view/document/obo-9780190922481/obo-9780190922481-0018.xml

the questions I had raised at the beginning of this article: 'whose theories and whose cities?' It emerged that established urban studies offered a hierarchical epistemic process where universalization was a norm, without trying to understand the situated context of the Southern cities, especially of the small and medium ones.

Following Spivak,[4] postcolonial urban scholars tried to explain how the legacies of colonialism in the forms of biases and prejudices have been carried forward by the scholars of urban studies to understand and interpret urbanization of the erstwhile 'third world'. By the beginning of the 21st century, postcolonial urban scholars[5] started arguing that the Euro–American city-centred urban theories cannot claim universality as they fail to act as a viable explanatory lens to understand and explain the cities of the Global South. They questioned the very practice of urban theory construction, laden with colonial baggage in interpreting southern urbanization and cities.

Postcolonial urbanism has acted as a radical call to change the epistemological grounding of urban studies. It calls for a cosmopolitan nation of urban theory to accommodate the diverse ontological practices of the Southern cities, as they are complex, contextual, and different from their Northern counterparts. It demands that urban studies focus intently on cities' essential character as sites of difference to understand their ordinariness.[6] Cities are not only spaces of capital accumulation and centres of development but are also spaces of diverse social and cultural practices leading to differential urbanism. Thus, urban theories need to go beyond the developmentalist approach of analyzing cities as sites for agglomeration economies. This approach limits our understanding of Southern cities by conceptualizing them as parasitic and dependent because of their inadequate economic bases. Thus, postcolonial urbanism argues for changing our singular and universal lens to understand and analyze the Southern experiences. This is a search for grey areas in urban studies instead of looking at just a North-South binary. Our own lived urbanscapes do not fit either of those categories and demand more attention to understand such nuances.

**Southern Urbanism: Constructing our theories and texts**

Coming back to my initial claim of searching for our theories and texts, we are now experiencing the ripple effect of postcolonial urbanism, and Southern urbanism has become an embodied practice inside the Global South. Although postcolonial urbanism critiques the universal application of Northern theory, it was not enough to challenge the age-old hierarchical relationship of colonialism in knowledge production. A more accessible and newer alternative has emerged within the hierarchical knowledge production structure these days-the so-called collaborative research projects funded by Global North-based institutions, where Northern

[4] Spivak, G. C. (2008). "Can the subaltern speak?" In *Marxism and the Interpretation of Culture*, eds. C Nelson and L Grossberg. Basingstoke: Macmillan. 271-313.

[5] Robinson, Jennifer (2006). *Ordinary Cities*, Routledge, London and New York; Roy, A. (2009) The 21st-century metropolis: new geographies of theory. *Regional Studies* 43: 819-830; Shepard, Eric, Leitner Helga and Maringanti, Anant (2013). Provincilalizing global urbanism: A manifesto, *Urban Geography*, 34(7): 893-900

[6] Robinson, Jennifer (2006) *Ordinary Cities*, Routledge, London and New York

scholars work with the help of Southern scholars. In these collaborative projects, there remains a chance of continued knowledge hierarchy. In many such research projects, Southern institutes and universities are in asymmetric relationships with Northern universities and serve primarily as extensions for fieldwork and data collection.[7] These collaborations are often targeted at minimizing the cost of fieldwork and saving time for the Northern Scholars for their institutions. The epistemological practice under such research projects will never create a level playing field for knowledge production worldwide, thus limiting the fruits of the postcolonial endeavour in bringing about the real epistemological change as sought.

Building theories on Southern cities requires rigorous work to correctly capture the situatedness and context of the multiple and diverse urbanization processes within the Global South. Pieterse[8] notes that it is important to know what is going on before constructing new theories. And to know 'what is going on, he recommends a methodological turn - meticulous, careful, and reflexive ethnographic research to make the invisible into a visible entity. He further recommends a research practice that can resist the demands for definite conclusions and solutions, resisting the temptation for generalized abstraction.

Thus Southern urbanism is an amalgamation of understanding different, diverse, and situated urban practices. Southern urbanism is also practised in many different ways, but I will discuss three trends here. The first one is the call for dislocating the centre from North to South.[9] In this radical call, it is argued that we need to find 'new geographies' of theory to understand better the multiple and heterogeneous urban processes and forms practised in the Global South. It is not just another 'add and stir' model of valuing Southern urban experiences in urban theory building. It is an entirely new way of analyzing space and place with their relational specificities. The second line of argument is institution building.[10] In this argument, institution building is prioritized as an essential step before theory-building. This is a preparatory process for the earlier discussed goal of 'dislocating the centre' and is necessary for developing contested spaces of power and control in positioning Southern knowledge since knowledge is always entangled with authority and hierarchy.

The third line of argument[11] is to go beyond the narrow focus of the Southern and Northern debate and to challenge 'conventional thinking'. According to this argument, there are disconnections between the existing theory and practices. For mending this disconnection, theory must be rooted in context to translate and apply in particular places. The additional argument is for expanding a vocabulary of Southern urban practice. To turn the trend of theory building, there is a dire need to start with new words, new language, and new ways of thinking- rooted in the Southern context and practices.

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[7]Pieterse, Edgar (2014). Epistemological Practices of Southern Urbanism Draft Paper presented at the African Centre for Cities Academic Seminar, 21February 2014 University of Cape Town

[8] ibid

[9] Roy, A. (2009). The 21st -century metropolis: new geographies of theory. *Regional Studies* 43: 819-830

[10] Pieterse, Edgar (2014). Epistemological Practices of Southern Urbanism Draft Paper presented at the African Centre for Cities Academic Seminar, 21February 2014 University of Cape Town

[11] Bhan, Gautam (2019). Notes on a Southern urban practice, *Environment and Urbanization,* 31(2): 639–654 https://doi.org/10.1177%2F0956247818815792

Following Pieterse's call for institution building within the Global South, the centres for urban studies such as the African Centre for Cities (ACC) within the University of Cape Town, South Africa, and the Indian Institute for Human Settlement (IIHS) in Bangalore, India have started co-producing knowledge on Southern urbanism by offering MPhil courses and PhD programs. In the course outline on Southern urbanism, the African Centre for Cities claims: 'Though the body of knowledge has always been paraded as universal, it is highly contextual. What we're trying to do is also to unpack the theoretical underpinnings of that approach and to suggest that there is a different way of thinking about urban theory.' They also claim that it is a critique from the Global South about the universality of knowledge production and theory building in urban studies.

However, Southern urbanism is not limited to these premier institutions of the Global South, such as ACC or IIHS. Many other institutions and universities of Asia, Africa , and Latin America have started offering programmes and courses on Southern urbanism - in cases partial, if not complete. Sometimes, it is also taught within the curriculum of urban geography. Some of those institutions are located in the provincial universities of India and might not be using the term Southern urbanism explicitly in their offered courses. These new ways and means, i.e., theories and methodologies of understanding the cities of the Global South, are being practised by many scholars scattered over intuitions of different hierarchies and scales within the South. At the end of the circle, which I started to draw at the beginning of this article, we can be cautiously optimistic about the fact that it is just a matter of time before we have at hand a set of our theories and our texts! Some people may call it a time lag, but I think it is more than that. We will still have to address many other kinds of baggage other than Northern hegemony and different hierarchies even within the South. Hopefully, these can be discussed in another series called Geo-Reflections.

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# IN REMEMBRANCE

## Professor Shah Manzoor Alam
## (1928-2021)

It was my proud privilege to be a student of an illustrious scholar of international repute like Prof. Shah Manzoor Alam. He touched many lives, including mine, during his journey on Earth. He combined exceptional calibre, discipline and hard work, a mix challenging to find in the present-day context. When I was a student, I would see him walk into the Geography Department, Osmania University, at precisely 8.30 AM. Once his car failed two kilometres away from the Department, he still walked in to meet our class at 9 AM. That was his sense of discipline. He is a role model for the coming generations. He had a keen and alert mind and would keep abreast of the latest technologies, and age was not a deterrent on this count. His motto was that if the institution grows, we grow with it. This principle guided him throughout his life. He had set exceptionally high standards for research and teaching and was an institution builder par excellence. He has a brilliant mind and could impart varying perspectives to issues and problems coming across his scrutiny.

Born on January 1, 1928, in Ghazipur town of Uttar Pradesh, Professor Alam had his early education in Gorakhpur and did his bachelor's and Master's degrees from Aligarh Muslim University, Aligarh. He was keenly interested in joining defence forces. However, destiny had something else in store for him. He entered teaching as a career in Uttar Pradesh. After a brief stint

there, he joined Osmania University, Hyderabad as a lecturer in Geography in 1952; this needs some elaboration.

In the aftermath of Independence in 1947 and the partition of India on religious lines, many faculty members from the Osmania University, Hyderabad, decided to migrate to newly born Pakistan. As a result, the then Vice-Chancellor of Osmania University was on a talent hunt all over the country to find suitable faculty members to fill the vacuum cleated in almost all the University Departments. Thus, Prof. Manzoor Alam landed at Osmania University, Hyderabad, from a college in Uttar Pradesh. While being employed in Osmania University, Professor Alam availed the British Council Travel Grant and the University of Edinburgh Scholarship to complete his Doctorate under the guidance of Professor Wreford Watson at the University of Edinburg.

Building institutes had been among his superb qualities. The Geography department was small when Prof. Alam joined and offered undergraduate courses. Professor Alam introduced the path-breaking PG Diploma in Cartography in 1967. The course was much sought after by the Survey of India officers. He did not stop here. Soon after, he started the Post Graduate Diploma in Urban and Metropolitan Planning and brought the University Grants Commission funded Special Assistance Program (SAP) for the Department in 1978. This was for upgrading the physical infrastructure and skill development. Under the scheme, the four faculty members went to upgrade their skills. But for his efforts and foresight, the Geography Department would have been obscure in the University, and he uplifted it to the present pedestal that it is on today. He also started the Centre for Area Studies at Osmania University in 1982. Indian National Cartographic Association (INCA), where prestigious government organizations such as Survey of India, Indian Space Research Organization, and National Hydrographic Organization interact with Geography Departments at the University was his brainchild; translated into reality in 1979.

He was among the few Indian Geographers who had a great vision with scholarship. When most Indian geographers were busy with regional studies, Professor Alam took the lead to planning and development studies. He took up the preparation of the Planning Atlas of Andhra Pradesh, highlighted the role of the spatial perspective in planning and brought around the planners to take cognition of maps as an effective tool in planning. I am told this Atlas bagged the President of India Gold Medal. Earlier, Professor Alam had drawn up the Master Plan of Hyderabad for the Hyderabad Urban Development Authority (HUDA), besides authoring books on Hyderabad-Secunderabad and Hyderabad Metropolitan Region. He has seven books to his credit and fifty research papers. His last book, 'War on Terrorism or American Strategy for Global Domination: Islamic Perspective on the Afghan-Iraq War', was published in 2009 by Vantage Press of USA. His writings have always been trendsetting and inspiring for the new generations. Apart from Urban Geography and Regional Planning, his interests included global warming, new astronomical findings, geopolitics, and natural disasters.

The Massey University, New Zealand and Macquarie University, Australia invited him as Visiting Professor to deliver lectures on Urban and Regional Planning. He was also a member of the Commission on Urban Development and National Settlement Systems of the International Geographical Union (IGU) from 1972 to 1980. He lectured widely in Malaysia and Eastern and Southern Africa. UNESCO utilized the services of Professor Alam to work on a project on 'Vulnerability and Resilience of Cities in India'. He also served as a Member of the Indian Council of Social Sciences from 1972 to 1975 and from 1988 to 1991.

Professor Alam took to energy studies and worked on a "Fuel Wood in Urban Markets" project, funded by the Resources for the Future, a Washington-based organization, and Joy Dunkerley – an American Economist. The success of this project deepened his interest in energy studies. He established the Institute of Energy and Environmental Studies in Hyderabad in 1990. In 1994, the Institute took up a World Bank-funded project on "Household Energy Consumption in Urban India—Case Study of Metropolitan Hyderabad." The project was jointly directed by Dr. Alam and Dr. Douglas Barnes of the World Bank.

Besides his academic insight, he was an administrator par excellence. Professor Alam held different posts in Osmania University like Head, Department of Geography, Dean, Faculty of Social Sciences, and Founder Director of Centre for Area Studies. Later he became Vice-Chancellor of Kashmir University. As a tribute to his contributions, the University Grants Commission selected him as National Lecturer in Geography in 1977. He was appointed Member of the Executive Council of several Central Universities of the Government of India. While on the Executive Council of the North-Eastern Hill University, during its formative years, Shillong played a crucial role in defining its development programmes.

He lost his only son to cancer a couple of years back, and when I went to meet him after a few days of that incident, he was his quiet self and never betrayed his emotions. He always spoke endearingly of his wife, who passed away long back. He also doted on his three daughters, who have come up well in life. Professor Alam remained academically active until his demise on June 22, 2021. With his passing away, the geography fraternity has lost a national figure, a legendary Geographer, an erudite scholar, a visionary and an able administrator.

May his soul rest in peace.

Kalpana Markandey,
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