Determinants of Infant mortality rate from NFHS-4 and AHS-3 data

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IN

ECONOMICS

BY

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May 2019

DECLARATION

I, ***Bikash Padhan*** *hereby declare that the work embodied in the present dissertation entitled* ***"Determinant of Infant mortality rate from NFHS-4 and AHS-3 data"*** *carried out under the supervision of* ***Prof. S. Sandhya,*** *School of Economics, for the award of Master of Philosophy in Economics from University of Hyderabad, is an original work of mine, and to the best of my knowledge no part of this dissertation has been submitted for the award of any research degree or diploma at any University.*

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I declare to the best of my knowledge that no part of the thesis was earlier submitted for the award of a research degree of any university or institute.

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Dedicated to

Smt. Binodini Padhan

Sri. Sansara Padhan

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Contents

List of tables

List of Figures

List of Abbreviations

AHS- Annual Health Survey

ANC-Antenatal care

BMI- Body mass index

CEB- Census Enumeration Block

IMR-Infant mortality rate

IFA- Iron folic Acid

MoHFW-Ministry of Health and Family Welfare

MDG- Millennium Development Goal

NMR-Neonatal mortality rate

NFHS- National family Health Survey

PMR-Post neonatal mortality rate

PNC-Post natal care

PSU- Primary Sampling Unit

TT- Tetanus Toxoid

WHO- World Health Organization

Chapter 1

Introduction

1.1 Introduction:

World Health Organisation (WHO) in 1946 defines Health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Health takes into account absence of disease, the mental and physical condition of individuals, which forms an integral part of a long and healthy life. Economists view healthy individuals as human capital that can help in the production process in an economy. Grossman (1972) states that health is a form of human capital as well as capital stock; it is like a durable good, which provides individuals with a healthy and good life. Health as a stock of capital provides services but it also requires investment. Individuals invest in health by taking medical care, insurance going for regular health check-ups. Clean environment, proper exercise, nutritious food, education, clean air contribute towards good health. The stock of health of individuals is not constant over a period, it falls down with increasing age and when it falls below critical minimum level death occurs.

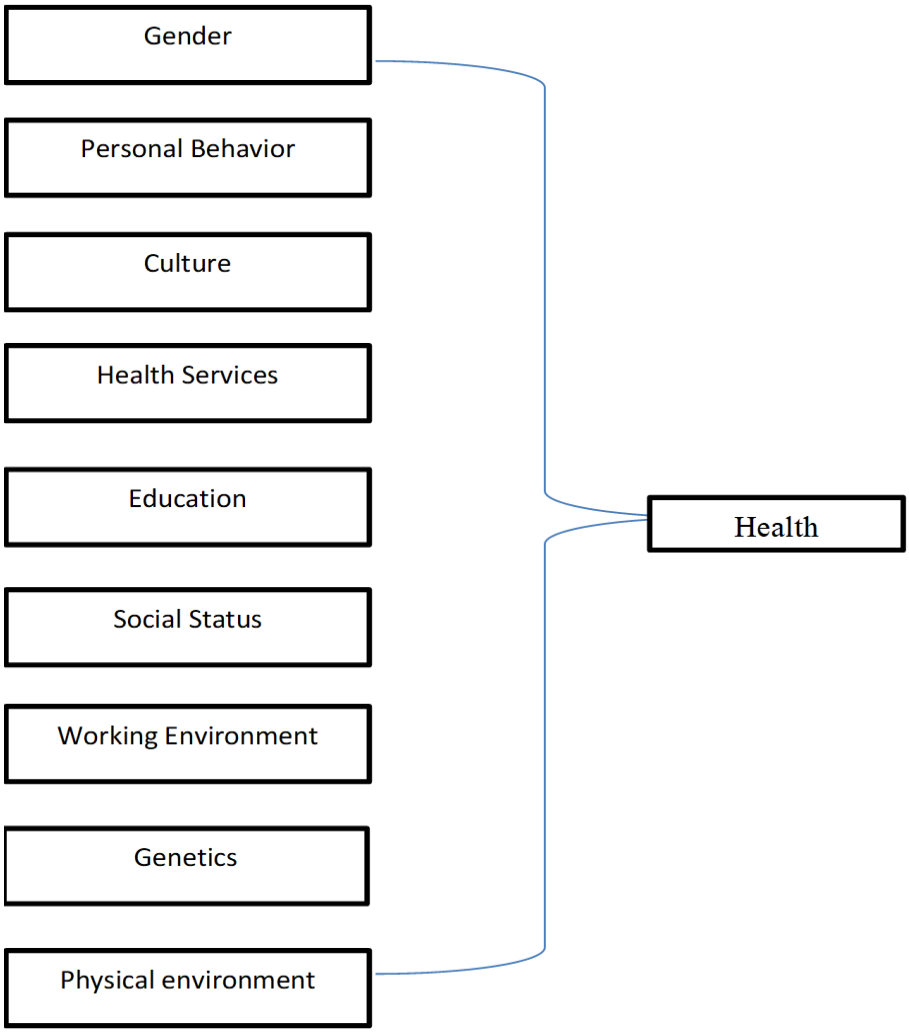
According to the World Health Organisation (1986) health is defined as "A resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities". This means that health shows a essential role in supporting the functioning of individuals and the existence of a full life depends on a healthy lifestyle. The "healthiness" of an individual or reduction of his stock of health depends on the controllable and uncontrollable factors such as socio-economic factors, cultural factors, environmental factor and the medical care he receives.

Health is a precise measure, which shows the quality of life. Ill-health creates an economic loss for individuals and households. Good health on the other hand represents a value of its own. Investment in health leads to increase in productivity and saving of time on sickness. On the other side, ill health leads to production loss due to sickness, absence from work, weakness, resistance to other causes in future. Sorkin (1976) relates good health with economic development saying that poor health leads to low labour productivity, a loan from private sources and the cost of taking care of the sick person. Ill health causes cost of infectious disease to others and reduces leisure and health of the family members. Good health generates positive

externalities in a society. Nordqvist (2017) is of the opinion that an individual with high socio-economic status can enjoy a better and healthy lifestyle because they are economically strong, educated and can afford health care whenever required. But, in case of low socio-economic status, it is difficult to enjoy a healthy life. Poor people have challenging daily lifestyle. It is difficult for them to maintain their daily expenses and with low income spending on health is very expensive for them. They cannot afford to spend on their medical care and that generate poor health. These constraints make them unable to access health care not only this but the culture and traditions of a family also affect the practice of health care services.

WHO (1946) defined the determinants of health on the basis of gender, health services, personal behaviour, culture, education, genetics, social status and working and physical environment. Male and female differences are found in case of the prevalence of diseases like ovarian cancer and breast cancer, which are found in women only and prostate cancer in men. The availability, accessibility and utilisation of health care services define the health condition of individuals. Personal preferences in terms of food habits and willingness to exercise are also choices that affect health. The belief and culture of an individual towards the practice of health care also determines his/her health condition. A person with education has a better understanding of health care services. Hereditary factors mostly affect the health in case of pregnancy. Pregnant woman with HIV positive will transfer the disease to her child. High income households are able to afford the health care services because their household economic condition is good. Working condition of an individual affects the health condition. For example, workers in cement factory are more likely to suffer from lung cancer as compared to agricultural workers. Household environment in which an individual lives also affect the health condition of an individual. This environment comprises of access to clean drinking water, air, sanitation and communication.

Figure 1.1a: WHO (1946) Determinants of Health



Source: World Bank, 1946

From the view of Economist, health is human capital and leads to economic growth. Health generates economic developments by increasing labour productivity, reducing time cost and family income loss and changing the attitude of a person towards growth creating activity. Health is a major factor that contributes to increased productivity, healthy and a long life. Better health is a signal of human welfare and economic advancement. It also affects the development and poverty reduction in a developing economy. A developing country can make better health programs and policies in order to make use of the human capital and have a healthy and productive population.

1.1.1 Health indicator : Infant mortality rate (IMR)

While there are many health indicators that reflects the health status of a country and state. Infant mortality rate reflect the socio-economic status of a country and state. One of the important indicators of health is IMR. “No fact is better established than that the death rate, and especially the death rate among children, is high in inverse proportion to the social status of the population” Newsholme (1910). Children are assets of a country and it is necessary to provide them the proper quality of care to reduce IMR. Since it is a sign of the socio-economic progress of a country; both National and International organizations are looking for reducing it and promoting child survival.

Children are the future and vulnerable part of a society. They are at risk of infectious diseases and malnutrition. So all the societies should make sure about their healthy growth and development.

Infant mortality is a health indicator and it reflects the socio-economic and cultural situation of a community, social group and country. It reflects the public attitude towards the value of human life. Infant mortality reflects the condition of state health, environmental situation, socio-cultural practices, cultural patterns about feeding and caring for health.

Infant mortality decides the forthcoming growth of the population of the country. The control of infant mortality means control of fertility rate. Also, an effective reduction in infant mortality leads to lower birth rate. Infant mortality affects the future working population of a country. When infant mortality is high, it directly affects the future adult population of the country. IMR is not only a question of the socio-economic and environmental conditions but it also reflects the motherhood. It shows the maternal health problems.

Improvement in socio-economic conditions brings changes in IMR and IMR is the most important determinant for the health of children in a nation. According to a study by Chandrasekhar (1972), reduction in infant mortality has taken place mainly due to modernization and industrialization of societies.

If IMR in a society is high due to the problem of inadequate socio-economic, environmental and health-related facilities then it means that the society has neither made effective policies nor programmed to control it. Hence, IMR is the greatest reflective and reliable indicator reflecting the socio-economic and health condition of a society.

1.1.2 Definition of IMR:

OECD (2006) defined IMR as "The Infant mortality rate is the number of deaths under one year of age occurring among the live births in a given geographical area during a given year, per 1,000 live births occurring among the population of the given geographical area during the same year."[1] Infant mortality is defined as the death of children within age one. It has been clear from the above definition that infant mortality does not include foetal death or stillbirth.

WHO defined live birth in 1950 as "Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life - e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles - whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born" [2]

WHO (1950) defined "Foetal death as death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy and which is not an induced termination of pregnancy; the death is indicated by the fact that after such expulsion or extraction, the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps" [3]

IMR is calculated by dividing the number of child deaths below age one by the number of live births multiplied by 1000.

$$IMR = \frac{\text{Number of child deaths below age one}}{\text{Number of live births}} \times 1000$$

IMR is divided into neonatal mortality rate (NMR) and post-neonatal mortality rate (PMR). Again, NMR is divided into Early-neonatal mortality rate and Late-neonatal mortality rate. NMR is the death of a child from birth to first month of life and PMR is the death of a child from first month to one year.

[1] Chandrasekhar,S. (1972): Infant mortality, Population growth and Family planning in India. USA: Routledge publication
[2] Ibid
[3] ibid

The NMR and PMR are expressed as death per 1000 live births within one month and one month to one year respectively.

NMR = Number of child deaths within one month x 1000

Number of live births

PMR= Number of deaths within the age of one month to one year x 1000

Number of live births

Early-neonatal mortality is the death of a child from birth to the first week and Late-neonatal mortality is the death of a child from the first week to one month.

1.1.3 India's Scenario in IMR:

Table 1.1: IMR in various countries

Country	IMR
India	32
China	8
Sri Lanka	7.50
Bangladesh	26.90
USA	5.70
Singapore	2.20
Nepal	27.80
Pakistan	61.20
Indonesia	21.40
Norway	2.10
Bhutan	25.60

Source: World Bank 2018

The world IMR indicates that IMR is high in Pakistan (61.20) and lowest in Norway (2.10) and in India, it is (32). In India IMR is higher than the neighbouring countries like Bhutan, Bangladesh, China and Nepal.

1.1.4 Indian States and Millenniums Development Goal- 4

Goal 4 of the millennium development is to decrease the IMR to 29 from 1990 to 2015. IMR has been gradually reducing in India over a period of time, but it is not achieving the

Millennium Development Goal-4. According to the National Family Health Survey (NFHS) 2015-16, India's IMR is 41 in total areas and in case of rural areas it is 46 and in urban areas, it is 29. The NFHS-4 data shows that India has not achieved the MDG-4 in rural areas and total areas.

Data from Table 1.2 show that most of the states have not achieved the MDG-4. But few states have achieved the MDG-4,like Karnataka (28) Maharashtra (24), Arunachal Pradesh (23), Manipur (22), Nagaland and Punjab (29), Tamil Nadu (20), Goa-13 and Kerala-(6). In case of rural areas, MDG-4 has been achieved in Manipur (25), Arunachal Pradesh (24), Maharashtra (24), Tamil Nadu (23), Goa (10) and Kerala (5). In case of urban areas, most of the states have achieved the MDG-4. In urban areas, Chhattisgarh and Madhya Pradesh (44) Jammu and Kashmir (37), Bihar (34), Jharkhand (31), Uttar Pradesh-(52), Haryana (31) and Mizoram (31) have not achieved the target.

Table 1.2: State wise IMR in rural and urban India

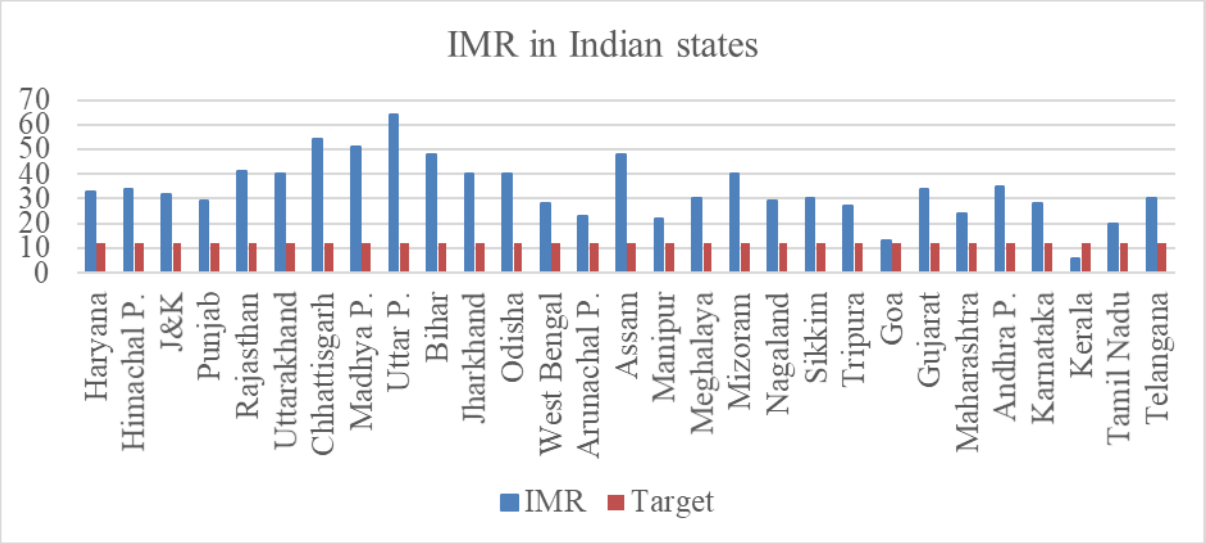
States	Rural IMR	Urban IMR	Total IMR
Haryana	34	31	33
Himachal Pradesh	35	18	34
Jammu and Kashmir	31	37	32
Punjab	34	22	29
Rajasthan	44	31	41
Uttarakhand	38	44	40
Chhattisgarh	56	44	54
Madhya Pradesh	54	44	51
Uttar Pradesh	67	52	64
Bihar	50	34	48
Jharkhand	50	31	40
Odisha	43	21	40
West Bengal	32	16	28
Arunachal Pradesh	24	19	23
Assam	50	28	48
Manipur	25	16	22
Meghalaya	32	16	30
Mizoram	50	31	40
Nagaland	33	21	29
Sikkim	38	13	30
Tripura	32	12	27
Goa	10	7	13
Gujrat	39	27	34
Maharashtra	24	23	24
Andhra Pradesh	40	20	35
Karnataka	33	19	28
Kerala	5	6	6
Tamil Nadu	23	18	20
Telangana	38	20	30

Source: NFHS-4 (2015-16)

1.1.4 Sustainable Development Goal-3:

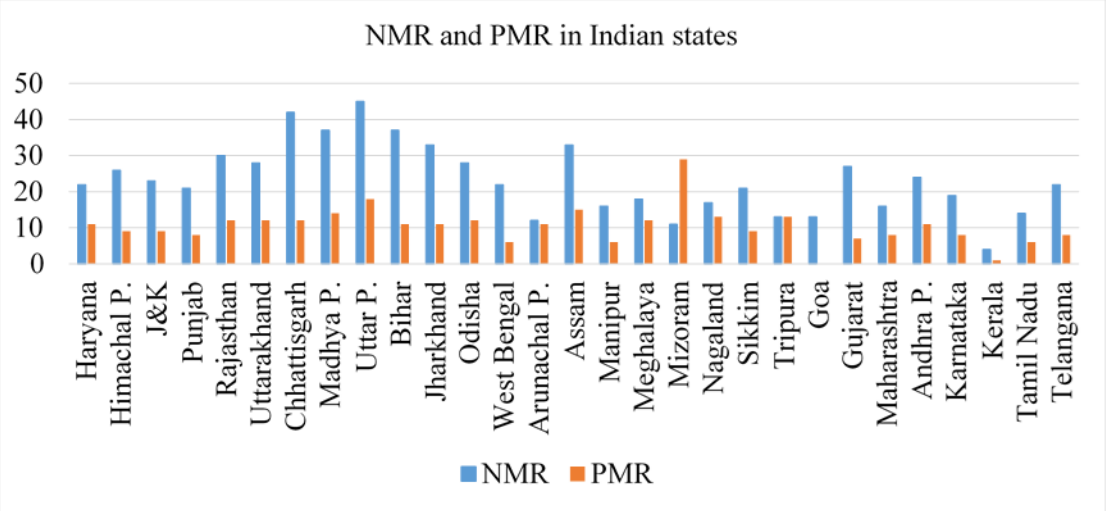
The Sustainable Development Goal 3 is to reduce IMR to 12 by 2030. Kerala as a state has reduced IMR to 12. In case of rural and urban areas, Kerala and Goa have achieved it.

Figure 1.1b: Sustainable Development Goal-3 and Indian States



Source: NFHS-4 (2015-16)

Figures 1.1c: NMR and PMR in Indian states:



Source: NFHS-4 (2015-16)

The figure 1.1c shows that NMR is higher than PMR in all Indian states except for Mizoram (rural= 29, urban=11). The NMR is more than 30 in the states of Madhya Pradesh, Chhattisgarh, Assam and Uttar Pradesh. The NMR is ranging from 4 in Kerala to 45 in Uttar Pradesh and the PMR is ranging from 0 in Goa to 29 in Mizoram.

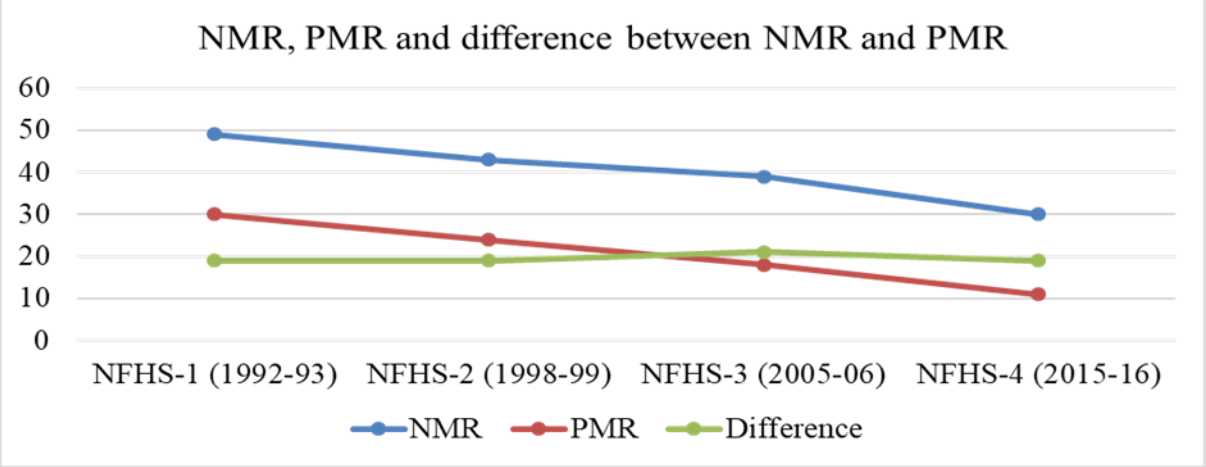
Table 1.3: IMR, NMR and PMR trends in India

Period	IMR			NMR			PMR		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
NFHS-1 (1992-93)	85	56	79	53	34	49	32	22	30
NFHS-2 (1998-99)	73	47	68	47	32	43	27	15	24
NFHS-3 (2005-06)	62	41	57	43	29	39	20	13	18
NFHS-4 (2015-16)	46	29	41	33	20	30	12	8	11

Source: NFHS-4 (2015-16)

Data from Table 1.3 show that IMR in India has declined from 79 to 41 from NFHS-1(1992-93) to NFHS-4 (2015-16). NMR and PMR have also declined from 49 to 30 and 30 to 11 respectively from NFHS-1 to NFHS-4.

Figures 1.1d: Trends of NMR and PMR, and gap between NMR and PMR

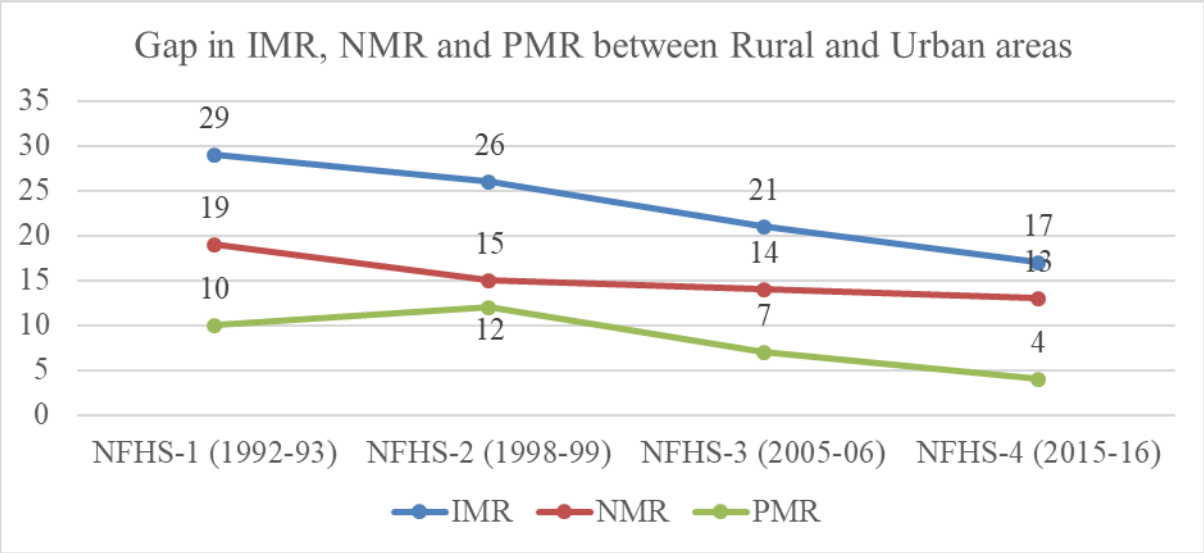


Source: NFHS-4 (2015-16)

Figure 1.1d shows that the NMR in India was higher than the PMR during the period of NFHS-1 to NFHS-4. Although NMR and PMR have declined from NFHS-1 to NFHS-4, but the gap between them is still prevailing in NFHS-4. The gap between NMR and PMR is 19 during the periods of NFHS- 1 and NFHS- 2. Again, it rises to 21 in NFHS- 3, and in NFHS-4 it is again 19. The gap between NMR and PMR in 2015-16 is still same as 1992-93. This reflects the fact that chances of infant death within one month is higher as compared to one month to one year.

Data from Table 1.3 also reflects the fact that IMR, NMR and PMR are higher in rural areas. These differences between rural and urban areas in IMR, NMR and PMR are found among NFHS-1 to NFHS-4. So, the divergence in health indicators of rural and urban areas show that there may be a differential in socio-economic, health and environmental conditions. Although there is a significant decline in IMR, NMR and PMR from NFHS-1 to NFHS-4, but the difference between rural and urban is still present. This clearly show the disparity in rural and urban health indicators. Another interesting thing is that the NMR is greater than the PMR in all the periods.

Figure 1.1e Rural and Urban gap in IMR, NMR and PMR from NFHS-1 to NFHS-4



Source: NFHS-4 (2015-16)

Figure 1.1e represents the gap in IMR, NMR and PMR between rural and urban areas from NFHS-1 to NFHS-4. However, the gap in rural and urban areas among these three indicators has declined from NFHS-1 to NFHS-4. In NFHS-4 the gap in PMR is 4 and in IMR i.e. 17 and in case of neonatal mortality it is 13. Also, the gap in case of IMR is always high and low in PMR in all periods. PMR has increased from 10 to 12 from NFHS-1 TO NFHS-2 and again

its declines. But in the case of NMR, it was found that from NFHS-3 to NFHS-4 it declined by only one point. Within 10 years the gap between rural and urban areas in NMR had declined from 14 to 13 point.

Data from Table 1.4 show that IMR in given 14 district is more than 40 in 2012-13. The 14 districts of Odisha and the state of Odisha, is far behind the MDG-4. IMR is higher in Balangir (97) followed by Puri (75), Khordha (67), Bargarh (60), Rayagada (58), Cuttack and Ganjam (56), Kendujhar (53). These districts having more than 50 infant death per 1000 live births. Districts like Jharsuguda (42), Baleshwar (45), Sambalpur and Sundargarh (47), Anugul and Koraput (48) having less than 50 IMR.

IMR and NMR are higher in rural areas than the urban areas in the 14 districts. PMR is higher in urban areas of Jharsuguda and Khordha districts and other districts are having a high PMR in rural areas than in urban areas. So, the regional difference is found in child health outcome. IMR is higher in rural areas as well as urban areas in the district of Balangir, Puri and Khordha. In the case of rural areas, districts like Jharsuguda and Baleshwar have less than 50 IMR and other districts have more than 50.

Table 1.4: IMR, NMR and PMR in Odisha and Districts of Odisha from AHS-3 (2012-13)

Odisha and Districts	Infant mortality rate			Neonatal mortality rate			Post neonatal mortality rate		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Odisha	59	37	56	39	23	37	20	14	19
Rayagada	61	36	58	31	11	28	31	25	30
Sundargarh	55	25	47	38	19	33	17	7	14
Koraput	50	35	48	33	23	32	17	15	17
Kendujhar	54	48	53	42	37	41	12	11	11
Sambalpur	59	27	47	41	15	32	17	12	15
Jharsuguda	45	36	42	39	27	34	6	10	8
Balangir	99	71	97	73	54	71	26	17	25
Bargarh	62	37	60	48	26	46	14	11	14
Anugul	50	38	48	37	31	36	13	7	12
Baleshwar	46	36	45	34	24	33	13	12	12
Khordha	73	60	67	49	35	43	24	25	25
Cuttack	67	29	56	43	13	35	24	15	21
Ganjam	62	20	56	39	13	35	23	7	21
Puri	80	48	75	43	29	41	37	18	34

Source: AHS-3 (2012-13)

In the districts of Odisha, the NMR is greater than PMR. This means the chances of death is higher in the first month of life than the post-neonatal period. The NMR is higher than the PMR in the major 13 districts except for Rayagada , which has high PMR than NMR. In addition, both the region have more NMR than PMR except for Rayagada. This shows that NMR contribute to a major portion of IMR.

1.2 Review of literature:

The review of the literature is arranged by grouping the variables that affect IMR.

Chandrasekhar (1972) has taken 1920 to 1965 years of data on infant mortality from the Vital Statistic of India and shown that neonatal death is more than postnatal death in a society with high socio-economic status. But, post-neonatal death is low and inversely related to the socio-economic condition. The infant mortality is low with high-income family and high with a low-income family. Reddy and Sholapurka (1983) conducted a primary survey in mid-1977 about 2000 pregnant women, and found that NMR of children is dependent on the delivery done by a traditional birth attendant or trained birth attendant. Mahadevan (1985) identified that the causes of infant mortality are different in both neonatal and post-neonatal period. Most of the causes are due to malnutrition, prematurity, asphyxia and delivery problems during neonatal period. Infant death in neonatal period is mostly due to birth-related problems, the poor health condition of the mother in the perinatal period and disease like tetanus, deaths after one month is due to socio-cultural and economic causes. Andreev (1991) has found that the IMR is determined by environmental factors, socio-economic on one hand and maternal health care, hereditary factors on other hands. Neonatal deaths are due to endogenic and PMR are due to exogenous factors.

Pradhan and Arokiasamy (2006) using NFHS-2 data for Odisha examine that women without TT (Tetanus Toxoid) in pregnancy are having high chances of neonatal mortality than the women who received. All the bio-demographic factors, age of women during delivery, birth interval, birth weight, birth order and nutritional level of mother have an influence on neonatal mortality. Shanker (2016) uses data on neonatal mortality from period 2000 to 2013 to show variations in NMR across Indian states due to divergence in health and social inequality. He found that population that belongs to lower social status and an unprivileged group has high neonatal mortality. The unprivileged section of the society like the tribal population and the scheduled caste are educationally and economically backward and have higher neonatal deaths in India. States with low per capita net state domestic product have a higher NMR.

The above literature shows that the factors affecting neonatal mortality and PMR are different. Neonatal mortality is determined by the maternal and child health and PMR is determined by the socio-economic and environmental factors. This show that infant mortality is a multivariate function and affected by many factors such as maternal, child, educational, economic, social and environmental factors.

1.2.1 Maternal and Child health factors:

Shanti (1977) has found that the age of mothers is a factor affecting the delivery of children and pregnancy linked problems. Age of mother defines her maturity and experience. Therefore, in case of young mother it is difficult to take proper care of children as she is immature and inexpert. Above 30 years of age of mother also leads to high risk of pregnancy related problems because of increasing inflexibility of the female reproductive organs. Prakasam (1993) in his study in Anantapur District of AndraPradesh, found that the chances of infant loss was higher for mothers whose previous child has died in infancy, than those mothers whose previous child has survived. When the first pregnancy result is not a live birth, the second pregnancy result is also not a live birth, and may have a possibility of stillbirth or abortion. The desire to replace child loss is high in those communities where infant mortality is high which causes repeated pregnancies and the low birth interval due to the fear of loss and this is the reason for infant and maternal mortality.

Mishra and Rutherford (2000) found that almost 50 percent of children are malnourished below the age of four based on NFHS-1 data. Mothers' education acts as a crucial element in defining the nutritional status of children even after controlling the other socio-economic variables. Malnutrition is the lowest among the literate women. Mothers with little or no literacy status have a low nutritional status of their children than the educated mothers. So there is an essential requirement for women to be educated and for nutritional programmes that can help in improving the child mortality. Singh and Pallikadavath et.al. (2014) found that ANC, which has positive effect on the health of children and mothers has an inverse relationship with neonatal death. At least four ANC visits can control the health outcomes of mother and child. Birth asphyxia, pre-mature birth, the low weight of the baby can be averted through taking IFA tablets. Neonatal death due to tetanus can be reduced by giving TT injections to mothers.

Altman and Sidney et.al.(2016) did a community based case study in three districts of Gujrat during July 2013 to November 2014. The study focused on the socio-economically poor sections of society, where 96 percent having BPL card and risk of neonatal death is high.

Babies born to mothers having complications during delivery experience double chance of neonatal death than mothers who have no such complications. It is found that the cause of death of newborn is an infection, pre-mature birth, low birth weight or breathing problems. Institutional delivery is a safeguard against the neonatal death if the complication is self reported by women during delivery. Maternal health plays significant role in IMR.

Pappachan and Choonara (2017) found that the health condition of child is dependent on maternal health. An undernourished mother is prone to have a undernourished infant. Antenatal care (ANC) is essential for the healthy baby. ANC is more or less common in Tamil Nadu, Kerala and Goa. Uttar Pradesh, Rajasthan, Jharkhand and Bihar are bigger states having worst condition in ANC. The difficulties in getting into healthcare are demonstrated by the challenges faced by the pregnant women in availing healthcare and visiting to the hospital. It further show that maternal health care affects infant health. Mothers' use of antenatal care services, IFA tablet, tetanus toxoids, institutional delivery, maternal age, nutrition and education affect the infant mortality. IMR is thoroughly associated to the health of the mother.

Young and Jiang (2019) using data from the National Population Study of 1.99 million children born in Denmark in the years 1981-2015 found that infant death are higher among the women with short term education (less than nine years of education) or no education. Also, women with premature birth and low fetal weight have an increased risk of their child dying during the first year.

1.2.2 Socio-economic factors:

The socio-economic and environmental factors of a household are related to infant mortality. Graham (1984) analysed that Infant death is more in the working-class family than the professional family because the chances of children suffering from illness, respiratory and infectious diseases are high in the former than the later. Also, working class family cannot meet the expenses of health requirement of the children satisfactorily. Working class women cannot take accurate care of herself and her child and can afford to neither herself nor her family. Mosiur and Mostofa et.al. (2010) found that educated, wealthy, not working women can take-care of their children better than working women. So the rate of ARI and Diarrhoea are lowest among educated, wealthy women than working women. Working women have less care to their children and unaware about the children health condition. The wealthy family uses proper pipe water, toilet, access health expenditure and able to care for the mother and the newborn baby

than the poor family. Where there is deficiency of safe drinking water and sanitation facility and unable to access health care services.

Baird and Friedman et.al. (2011) in a cross-country study of 59 developing countries of the World, found that a reduction in per capita income leads to low level of living status and expenditure. These lead low outgoings on household food nutrition, health services and incompetence to maintain clean water, proper sanitation and other health care facilities. Another serious conclusion of the negative shock of per capita income is that parental times for childcare reduced.

Jyoti and Halad (2013) in eight districts of north Karnataka examined the determinants of NMR. Children of mothers belonging to agriculture and the non-agricultural sectors as blue-collar workers, collie or casual workers are having high neonatal and postnatal death. Women below 18 years of age or not matured at the time of delivery having more IMR. Mother education and information can handle the healthiness of children as she can direct the suitable usage of child nutrition. Shanker (2016) found that, economic situation of a family reflects their household environmental condition. The environmental condition of the household such as clean drinking water, proper sanitation facility, indoor air pollution cause neonatal death. Lack of sanitation facility causes infectious diseases and unhygienic condition of the house leading to death.

Pappachan and Choonara (2017) found that economic wellbeing of women is indispensable for the child health. In rural areas, in order to travel to the hospital or spending on health care, women generally take the consent from a man of her family. The case is also identical to the urban women.

Mukharjee and Dasgupta et.al (2019) using Sample Registration Survey 2015 data on state level examine that IMR is determined by employment status, education of women, availability of neonatal care services, income inequality in rural areas. Employment status of women and higher the income gap between rich and poor directly affect IMR. Availability of neonatal care services and education of women reduce the chances of IMR.

It is no twist of fate that Kerala is having high women education as well as child health. Education along with financial independence are significant contributing factor of child healthiness in India.

The socio-economic condition of a household determines their capability of practice of health care services and their affordability. In addition, it reflects their accessibility and awareness about health care services.

1.2.3 Environmental factors:

Graham (1984) analysed that environmental factors such as poor housing, inappropriate nutrition, lack of infrastructure, unsafe livelihood, etc. makes differential in child health. Mishra and Retherfords (1984) brought out the effect of cooking fuels on IMR. Family having no separate kitchen room leads to high risk of ARI in children than a family with separate kitchen. Also, the negative effect of pollution is high for small children who are less than one or two years old, when their mothers are cooking because they are mostly with their mother on her back or lap. This study shows that poor housing condition is expected to affect ARI. Mothers education, socio-economic status, culture, religion, the class also affect the use of biomass.

WHO (2011) analysed that hygiene, cleanliness and sanitation can remove the fear of diseases. Proper drinking water consists of its safe storage, treatment, and supply through the pipe. Similarly, proper sanitation and awareness among individual regarding cleaning hand by soap (before food making and after toilet) is a good measure of health. Which can control diarrhoea but the individual mindset has a great role to play. Environmental conditions of a household in which a child survive determine their health condition. Households with poor environmental conditions having a high chance of infectious disease and leading to infant mortality.

Sankar and Neogi et. al (2016) found that neonatal mortality rate declined from 52 per 1000 live births in 1990 to 28 per 1000 live births in 2013. But the rate of decline has been slow. The chances of new born mortality is high due to inadequate water and sanitation, indoor air pollution, crowding and poor housing conditions, women with low BMI, low birth weight of children, pre matured birth, lack of utilization of health care services.

1.2.4 Supply side problems of health care in India:

Andes (1989) in a study of 124 communities of Peru found that the use of health facilities rest on the network of social constraints. Individuals' health condition depends on the availability of health services, the ability to purchase and utilize it. Rao and Mishra et.al. (1998) in their study built on the NFHS-1 data analyzed that the information regarding the treatment of

Diarrhea is necessary and in this case mass media plays an important role. It shows that women's education leads to an understanding of health care services and its proper utilization.

Kesterton and Cleland et.al. (2010) examined the problems in receiving ANC. The availability of transports, the high cost of transports, lack of infrastructure and distance to health facilities are still preventing the access and consumption of care. Similarly, the status of women, the cost of care, lack of wakefulness about delivery, unacceptable experience in previous health care and poor quality of care from hospital and belief in TBA are obstacles in the attainment of institutional delivery. Barik and Thorat (2015) shows that the prevalence of difficulties in getting health facilities in rural areas. Rural areas in India were usually excluded and ignored. Lack of education and poverty persists in rural areas than the urban areas, which cause low health care alertness in the rural areas. Indian health care system is mainly focused on urban areas. Access to the utilization of health care services in the rural areas are difficult. People in the rural area prefer private health centres due to unavailability and high distance to public medical care. And the major diseases are untreated due to the absence of a diagnostic facility near the local area. But in the case of the urban areas, only few portions of major illnesses are untreated. Another reason is long distance to government hospital than private health providers.

Sharma (2016) found that in case of urban areas, huge number of people from the population are unable to meet the basic health care that is needed due to financial or other problems. The use of ANC services and institutional delivery changes with the economic status of the family. Women belonging to slums have less chances of using health care and they rarely go for institutional delivery. Also, the use of these services and teenage pregnancy vary with socio-economic status in the urban area. Again, in the case of urban area health care system mainly focuses on curative care, secondary and tertiary care and not on primary care. Also, most of the hospitals are the private sector and not affordable for poor people. Slum population faces more unhealthy environmental problems such as unavailability of safe drinking water, proper sanitation facility, clean air and overcrowding etc.

The review of literatures identifies the following factors affect IMR: education of women, environment of households, income of households, use of health care services by women and children, age of women, absence of health care services, awareness regarding health care services, insufficient infrastructure and transportation facility, beliefs in traditional methods and lack of financial support.

1.3 Research gaps:

Form the above literature review it has been observed there are not many studies based on recent data to look at the factors determining IMR and the reasons for not meeting the MDG-4 in 2015-16 at the state level in India. There are not many studies to find the determinants of IMR in Odisha at the district level and to find the differences in determinants of IMR, NMR and PMR between the rural and urban areas of Odisha at district level.

1.4 Need for the study:

Health of a household or an individual depends on both the demand and supply side variables. The demand side of health is explained by the practice of health services whereas the supply side of health depends on the availability of health care services. The practice of health services is based on the income of households, socio-cultural factors, awareness of health care, communication and beliefs. On the other hand, obtainability of medical care depends on the supply of health services from the government and private sources.

Nguyen and Kim (2016) have done a survey on 4,052 households of Vietnam on the practice of health care services by newborn age less than 24 months. They found that visits to health care services depend on both demand and supply-side factors. Demand-side factors such as education of women, household occupation, maternal ethnicity and women's age are leading causes in the practice of health care services. Also exposed to mass media and awareness about the services affect the utilization of services. On the other hand, availability of staff, infrastructure facility and quality of care are the main supply-side factors affecting visits to health care. Demand creation activities likes income, awareness about health facilities are important for visits to health care centers and its appropriation.

There is a regional divergence in IMR in Indian states, which affects the future working population of a country. The gaps between rural and urban areas is still prevailing in case of IMR, NMR and PMR. Although NMR and PMR has declined form 1992-93 to 2015-16 but, the gap between NMR and PMR is still same. So, reduction in IMR is necessary for meeting the MDG-4 and development of the country. There is district wise disparity in IMR, NMR and PMR in Odisha. In this context, it is important to examine the factors affecting the IMR, NMR and PMR, and the rural and urban differences in the IMR. The present study is an endeavour to find the factors affecting IMR, NMR and PMR by using NFHS-4 data and AHS-3 data.

1.4 Research questions:

1. Why some Indian states are failed to achieve the MDG-4?
2. What are the factors creating a regional divergence in IMR, NMR and PMR in Indian states and at the district level in Odisha?

1.5 Objectives of the study:

1. To examine the relationship between the environmental factors, maternal factors and socio-economic factors with IMR, NMR and PMR at the state level in India.
2. To analyze the factors affecting IMR, NMR and PMR at the district level in Odisha.

1.6. Conceptual framework:

IMR is a multivariate function. It is determined by both the demand and supply side factors. It is determined by the social, economic, maternal, children, environmental and demographic factors. Present section provides the analytical framework for the determinants of IMR.

Pichat (1951) suggested an explanation that the essential factors affecting IMR are endogenous and exogenous factors. The endogenous variables are maternal and child health factors. Whereas, exogenous variables are the economic, environmental and social factors. The endogenous factors such as maternal and child health are depend on the availability, accessibility, utilization and awareness regarding the health care services. The exogenous factors are depend on the availabilities, income, preferences, beliefs and practices, religion, sex etc. Mosely and Chen (1984) defined the determinants of IMR as maternal factors, nutritional factors, personal hygiene, injuries and environmental factors.

Daugherty and Kammeyer (1995) found that IMR replicate the socioeconomic improvement of people. Societies having the highest IMR have the most backward socio-economic development. The study is based on the framework of the "Theory of Demographic Transition", which states that social improvement and economic progress will have a drop in mortality and fertility rate. The social improvement and economic progress creates better quality of standard of living, clean environment, accessibility and utilization of health care, improvement in nutrition and advance in medical and technology lower the mortality rate. Therefore, higher the socio-economic development of society, lower the IMR.

The present study is based on both types of variables. The maternal factors are the percentage of women with at least 4 ANC visits, percentage of women with at least 2 TT, percentage of

women with PNC, percentage of women with low BMI, percentage of women who consumed IFA tablets for more than and equal to 100 days. The child health factors are the percentage of children taken for health checkup within 2 days of birth, the percentage of children with birthweight less than 2.5 kg. The economic factor is the percentage of households with lowest wealth index. The environmental factors are the percentage of households using clean cooking fuels, percentage of households with proper sanitation facility, percentage of households with improved sources of clean drinking water. The social factors are the percentage participation of women in work participation from the age of 15 years and above, percentage of women up to 10 years of education and above, percentage of women's literacy, percentage of women participated in households decisions making, percentage of women married before the legal age.

1.7 Hypotheses:

The following hypotheses were set from the literature review.

1. Children health check-up after delivery reduces NMR and IMR
2. Low birthweight children (less than 2.5 kg) will result in high NMR and IMR.
3. Women with IFA tablets for 100 or more days, women with at least 3 or 4 ANC visits and at least 1 or 2 TT and post-natal care will experience lower NMR and IMR
4. Women with low body mass index will experience high NMR and IMR.
5. PMR and IMR will be lower for women who are literate and with 10 or more years of education.
6. Women married before the age of 18 years will experience higher PMR and IMR.
7. Women participation in household decision-making and in work will have lower PMR and IMR.
8. Households with the lowest wealth index will have high PMR and IMR.
9. Households with improved source of drinking water, proper sanitation facility and clean cooking fuel will have lower PMR and IMR.
10. Women who had caesarian section delivery will have lower NMR and IMR.

1.8 Chapterisation :

Chapter 1 gives the Introduction. This chapter includes the importance of health for human beings, determinants of health and importance of infant mortality. It also gives literature review, gaps in literature, need for the study, research questions, objectives of the study, conceptual framework, hypotheses and chapterisation.

Chapter 2 describes the Methodology part. In this part variables, measurement of variables, sources of data collection in case of both state level in India and district level in Odisha are given. It also specifies the econometric tools used for the analysis.

Chapter 3 explains the determinants of IMR, NMR and PMR state wise during the period of NFHS-4 (2015-16) for total, rural as well as urban areas. The results of the multiple linear regression models and discussions are given.

Chapter 4 describes the district wise analysis of the determinants of IMR, NMR and PMR in total, rural and urban areas in Odisha. The results of the multiple linear regression models and discussions are given.

Chapter 6 gives the conclusions and policy suggestions.

Chapter 2

Methodology

2.1 Introduction:

In order to meet the aims of the study and for empirical verification of the premise, data has been collected from selected secondary sources. The present study focuses on IMR in Indian states and in selected districts of Odisha. So data has been taken for Indian states and districts of Odisha for both rural and urban areas. The first objective of the study is based on the data from National survey done by the Ministry of Health and Family Welfare (MoHFW) are known as NFHS-4. The second objective is based on district level of Odisha and data is taken from AHS-3. The study is based on aggregate level data of NFHS-4 and AHS-3. Multiple linear regression is used as an econometric tool for data analysis. This chapter describes the sources of data, sampling design, variables used in this study, measurement of variables, the hypothesis of the study, uses of model and technique used for data analysis.

2.2 Data Sources:

The first objective is to find out the relationship between the demographic factors, environmental factors, maternal factors and socio-economic factors with IMR, NMR and PMR. Data from 29 states and for rural and urban areas was collected from NFHS 4 (2015-16). NFHS 4 is the latest data set available lead by MoHFW, Government of India in collaboration with International Institute for Population Science, Mumbai, India and Macro International, Maryland, USA. NFHS-4 has collected data on 29 states and all Union Territories of India. NFHS-4 has collected data for both rural urban areas of all states, and district level indicators of 640 districts of country as per 2011 census.

It provides data on many key indicators like population, child health, maternal health, maternal and child survival, family planning, nutrition, diseases, household socio-economic variables, violence against women and women empowerment. Moreover, it gathers data on demographic and economic and social related factors of respondents for a detailed analysis. This analysis helps in policy and decision making about health, family planning etc.

The second objective deals with analysing the factors affecting IMR, NMR and PMR in the districts of Odisha. District-level data was collected from the AHS 2012-13, Office of the Registrar General, Government of India. AHS collected data on 284 districts of 9 high focus states, like Jharkhand, Uttarakhand, Odisha, Uttar Pradesh, Assam, Madhya Pradesh

Chhattisgarh, Bihar and Rajasthan. These states are having high mortality and fertility with nearly 48 per cent of India's population. AHS aims to provide data on the district level health indicators. AHS provides data on child health and maternal health, fertility and mortality, the prevalence of diseases and family planning etc.

2.3 Sample Design:

In all, 28,586 Primary Sampling Units (PSUs) were selected across the country in NFHS-4, of which fieldwork was completed in 28,522 clusters. The NFHS-4 sample is a stratified two-stage sample. The 2011 census served as the sampling frame for the selection of PSUs. PSUs were villages in rural areas and Census Enumeration Blocks (CEBs) in urban areas. PSUs with fewer than 40 households were linked to the nearest PSU. Within each rural stratum, villages were selected from the sampling frame with probability proportional to size (PPS).

In each stratum, six approximately equal substrata were created by crossing three substrata, each created based on the estimated number of households in each village, with two substrata, each created based on the percentage of the population belonging to scheduled castes and scheduled tribes (SCs/STs). Within each explicit sampling stratum, PSUs were sorted according to the literacy rate of women age 6 and above years.

The final sample PSUs were selected with PPS sampling. In urban areas, CEB information was obtained from the Office of the Registrar General and Census Commissioner, New Delhi. CEBs were sorted according to the percentage of the SC/ST population in each CEB, and sample CEBs were selected with PPS sampling.

In every selected rural and urban PSU, a complete household mapping and listing operation was conducted prior to the main survey. Selected PSUs with an estimated number of at least 300 households were segmented into segments of approximately 100-150 households. Two of the segments were randomly selected for the survey using systematic sampling with probability proportional to segment size. Therefore, an NFHS-4 cluster is either a PSU or a segment of a PSU. In the second stage, in every selected rural and urban cluster, 22 households were randomly selected with systematic sampling.

AHS uses uni-stage stratified simple random sampling for villages with population less than 2000 without any replacement. Two-stage stratified sampling is followed if the population is more than equal to 2000. Villages in rural areas and CEBs in urban areas are considered as the sampling units. Villages with a population of less than 200 are not included in sampling and

villages having more than 2 percent of district population are also excluded. Each stratum is a sampling unit in case of villages with less than 2000 population and with more than or equal to 2000 population is a case of stratum two.

2.4 Survey and Study Sample:

NFHS-4 collects data in two-phases, from January 2015 to December 2016. NFHS-4 has a sample of 628,900 households for all India. Of this 616,346 were occupied and 601,509 were interviewed from the occupied households. NFHS-4 has 98 percent response rate. In this survey, women in age group of 15-49 years and men in the age group of 15-45 years were surveyed. For this survey eligibility defines as women in the age group of 15-49 year and men in as group of 15-54 years, also they have to stay in the house a night before the survey. In case of women, 723,875 eligible women were considered and out of them 699,686 were interviewed. In the case of men, 122051 were considered and 122,122 men had completed their interview. The response rate was quite high for both male and female: for female it was 97 percent and for male it was 93 percent in rural areas. The respective percentage are 96 and 90 in urban areas.

Table 2.1. Number of households, number of interviews with women and men, and response rates, according to the residence, India, NFHS-4(2015-16)

	Rural	Urban	Total
Households selected	441,805	187,095	628,900
Households occupied	433,931	182,415	616,346
Households interviewed	425,563	175,946	601,509
Household response rate (percent)	98.1	96.5	97.6
Number of eligible women	510,116	213,759	723,875
Number of eligible women interviewed	494,951	204,735	699,686
Eligible women response rate (percent)	97.0	95.8	96.7
Number of eligible men	82,427	39,624	122,051
Number of eligible men interviewed	76,596	35,526	112,122
Eligible men response rate (percent)	92.9	89.7	91.9

Source: NFHS-4 (2015-16)

AHS was conducted during 2012-13 (November to May). It surveyed 4.32 million households. In case of Odisha, data was collected from 2364 sample units, 1798 in rural areas and 566 sample units in urban areas respectively.

2.5 Variables and Measurement:

2.5.1 Variables and Measurement for objective 1

To analyze the factors affecting IMR, NMR and PMR in the states of India and variables were taken from NFHS-4 (2015-16) data. Dependent variables used for the study are IMR, NMR and PMR. Independent variables are maternal factors, social factors, economic factors, environmental factors, child factors etc. Maternal and child factors used in this study are women with at least 4 ANC visits, women consumed IFA tablets for more than and equal to 100 days, post-neonatal care of women, children health check-up after birth, women's education, marital status, women BMI and place of delivery. Socio-economic factors are the

use of improved drinking water sources, proper sanitation facility, clean fuel for cooking, households wealth index and participation in households decision -making.

Table 2.2: Measurement and sources of variables for state level analysis from NFHS-4

Variables name	Measurement of variables
IMR	Infant mortality rate
NMR	Neonatal mortality rate
PMR	Post-neonatal mortality rate
Women with at least 4ANC visits	Percentage of mothers of aged 15-49 years taken at least 4 antenatal care (ANC) visits for last birth
IFA tablets for more than and equal to 100 days	Percentage of mothers of aged 15-49 years consumed iron-folic acid (IFA) tablets for more than and equal to 100 days
Women with PNC	Percentage of mothers aged 15-49 years received postnatal care (PNC) from a doctor/nurse/LHV/ANM/midwife/other Health personnel within 2 days of delivery
Women with low BMI	Percentage of women aged 15-49 years whose Body Mass Index (BMI) is below normal (BMI < 18.5 kg/m2)[4]
Women up to 10 years of education and above	Percentage of women aged 15-49 years up to 10 years of education and above
Women married before the legal age	Percentage of women aged 20-24 years married before the legal age (18 years)
Children taken for health check-up	Percentage of children received health check-up after birth form doctor/ ANM/LHV/nurse/midwife/other health personnel within 2 days of birth
Households with lowest wealth index	Percentage of households belongs to poorer and poorest group of wealth index (lowest wealth index)[5]

[4] Body mass index is defined as the weight in kilogram divided by the height in meter square (km/m2)

[5] Households are given scores based on the number and kinds of consumer goods they own, ranging from a television to a bicycle or car, and housing characteristics such as the source of drinking water, toilet facilities, and flooring materials

Women with cesarean section delivery	Percentage of birth delivered in a cesarean section of both public and private healthcare
Proper sanitation facility	Percentage of households using proper sanitation facility [6]
Clean fuel for cooking	Percentage of households using clean fuel for cooking (Electricity, LPG/natural gas, biogas.)
Women participated in households decision making	Percentage of women aged 15-49 years who participated in households decision making
Improved source of drinking water	Percentage of households having an improved source of drinking water[7]

2.5.2 Variables and Measurement for objective 2

AHS collected data from women aged between 15-49 years. District wise variables were taken for analysis. On the basis of availability of data on rural and urban areas, 14 major districts were selected. Dependent variables used in this study are IMR, NMR, PMR. Independent variables used in this study are low birthweight of children, children check-up after birth, women work participation, women's literacy, women married before legal age (age 18 years), institutional birth and women use of IFA tablets for 100 or more days, women having 3 or more ANC visits and at least 1 TT.

[6] Flush to piped sewer system, flush to septic tank, flush to pit latrine, ventilated improved pit (VIP)/biogas latrine, pit latrine with slab, twin pit/composting toilet, which is not shared with any other household

[7] Piped water into dwelling/yard/plot, public tap/standpipe, tube well or borehole, protected dug well, protected spring, rainwater, community RO plant

Table 2.3: Measurement of Variables for districts of Odisha from AHS- 3

Variables	Measurement of variables
IMR	Infant mortality rate
NMR	Neonatal mortality rate
PMR	Post-neonatal mortality rate
Children birth weight<2.5kg	Percentage of children having birth weight less than 2.5 kg
Children check-up after birth	Percentage of children received health check-up after birth from doctor/ANM/LHV/nurse/midwife/ other health personnel within 2 days of birth
Women with at least 3 ANC visits	Percentage of mothers aged 15-49 years received at least 3 or more antenatal care visits
IFA tablets for more than and equal to 100 days	Percentage of mothers aged 15-49 years who consumed Iron-folic acid tablets for more than and equal to 100 days
Women with at least 1 TT	Percentage of mothers aged 15-49 years received at least one tetanus toxoid injection
Participation of women in work from the age of 15 years	Percentage participation of women (aged 15-49 years) in work from the age of 15 years or above
Women's literacy	Percentage of women aged 15-49 years who are literate
Women married before legal age	Percentage of women aged 15-49 years who married before legal age (18 years)

2.6 Model Specification:

For the testing the objectives of the study, multiple linear regression model was used to examine the factors affecting IMR, NMR and PMR at state levels and district level of Odisha. Multiple linear regression model was fitted separately for total area, rural and urban areas. The model describes the output variable Y over a linear combination of more input variables x1 x2 x3---- xn. The model has one dependent and many independent factors and is defined by the formula $y = c + b_J * x_J$, where y = estimated value of the dependent variable, c = constant, b_j = regression coefficients; j=1…..n, and x_J = average value of the independent variables: j=1……n.

2.7 Plan of Analysis:

The dependent variable used are IMR, NMR and PMR and the independent variables used are social, environmental, economic, maternal and children health factors. These variables are taken from NFHS-4 and AHS-3 for all Indian states and districts of Odisha respectively. Multiple linear regression model is fitted to define the association between dependent variable and independent variables.

2.8 Limitations:

Data on household's income is not available in NFHS-4, Therefore, Households wealth index is taken as income of Households. Work participation of women from the age of 15 years or above is a proxy of women empowerment. This study is based on the 14 districts of Odisha. In case of Odisha, data for major 14 districts urban areas was available. In case of total and rural areas all the districts data are available. But, the models are not significant when all the districts in total and rural areas are included. So, major 14 districts are used for the analysis.

Chapter 3

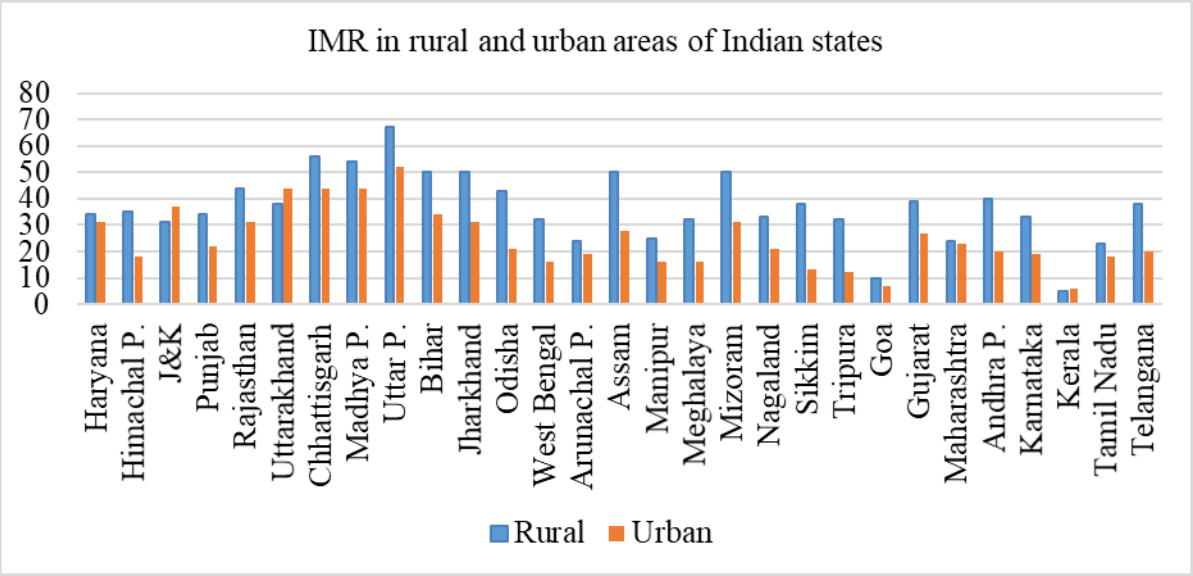
Determinants of IMR, NMR and PMR in Indian States

3.1 Introduction:

This chapter provides the IMR, NMR and PMR in the rural and urban areas of Indian states. Along with this, it provides the disparity in socio-economic, environmental, maternal and child health factors in Indian states. It also provides the determinants of IMR, NMR and PMR in total, rural and urban areas of Indian states, discussions and conclusions.

India is a country with high regional differences. As per census 2011, 68.84 percent of the population resides in rural region and 31.16 percent in urban region. NFHS-4 (2015-16) shows that there exists a disparity in rural and urban health indicators in India states. It shows that health condition of infants in rural areas is far behind than that of urban areas and NMR is higher and it contributes a major portion of IMR. So, the study tries to analysed the reasons for high NMR than PMR and rural and urban differences in IMR, NMR and PMR in Indian states.

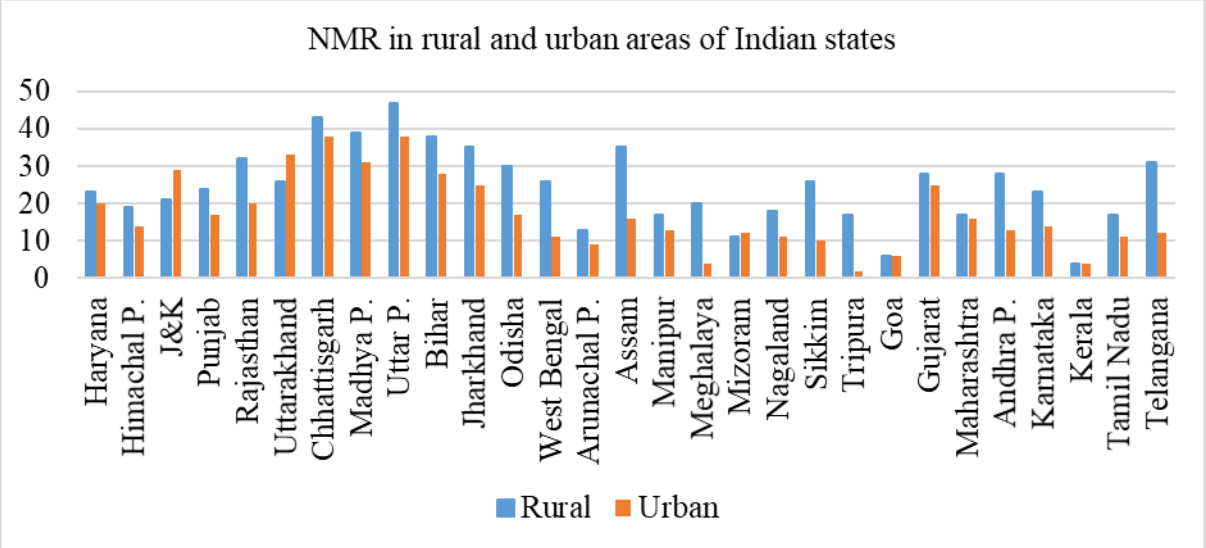
Figure 3.1a: IMR in rural and urban areas of Indian states



Source: NFHS-4 (2015-16)

Figure 3.1a shows that IMR is greater in rural areas in all Indian states excepting Kerala and Jammu and Kashmir.

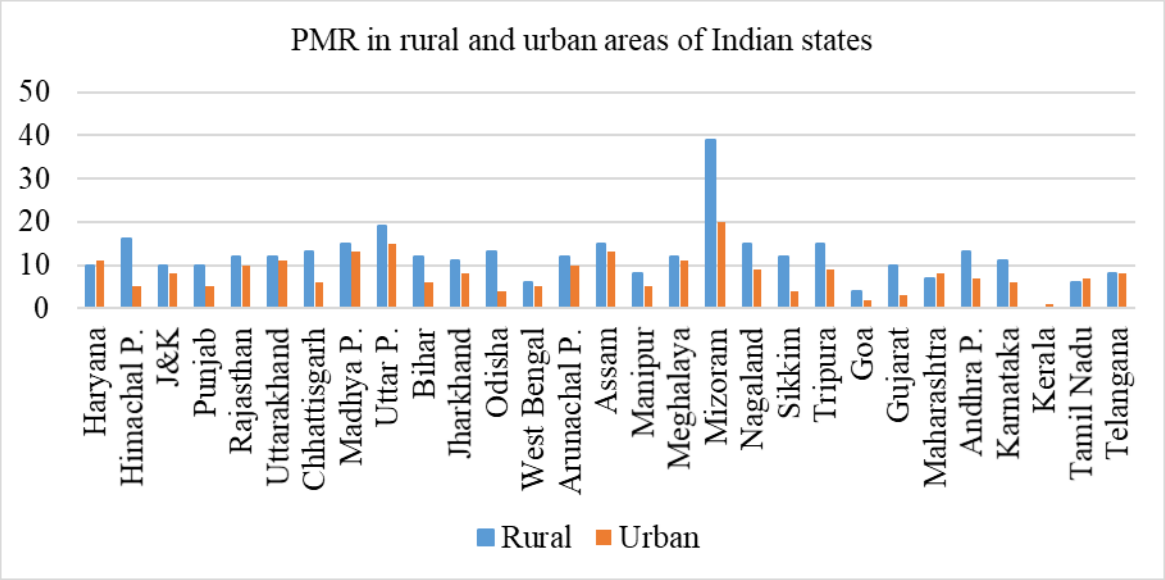
Figure3.1b: NMR and PMR in Indian states



Source: NFHS-4 (2015-16)

Figure 3.1b shows that NMR is higher in rural areas of all the Indian states except for Jammu and Kashmir, Uttarakhand and Mizoram, which have high NMR in urban areas

Figure 3.1c: PMR in rural and urban areas of Indian states



Source: NFHS-4 (2015-16)

Figures 3.1c shows that PMR is higher in rural areas of all the Indian states except for Haryana, Maharashtra, Kerala and Tamil Nadu, which have the high PMR in urban areas. Mizoram has highest (39) PMR and Kerala has lowest (1).

3.2 Disparity in social, economic, environmental, maternal and child health factors in Indian states

Disparity in various social, economic, environmental, and maternal and child health factors is measure by regional divergence within states and among the Indian states.

Table 3.1: Percentage of households with Improved source of clean drinking water, Proper sanitation facility, Women up to 10 years of education and above, Women with at least 4 ANC visits, Women who consumed IFA tablets for more than and equal to 100 days, Women with PNC and Children taken for health check -up within 2 days of birth in total areas at state level

States	Improved source of drinking water	Proper sanitation facility	Women up to 10 years of education and above	Women with at least 4 ANC visits	Women who consumed IFA tablets for more than and equal to 100 days	Women with PNC	Children taken for health check -up within 2 days of birth
Haryana	92	79	46	45	33	67	21
Himachal Pradesh	95	71	59	69	49	70	29
Jammu & Kashmir	89	53	37	81	30	75	20
Punjab	99	82	55	69	43	87	47
Rajasthan	86	45	25	39	17	64	23
Uttarakhand	93	65	45	31	25	55	19
Chhattisgarh	91	33	27	59	30	64	34
Madhya Pradesh	85	34	23	36	24	55	18
Uttar Pradesh	96	35	33	26	13	54	24
Bihar	98	25	23	14	10	42	11
Jharkhand	92	84	40	62	54	65	11
Odisha	89	29	27	62	37	73	30
West Bengal	95	51	27	77	28	61	27
Arunachal Pradesh	88	61	31	27	8	29	8
Assam	78	84	26	47	32	54	23
Manipur	42	50	46	69	39	65	11
Meghalaya	68	60	34	50	36	48	9

Mizoram	92	84	40	62	54	65	11
Nagaland	81	75	33	15	4	22	2
Sikkim	98	88	41	75	53	74	13
Tripura	87	61	23	64	13	62	8
Goa	96	78	58	89	67	92	50
Gujarat	91	64	33	71	37	63	16
Maharashtra	92	52	42	72	41	79	31
Andhra Pradesh	73	54	34	76	56	80	29
Karnataka	89	58	46	70	45	66	22
Kerala	94	98	72	90	67	89	49
Tamil Nadu	91	52	51	81	64	74	35
Telangana	78	50	43	75	53	82	25

Source: NFHS-4 (2015-16)

Data from Table 3.1 show that the percentage of households with improved source of drinking water is lowest in Manipur (41.6 %) and highest in Punjab (99.1 %). The percentage of households using improved source of drinking water is more than 50 percent in all the states except for Manipur.

The percentage of households with proper sanitation facility is below 50 percent among the EAG states (Empowered Action Group states are Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh) except for Uttarakhand and Jharkhand, and Manipur. It is more than 80 percent among Assam, Punjab, Jharkhand, Mizoram, Sikkim and Kerala. The percentage of households with proper sanitation facility is highest in Kerala (98.1 percent) and lowest in Bihar (25.2 percent).

The percentage of women up to 10 years of education and above is more than 50 percent in the states of Goa, Himachal Pradesh, Tamil Nadu, Kerala and Punjab. It is highest in the state of Kerala (72.2 percent) and lowest in the state of Bihar (22.8 percent).

The percentage of women with at least 4 ANC visits is less than 50 percent among the states of Haryana, EAG states (except for Chhattisgarh, Jharkhand and Odisha), Arunachal Pradesh, Assam, Meghalaya and Nagaland. It is lowest in the states of Bihar (14.4 percent) and Nagaland (15 percent). It is highest in the states of Goa (89 percent) and Kerala (90.2 percent).

The percentage of women who consumed IFA tablets for more than and equal to 100 days is more than 50 percent among the states of Mizoram, Sikkim, Goa, Jharkhand, Andhra Pradesh, Kerala, Tamil Nadu and Telangana. It is lowest in Nagaland (4.4 percent) and highest in Goa (67.4 percent). States like Nagaland, Rajasthan, Bihar, Arunachal Pradesh and Uttar Pradesh

having less than 20 percent of women consumed IFA tablets for more than and equal to 100 days.

The percentage of women with PNC is more than 50 percent among most of the states. However, it is less than 50 percent in the states of Arunachal Pradesh, Bihar, Meghalaya and Nagaland. It is low in Nagaland (22.3 percent) and high in Goa (92.1 percent).

The percentage of children taken for check-up within 2 days of birth is less than 50 percent among all the states. However, it is more than 30 percent in the states of Punjab, Chhattisgarh, Goa, Kerala and Tamil Nadu. It is less than 10 percent in the states of Meghalaya, Arunachal Pradesh, Tripura and Nagaland.

Table 3.2: Percentage of Women with low BMI, Women participated in households' decision-making, Women married before the legal age, Households with lowest wealth index, Caesarean section delivery and Households using clean fuel for cooking in total areas at state level

States	Women with low BMI	Women participated in households' decision-making	Women married before the legal age	Households with lowest wealth index	Women with caesarean section delivery	Households using Clean fuel for cooking
Haryana	16	77	19	10	12	52
Himachal Pradesh	16	91	9	12	17	37
Jammu & Kashmir	12	84	9	26	33	58
Punjab	12	90	8	5	25	66
Rajasthan	27	82	35	42	9	32
Uttarakhand	18	90	14	23	13	51
Chhattisgarh	27	91	21	59	10	23
Madhya Pradesh	28	83	32	55	9	30
Uttar Pradesh	25	82	21	54	9	33
Bihar	30	75	45	75	6	18
Jharkhand	8	96	44	68	10	67
Odisha	26	82	22	64	14	19
West Bengal	21	90	47	54	24	28
Arunachal Pradesh	9	89	26	44	9	45

Assam	26	87	32	63	13	48
Manipur	9	96	15	41	21	42
Meghalaya	12	91	20	47	8	22
Mizoram	8	96	17	17	13	67
Nagaland	12	97	16	43	6	33
Sikkim	6	95	14	8	21	59
Tripura	19	92	36	56	21	32
Goa	15	94	3	6	31	84
Gujarat	27	85	31	25	18	53
Maharashtra	24	89	33	27	20	60
Andhra Pradesh	18	80	33	22	40	62
Karnataka	21	80	25	27	24	55
Kerala	10	92	8	3	36	57
Tamil Nadu	15	84	19	20	34	73
Telangana	23	81	26	26	58	67

Source: NFHS-4 (2015-16)

Data from table 3.2 show that the percentage of women with low BMI is highest in Bihar (30.4 percent) and lowest in Sikkim (6.4 percent). It is less than 10 percent in the states of Jharkhand, Arunachal Pradesh, Mizoram, Sikkim , Manipur and Kerala.

The percentage of women participation in household decisions making is more than 50 percent among all the states. It is and highest in Nagaland (97.4 %) and lowest in Bihar (75.2 %). The percentage of women married before the legal age is highest in West Bengal (47.3 percent) and lowest in Goa (2.7 percent). It is less than 10 percent in the states of Himachal Pradesh, Jammu and Kashmir, Punjab, Goa and Kerala. It is more than 30 percent in the states of Rajasthan, Jharkhand, Madhya Pradesh, Tripura, West Bengal, Gujrat, Bihar, Assam, Maharashtra and Andhra Pradesh.

Telangana (58%) is having highest percentage of caesarean section delivery and it is lowest in Nagaland (5.8 %). It is less than 10 percent in Rajasthan, Chhattisgarh, Madhya Pradesh, Meghalaya, Uttar Pradesh, Jharkhand, Arunachal Pradesh, Bihar and Nagaland. The percentage of institutional birth is more than 50 percent among all the states except for Nagaland (32.8 percent). Institutional birth is 99.9 percent in Kerala.

The percentage of households belonging to lowest wealth index is more than 50 percent among the EAG states (except for Rajasthan and Uttarakhand), West Bengal, Assam and Tripura. It is

highest in Bihar (75.2 %) and lowest in Kerala (3.2 %). It is less than 10 percent in Punjab, Sikkim, Goa and Kerala.

The percentage of households using clean fuel for cooking is less than 50 percent in the states of Himachal Pradesh, Rajasthan, Chhattisgarh, Madhya Pradesh, Bihar, West Bengal and Northeast states (except for Mizoram and Sikkim).

Tables 3.3: Percentage of households with Improved source of drinking water, Proper sanitation facility, Women up to 10 years of education and above and Women with at least 4 ANC visits in rural and urban areas at state level

States	Improved source of drinking water		Proper sanitation facility		Women up to 10 years of education and above		Women with at least 4 ANC visits	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Haryana	94	88	77	82	40	55	43	49
Himachal Pradesh	95	94	70	79	58	74	67	90
Jammu & Kashmir	85	98	46	66	32	50	79	89
Punjab	99	99	79	85	47	67	68	69
Rajasthan	83	92	36	73	19	43	34	54
Uttarakhand	90	99	60	73	39	55	26	41
Chhattisgarh	89	97	23	64	20	46	56	71
Madhya Pradesh	80	97	19	67	14	44	30	52
Uttar Pradesh	98	93	23	68	27	48	22	43
Bihar	98	98	21	55	20	44	13	26
Jharkhand	88	94	73	91	21	52	43	78
Odisha	88	95	23	61	23	44	61	70
West Bengal	95	94	46	62	20	40	76	78
Arunachal Pradesh	85	95	57	73	24	51	24	37
Assam	83	89	45	62	23	47	45	60
Manipur	38	47	51	48	38	57	62	82
Meghalaya	63	85	58	68	26	59	46	71
Mizoram	88	94	73	91	21	52	43	78
Nagaland	81	80	79	68	22	51	9	29
Sikkim	97	99	94	76	36	50	74	76
Tripura	83	98	60	65	16	40	60	77
Goa	94	98	81	77	58	59	86	91
Gujarat	89	93	47	85	23	45	63	81
Maharashtra	86	98	44	60	33	52	69	76

Andhra Pradesh	74	71	43	77	28	47	75	80
Karnataka	89	90	43	77	35	59	71	70
Kerala	93	96	98	99	71	74	92	89
Tamil Nadu	95	87	34	70	43	59	81	81
Telangana	76	80	39	64	31	57	73	78

Source: NFHS -4 (2015-16)

Data from Table 3.3 show that rural areas have higher percentage of households with improve sources of clean drinking water urban areas in the states of Haryana, Uttar Pradesh, Bihar, West Bengal, Andhra Pradesh and Tamil Nadu. It is lowest in rural (38 %) and urban (47.1 %) areas of Manipur.

The urban areas have higher percentage of households with proper sanitation facility in all the states except for Nagaland and Sikkim. It is less than 30 percent in the rural areas of Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Bihar and Odisha.

The urban areas have higher percentage of women up to 10 years of education and above in all the states. The gap between rural and urban areas is low in the states of Goa and Kerala. The percentage of women up to 10 years of education and above is less than 20 percent in the rural areas of Rajasthan, Madhya Pradesh, Bihar, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram.

The rural areas have lower percentage of women with at least 4 ANC visits in all the states excepts for Kerala. In case of rural areas, it is less than 20 percent in the states of Bihar and Sikkim. It is less than 50 percent in the states of Haryana, Rajasthan, Bihar, Uttarakhand, Madhya Pradesh, Jharkhand, Uttar Pradesh, Arunachal Pradesh, Meghalaya, Assam Mizoram and Nagaland. In case of urban areas, it is less than 50 percent in the states of Haryana, Uttarakhand, Madhya Pradesh, Bihar, Arunachal Pradesh and Nagaland.

Table 3.4: Percentage of Women who consumed IFA tablets for more than and equal to 100 days, Women with PNC, Children taken for health check-up within 2 days of birth, Women with Institutional delivery and Women with low BMI in rural and urban areas at state level

States	Women who consumed IFA tablets for more than and equal to 100 days		Women with PNC		Children taken for health check up within 2 days of birth		Women with low BMI	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Haryana	33	31	67	67	23	20	18	12
Himachal Pradesh	49	54	69	84	28	36	17	12
Jammu & Kashmir	30	32	71	87	18	26	14	8
Punjab	40	47	88	87	48	47	14	9
Rajasthan	15	26	62	71	22	25	30	19
Uttarakhand	24	27	49	66	17	24	20	16
Chhattisgarh	28	39	61	75	32	41	30	18
Madhya Pradesh	21	32	50	67	17	20	32	21
Uttar Pradesh	11	20	52	63	22	33	28	18
Bihar	9	12	41	53	10	17	32	22
Jharkhand	47	59	50	77	9	13	10	8
Odisha	36	41	73	74	30	25	29	16
West Bengal	27	32	58	69	27	26	25	14
Arunachal Pradesh	8	11	26	38	9	6	9	9
Assam	31	44	52	72	23	25	27	18
Manipur	33	51	57	78	9	15	9	9
Meghalaya	33	54	43	76	8	15	12	11
Mizoram	47	59	50	77	9	13	10	8
Nagaland	3	8	16	36	1	2	12	13
Sikkim	55	49	72	79	14	10	6	8
Tripura	12	16	58	73	9	7	20	16
Goa	70	66	91	93	48	50	22	10
Gujarat	31	44	60	68	16	16	34	18
Maharashtra	38	44	76	82	32	29	30	17
Andhra Pradesh	56	56	78	85	28	30	20	12
Karnataka	45	46	65	67	23	21	24	16
Kerala	65	70	90	88	50	48	10	9
Tamil Nadu	63	65	74	74	36	35	19	11

Telangana	48	59	79	85	29	21	29	16

Source: NFHS-4 (2015-16)

Data from Table 3.4 show that the percentage of women who consumed IFA tablets for more than and equal to 100 days is higher among the rural areas than urban areas in Indian states except for Sikkim, Goa and Andhra Pradesh. In case of rural areas, percentage of women who consumed IFA tablets for more than and equal to 100 days is more than 50 percent in the states of Sikkim, Goa, Andhra Pradesh, Kerala and Tamil Nadu. In case of urban areas, it is more than 50 percent in the states of Himachal Pradesh, Jharkhand, Meghalaya, Mizoram, Goa, Andhra Pradesh, Kerala, Tamil Nadu and Telangana.

The urban areas have higher percentage of women with PNC within 2 days of delivery among all the states except for Punjab and Kerala. In case of rural areas, the percentage of women PNC within 2 days of delivery is less than 50 percent in the states of Uttarakhand, Jharkhand, Arunachal Pradesh, Meghalaya, Bihar, Mizoram and Nagaland. In case of urban areas, it is less than 50 percent in the states of Nagaland and Arunachal Pradesh.

The rural areas have higher percentage of children check-up after birth (within 2 days) among all the states except for Haryana, Punjab, Odisha, West Bengal, Sikkim, Tripura, Maharashtra, Karnataka, Kerala, Tamil Nadu and Telangana. It is more than 50 percent only in the urban areas of Goa (50. 3 %) and more than 40 percent in the rural areas of Punjab and Kerala. It is less than 10 percent in the rural areas of Bihar, Jharkhand, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. In case of urban areas, it is less than 10 percent in the states of Nagaland, Arunachal Pradesh, Sikkim and Tripura.

The percentage of women with low BMI (less than 18kg/m2) is higher in rural areas in all the states except for Nagaland and Sikkim. It is higher (more than 25 %) in the rural areas of EAG states except for Jharkhand, Assam, Gujarat, Maharashtra and Telangana. It is less than 10 percent in the rural as well as urban areas of Arunachal Pradesh, Sikkim, Manipur, Jharkhand, Mizoram and Kerala and in the urban areas of Punjab and Jammu and Kashmir.

Table 3.5: Percentage of Women participated in household decision-making, Women married before the age of 18 years, Households with lowest wealth index, Caesarean section delivery and Households using clean fuel for cooking in rural and urban areas at state level

States	Women participated in households decision making		Women married before the age of 18 years		Households with lowest wealth index		Caesarean section delivery		Households using clean fuel for cooking	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Haryana	76	77	19	20	12	4	11	14	29	85
Himachal Pradesh	90	96	9	7	12	3	16	30	30	89
Jammu & Kashmir	83	88	10	4	35	7	27	53	42	91
Punjab	91	90	8	7	6	2	24	26	49	90
Rajasthan	80	87	41	20	50	9	7	16	15	80
Uttarakhand	88	93	15	12	32	5	10	19	31	87
Chhattisgarh	90	92	24	15	69	14	8	19	8	71
Madhya Pradesh	81	88	39	18	69	14	5	19	10	75
Uttar Pradesh	80	86	25	11	65	13	7	19	16	79
Bihar	75	78	45	29	81	31	5	14	11	64
Jharkhand	96	96	44	21	82	21	7	22	30	93
Odisha	81	85	22	20	71	25	12	24	11	61
West Bengal	89	92	47	28	67	22	19	37	11	62
Arunachal Pradesh	89	90	26	19	56	8	6	20	30	87
Assam	86	94	32	24	70	16	11	37	16	77
Manipur	96	96	15	12	50	23	15	33	28	63
Meghalaya	91	93	20	9	56	11	6	21	9	66
Mizoram	96	96	17	7	33	3	6	19	30	93
Nagaland	97	98	16	9	58	15	3	12	14	67
Sikkim	95	96	14	16	10	2	17	29	42	93
Tripura	90	97	36	27	70	21	12	46	16	69
Goa	93	95	3	15	7	3	28	34	72	91
Gujarat	84	87	31	17	40	6	12	28	27	84
Maharashtra	89	89	33	20	41	7	15	26	34	87
Andhra Pradesh	80	79	36	27	26	5	37	48	50	90
Karnataka	78	84	25	17	40	7	20	29	32	84
Kerala	92	92	8	8	4	1	35	37	51	65
Tamil Nadu	85	83	19	13	29	8	32	36	58	87
Telangana	80	82	36	16	40	5	53	63	48	90

Source: NFHS-4 (2015-16)

Table 3.5 show that percentage of women participated in households decisions making is more than 50 percent among Indian state. There are fewer differences between rural and urban areas in women Participation in households' decision- making.

The percentage of women who had caesarean section delivery is higher in rural areas. It is more than 50 percent in the urban areas of Jammu and Kashmir and Telangana. It is more than 20 percent in the rural areas of Jammu and Kashmir, Punjab, Goa, Andhra Pradesh, Kerala, Tamil Nadu and Telangana.

The percentage of women married before the legal age is higher in rural areas among most of the states. However, it is more in urban areas of Haryana, Sikkim and Goa. In case of rural areas, it is more than 30 percent in the states of Rajasthan, Madhya Pradesh, Bihar, Assam, Jharkhand, West Bengal, Maharashtra, Andhra Pradesh, Tripura and Telangana.

The percentage of households using clean fuel for cooking is higher in urban areas than rural areas in Indian states. In case of rural areas, it is less among the EAG states and Northeast states.

The percentage of households belonging to lowest wealth index is higher in rural areas among all the states. In case of rural areas, it is more than 50 percent in the states of Rajasthan, Chhattisgarh, Uttar Pradesh, Bihar, Assam, Jharkhand, West Bengal, Meghalaya, Arunachal Pradesh, Manipur, Odisha, Nagaland and Tripura.

2.3 Results and Discussions:

To find out the effect of socio-economic, environmental and maternal factors on IMR, NMR and PMR, Multiple linear regression models have been fitted.

IMRs, NMR and PMR of Indian states have been taken as dependent factors and independent factors are from the socio-economic, environmental and maternal factors. The independent variables are as follow:

1. Percentage of households with improved source of drinking water
2. Percentage of households using proper sanitation facility
3. Percentage of households using clean fuel for cooking
4. Percentage of households with the lowest wealth index
5. Percentage of women who participated in household decision making
6. Percentage of women with 10 or more years of education

7. Percentage of women who married before the legal age
8. Percentage of women with low body mass index
9. Percentage of women with at least 4 ANC visits
10. Percentage of women who consumed IFA tablets for more than and equal to 100 days
11. Percentage of women with PNC within 2 days of delivery
12. Percentage of children take for health check-up within two days of birth
13. Percentage of women who had cesarean section delivery

The hypothesis for the regression analysis is:

Ho: There is no effect of socio-economic, environmental, demographic and maternal factors on IMR, NMR and PMR.

HA: IMR, NMR and PMR in Indian states are determined by the socio-economic, environmental and maternal factors.

Results:

Table 3.6: Factors affecting IMR in total areas- State level

Independent variables	Coefficient	t value
IFA tablets for more than and equal to 100 days	.3994	2.21*
Women with at least 4 ANC visits	-.3774	-3.07*
Women with low BMI	.6192	2.46**
Women with 10 or more years of education	-.6552	-2.70**
Women married before legal age	-.2637	-1.40
F value P value Adj. R square	8.48** 0.0001 .5757	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.7: Factors affecting NMR in total areas- State level

Independent variables	Coefficient	t value
Women with at least 4 ANC visits	-.2387	-1.78
Women with low BMI	.4910	2.08*
Women married before legal age	-.0917	-.59
Households with lowest wealth index	.2094	2.03*
Women with PNC	.3602	2.03*
Women with caesarean section delivery	-.1341	-.84
F value P value Adj. R square	6.34** 0.0005 .5378	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.8: Factors affecting PMR in total areas- State level

Independent variables	Coefficient	t value
Children health check-up after birth	-.1520	-1.72
IFA tablets for more than and equal to 100 days	.2129	2.33**
Women with at least 4 ANC visits	-.1451	-2.25**
Women with 10 or more years of education	-.3218	-2.65**
Women married before legal age	-.1642	-1.77
Improved source of drinking water	.0909	1.24
F value P Value	4.16** 0.0061	

Adj. R square	.404	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.6, 3.7 and 3.8 gives the results of multiple linear regression between three dependent variables and independent variables in total areas of Indian states. Table 3.6 one shows the relationship between the dependent factor IMR and independent factors. The dependent variable in table 3.7 is NMR and in Table 3.8, it is PMR. All models are good fit. Table 3.6 having F-value 8.48 (P= 0.0001), table 3.7 having F-value 6.43 (P=0.0005) and table 3.8 having F-value 4.16 (P=0.0061). The adjusted R-square in table 3.6, 3.7 and 3.8 shows that they explain 57 percent, 53 percent and 40 percent variation in dependent variable IMR, NMR and PMR respectively by the independents variables. The collinearity test of variance shows that the variables are free from multicollinearity. Also the variables are normally distributed. There is a linear association between the dependents variables and independents variables, hence rejecting the null hypothesis.

Table 3.6 shows that IMR is negatively associated with percentage of women with 4 ANC visits (B= -3774), percentage of women up to 10 years of education and above (B= -.6552) and percentage of women married before the legal age (B= -.2634). IMR is positively related to percentage of women taken IFA tablets for 100 or more days (B= .3994) and percentage of women with low BMI (B= .6192). The positive relationship between percentage of women taken IFA tablets for 100 or more days with IMR is unexpected result. The negative relationship between percentage of women married before the legal age with IMR is unexpected result. The percentage of women with at least 4 ANC visits and percentage of women up to 10 years of education and above are highly significant at 1 percent and percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with low BMI are significant at 5 percent. The percentage of women married before the age 18 years is statistically not significant.

Table 3.7 shows the relationship between NMR and independents variables. NMR is negatively associated with percentage of women with at least 4 ANC visits (B= -.2387), percentage of women married before the legal age (B= -.0917) and percentage of caesarean section delivery (B= -.1341). It is positively associated with percentage of women with low BMI (B= .4910), percentage of households with low wealth index (B= .2094) and percentage of with PNC (B= .3602). The positive relation between percentage of women with PNC with NMR is unexpected result. The negative relation between percentage of women married before the legal age with

NMR is unexpected result. The percentage of women with low BMI, percentage of households with the lowest wealth and percentage of women with PNC is significant at 5 percent. Percentage of women with at least 4 ANC visits is statistically not significant.

Table 3.8 shows the variables related to PMR. PMR is negatively linked to percentage of children check-up after deliver (B= -.1520), percentage of with at least 4 ANC visits (B= -.1451), percentage of women up to 10 years of education and above (B= -.3218) and percentage of women married before age of 18 years (B= -.1642). PMR is positively related to the variables percentage of women who consumed IFA tablets for more than and equal to 100 days (B= .2129) and percentage of households using clean drinking water (B= .0909). The negative relationship between percentage of women married before the legal age with PMR and positive relationship between percentage of households with improve sources of clean drinking water with PMR, are unexpected results. The percentage of women who consumed IFA tablets for more than and equal to 100 days and percentage of women with at least 4 ANC visits are significant at 5 percent. Percentage of women up to 10 years of education and above is significant at 1 percent.

Table 3.9: Factor affecting IMR in rural areas- State level

Independent variables	Coefficient	t value
Children health check-up after birth	-.5751	-2.21*
Proper sanitation facility	-.2101	-2.38*
Women with at least 4 ANC visits	-.3655	-2.51*
Women with Postnatal check-up	.6267	2.47*
Improved source of drinking water	.2852	1.83
F value P value Adj. R square	7.25** 0.0002 .5724	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.10: Factor affecting NMR in rural areas- State level

Independent variables	Coefficient	t value
Women with at least 4 ANC visits	-.3723	-2.89**
Households with lowest wealth index	.3118	3.84**
Women with Postnatal check-up	.5614	3.41**
IFA tablets for more than and equal to 100 days	-.0389	-.02
F value P value Adj. R square	7.78** 0.0004 4921	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.11: Factor affecting PMR in rural areas- State level

Independent variables	Coefficient	t value
IFA tablets for more than and equal to 100 days	-.2308	-2.49**
Women with at least 4 ANC visits	-.1657	-2.51*
Women with 10 or more years of education	-.4892	-3.84**
Women married before legal age	-.3312	-2.96**
Improved source of drinking water	.0704	0.91
F value P value Adj. R square	5.55** 0.0017 .4485	

Note: * significant at 5 percent, ** significant at 1 percent

Results from table 3.9, 3.10 and 3.11 shows that in rural areas models are good fit. Table 3.9 having F-value 7.25 (P value= 0.0002), table 3.10 having F-value 7.78 (P value= 0.0004) and table 3.11 having F-value 5.55 (P value= 0.0017). The adjusted R square in table 3.9, 3.10 and 3.11 shows that they explain 57 percent, 47 percent and 49 percent variation in dependent

variables respectively by independent variables. There is a linear association between the dependent factors and independent factors, hence rejecting the null hypothesis. The variables in this analysis are free from multicollinearity. The dependent factors in this regression analysis are IMR, NMR and PMR.

IMR in rural areas is negatively associated with percentage of children check-up after birth within two days of delivery (B= -.5751), percentage of households using proper sanitation facility (B= -.2101), percentage of women with at least 4 ANC visits (B= -.3655). IMR is positively associated with percentage of women with PNC (B= .6267) and percentage of households using clean drinking water (B= .2852). The positive relation between percentage of women with PNC and percentage of households with improved sources of clean drinking water with IMR are unexpected results. IMR is significant at 5 percent with percentage of women with at least 4 ANC visits, percentage of women with PNC (PNC), percentage of children check-up within two day of delivery and percentage of households using proper sanitation facility. The percentage of households using clean drinking water is statistically not significant.

Table 3.10 shows that percentage of women with at least 4 ANC visits (B= -.3723) is negatively associated with NMR and percentage of households with the lowest wealth index (B= .3118) and percentage of women with postnatal check-up (B= .5614) are positively related to NMR. The positive relation between percentage of women with PNC and NMR is unexpected. These variables are significant at 1 percent with NMR. Women consumed IFA tablets for more than and equal to 100 days is negatively associated with NMR but not significant.

PMR is negatively associated with percentage of women with 10 or more year of education (B= -.4892) and percentage of women married before the legal age (B= -.3312) and percentage of women with at least 4 ANC visits (B= -.1657) and percentage of women who consumed IFA tablets for more than and equal to 100 days (-.2308). The negative relation between percentage of women married before the legal age with PMR and positive relation between percentage of households with improved sources of clean drinking water with PMR are unexpected results. The percentage of women with 10 or more year of education and percentage of women married before the legal age are significant at 1 percent. The percentage of women with at least 4 ANC visits and percentage of women who consumed IFA tablets for more than and equal to 100 days are significant at 5 percent.

Table 3.12: Factors affecting IMR in urban areas- State level

Independent variables	Coefficient	t value
Women with 4 ANC visits	-.1875	-2.02*
Women with low BMI	1.119	2.33*
Women with 10 or more years of education	-.7296	-3.02**
Women married before legal	-1.084	-3.51**
Women participation in household decision making	-.2238	-.78
Clean fuel for cooking	.3186	2.10*
F value P value Adj. R square	6.24** 0.0006 .5289	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.13: Factors affecting NMR in urban areas- State level

Independent variables	Coefficient	t value
Women with 10 or more years of education	-.8775	-3.32**
Women married before legal age	-.7089	-2.33*
Children check-up after birth	.2726	1.95
Women with caesarean section delivery	-.2688	-2.18*
Women participation in household decision making	-.5099	-1.90
F value P value Adj. R square	4.27** 0.0068 .3684	

Note: * significant at 5 percent, ** significant at 1 percent

Table 3.14: Factors affecting PMR in urban areas- State level

Independent variables	Coefficient	t value
Women with at least 4 ANC visits	-.1525	-2.50*
Women with 10 or more years of education	-.2459	-2.27*
Women married before legal age	-.3323	-2.46*
Improved source of drinking water	-.0406	-.62
F value P value Adj. R square	2.89** 0.0037 .2591	

Note: * significant at 5 percent, ** significant at 1 percent

Results from table 3.12, 3.13 and 3.14 show the states wise multiple linear regression in urban areas separately. Table 3.12 represent the dependent variable IMR, table 3.13 represent the NMR and table 3.14 represent the PMR. Models are good fit with F values 6.24 (P value= 0.0006), 4.27 (P value= 0.0068), 2.30 (P value= 0.0031). The adjusted R square in table 3.12, 3.13 and 3.14 shows that they explain 53 percent, 37 percent and 26 percent variation in dependent variables respectively by independent variables. There is a linear regression between the dependent factors and independents factors, hence rejecting the null hypothesis.

IMR in urban areas is negatively associated with percentage of women with at least 4 ANC visits, women with 10 or more years of education, women married before the legal age and women participation in households decision-making. The percentage of women with low BMI and percentage of households using clean fuel for cooking are positively related to IMR. The negative relationship between women married before the legal age with IMR and positive relationship between percentage of households using clean fuel for cooking with IMR are unexpected results. Percentage of women with 10 or more years of education and percentage of women married before legal age are significant at 1 percent. The percentage of women with at least 4 ANC visits, percentage of women with low BMI and percentage of households using clean fuel for cooking are significant at 5 percent.

The percentage of women up to 10 years of education and above (B= -.8177), percentage of women who married before the age of 18 years (B= -.7089), percentage of women with caesarean section delivery (B= -.2688) and percentage of women participation in household decision-making (B= -.5099) are negatively associated with NMR. NMR is positively related to children health check-up after birth. The negative relationship between percentage of women married before legal age with NMR and positive relationship between children health check-up with NMR are unexpected results. The percentage of women with 10 or more years of education is significant at 1 percent. The percentage of women married before legal age and percentage of women with caesarean section delivery are significant at 5 percent.

PMR is negatively associated with percentage of women with at least 4 ANC visits (B= -.1526), percentage of women up to 10 years of education and above (B= -.2459), percentage of women who married before the age of 18 years (B= -.3323), and percentage of households using clean drinking water (-.0406). The negative relation between percentage of women married before the legal age with PMR are unexpected results. The percentage of women with at least 4 ANC visits, percentage of women up to 10 years of education and above and percentage of women who married before the age of 18 years are significant at 5 percent.

3.3.2 Discussions:

ANC visits are the health check-up of women by the health personnel during pregnancy. It identifies the risk of maternal and child health which can be stopped or reduced. Women can discuss with the health personnel regarding the problem they are experiencing and the health care required for safe motherhood and children. ANC visits makes some health check of women and provide pregnancy related health care to women. This may be the reason that percentage of women with at least 4 ANC visits negatively affecting IMR , NMR and PMR. Women with antennal care visits reduce pregnancy-related problem and keep the child strong during the post-neonatal period.

Iron-folic acid tablets are consumed by pregnant women for 100 or more days. IFA tablets reduces the risk of low blood level and prevent anaemia. Iron is an essential mineral that the body needs to produce red blood cells and keep the mother and child in good health. Also, IFA tablets prevent the risk of child low birth weight and neural tube defect and keep the child strong during neonatal and post-neonatal periods. Women taken IFA tablets for 100 or more days reduce child death during neonatal and post-neonatal periods. This may be the reason that

it is negatively affecting PMR. A caesarean delivery is typically performed when complications from pregnancy make traditional vaginal birth difficult, or put the mother or child at risk. Sometimes caesarean deliveries are planned early in the pregnancy, but they're most often performed when complications arise during labor. A caesarean delivery reduce the risk of IMR and it is negatively related to NMR.

Children taken for health check-up within two days of delivery are important for good health. It makes overall health check-up of the child. Children taken for health check up within two days of delivery reduced birth-related complications and support the physical health of children. Children taken for health check-up are essential for the growth and development of children, prevention of infectious disease and nutritional deficiency in children. Therefore, children taken for health check-up are a major factor affecting IMR.

For women, if BMI is below 18.5 kg/m, it is considered as low BMI. Women with low BMI will have the risk of delivering a child with low birth weight and high chances of having a premature birth of children. Women with high BMI will have the risk of high blood pressure, gestational diabetes and chances of delivering large baby. Women with normal BMI will have safe maternal health and child health. Therefore, percentage of women with low BMI may positively to IMR and NMR.

Wealth index shows household's ability to access medical care and the utilization of various medical care services. A poor household is unable to meet the health care need of his children. In addition, women belonging to poor households cannot give proper attention to their children because they were mainly engaged in work. Women working during pregnancy or after pregnancy enhances the risk of child mortality. The cost of transportation and cost of treatment are major barriers for a poor household to fully utilize the health care services during the neonatal period and Post-neonatal periods. Households with low wealth index cannot make their living environment disease-free. Also, Income of households determines the availability of clean drinking water, proper sanitation facility, electricity, use of clean cooking fuels and toilet. A rich household keeps its environment neat and clean. Based on the above reasons percentage of households with low wealth index may be positively affecting neonatal mortality rate.

Women's education is a basic factor affecting infant health during neonatal and Post-neonatal periods. Women's education affects the consciousness about child health care, including the use of child health care and access to resources. Educated women take participation in

household decision making and aware of the information on childhood diseases. Also, the practice of health care and contamination food during Post-neonatal periods depend on women's education. This may be the reason that IMR, NMR and PMR are negatively associated with percentage of women up to 10 years of education and above.

Households with proper sanitation facility negatively affects IMR. This may be because it reduces the risk of infectious disease, water born disease such as diarrhoea and reduce the underweight of children. Also, proper sanitation facility maintains a hygienic condition in house. Therefore, percentage of households with proper sanitation facility negatively related to IMR.

3.4 Conclusions:

This chapter concludes that there exists rural and urban differences between IMR, NMR and PMR in Indian states. The factors determining the IMR, NMR and PMR are different. The factors that increase the IMR, NMR and PMR are greater in rural areas than urban areas.

The IMR in total areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits, percentage of women with low BMI and percentage of women up to 10 years of education and above. The percentage of women with low BMI, percentage of households with lowest wealth index and percentage of women with PNC are the determinants of NMR in total areas. PMR in total areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits and percentage of women up to 10 years of education and above.

The IMR in rural areas is determined by the percentage of children taken for health check-up after 2 days of birth, percentage of households with proper sanitation facility, percentage of women with at least 4 ANC visits and percentage of women with PNC. The NMR in rural areas is determined by the percentage of women with at least 4 ANC visits, percentage of households with lowest wealth index and percentage of women with PNC. PMR in rural areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits, percentage of women up to 10 years of education and above and percentage of women married before the legal age.

The IMR in urban areas is determined by thepercentage of women with at least 4 ANC visits, percentage of women with low BMI, percentage of women upto 10 or more years of education,

percentage of women married before legal age and percentage of households using clean fuel for cooking. NMR in urban areas is determined by the percentage of women with 10 or more years of education, percentage of women married before legal age and percentage of women with caesarean section delivery. PMR in urban areas is determined by the percentage of women with at least 4 ANC visits, percentage of women up to 10 years of education and above, and percentage of women married before the legal age.

Chapter 4

Determinants of IMR, NMR and PMR in odisha: A district level analysis

4.1 Introduction:

This chapter provides the IMR, NMR and PMR in the rural and urban areas of Odisha. Along with this, it provides the disparity in socio-economic, environmental, maternal and child health factors at district level in Odisha. It also provides the determinants of IMR, NMR and PMR in total, rural and urban areas in district level in Odisha, discussions and conclusions.

Odisha is the 11th largest Indian states by population and is the 3rd by tribal population. In the states of Odisha, 83.32percent of the population lives in rural areas and 16.68percent lives in urban areas. There is a great divergence in rural and urban population in Odisha. According to the Minister of Health and Family Welfare's IMR Mission (2001), "IMR continues to be high in Orissa. It is recognized that about 60 percent of Infant deaths occur during the neonatal period (first four weeks of life). Most of these deaths are due to pre-maturity, low birth weight, respiratory infections, diarrhoea and malnutrition. It is also acknowledged that infant mortality is high in lower socio-economic groups residing in backward tribal districts of Orissa." The lack of awareness among the population of Odisha regarding the practice of health care services, traditional beliefs and practises, lack of transportation facilities are the major problem. Sahu (2017) compares the NMR and PMR of Odisha, Jharkhand, Kerala and India during 2011 and 2013 and found that Odisha had high IMR and NMR than Jharkhand, Kerala and India. Jharkhand is one of the poorest state like Odisha and it has highest tribal population, and Odisha's population is same as Kerala, but the IMR of Odisha is far behind these two states.

The health indicators of Odisha indicates that they are near to India.

Table 4.1: Child health indicators in India and Odisha

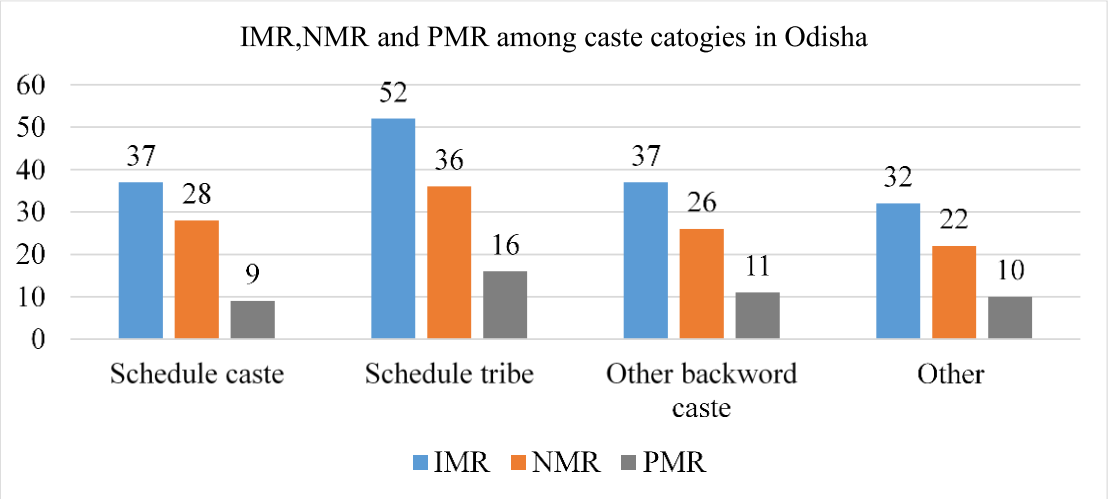
	IMR	NMR	PMR
India	41	30	11
Odisha	40	28	12

Source: NFHS-4 (2015-16)

As per the Millennium Development Goals (MDG) four target, IMR should be reduced to 28

by 2015. The data of Table 4.1 show that the MDG-4 target is achieved neither by India nor by Odisha. This target is achieved in urban areas of Odisha, i.e. 21 IMR. Odisha is lacking behind in achieving the MDG-4 target, but Odisha's economy is experiencing steady economic growth. Sasi (2013) found that Odisha's growth rate in Gross States the Domestic Product (GSDP) is higher than that of India. India's GDP growth in the 2012-13 fiscal year is 5percent and in the case of Odisha, it was 9.14. The GSDP growth rate is double in Odisha. Despite of this health of children in Odisha is not improving and getting less and less attention.

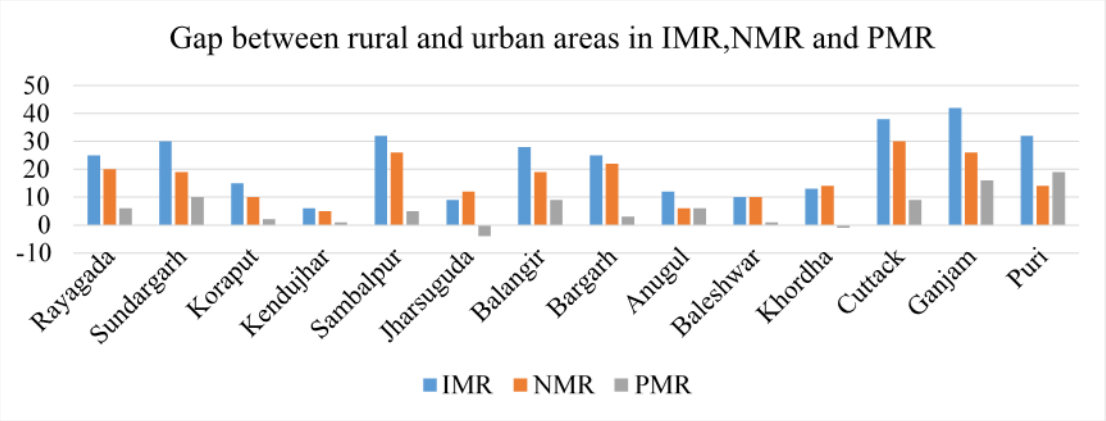
Figure 4.1a: IMR, NMR and PMR among caste categories of Odisha



Source: NFHS-4 (2015-16)

IMR, NMR and PMR are higher among the tribal population as compared to non-tribal population. In addition, the gap between the NMR and PMR is higher among the tribal.

Figure 4.1b: Gap between rural and urban areas in IMR, NMR, and PMR during 2012-13 (AHS-3).



Source: AHS-3 (2012-13).

Figure 4.1b shows that there is a rural and urban gap in IMR, NMR and PMR based on AHS-3 (2012-13) data. It is evident that there are huge differents in child mortality in rural and urban areas of Odisha. The gap among rural and urban areas is higher in case of IMR followed by NMR and then PMR. Districts like Rayagada, Sundargarh, Sambalpur, Puri, Ganjam, Cuttack, Bargarh, Balangir having more than 20 points gap in IMR between in rural and urban areas. The gap is lower in the districts of Kendujhar and Jharsuguda i.e. less than 10 points. The NMR gap in rural and urban areas is more than 15 points in the districts of Balangir, Bargarh, Cuttack, Ganjam, Rayagada, Sambalpur and Sundargarh. In case of PMR, Sundargarh, Puri and Ganjam having more than 10 points. The PMR is lower than NMR and IMR and its gap among rural and urban areas is lower. So, there exits differential in IMR, NMR and PMR in rural and urban areas of Odisha. The high IMR, NMR and PMR in rural areas of districts show the poor socio-economic, environmental and health conditions of Odisha.

Table 4.3: Child health indicators in rural and urban areas of India and Odisha

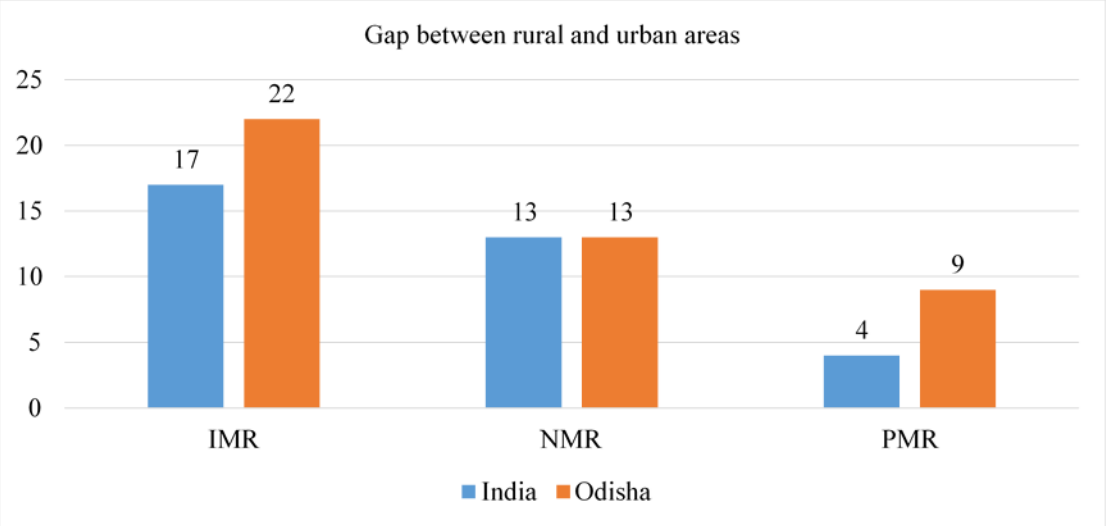
India And Odisha	Percentage of the population		IMR		NMR		PMR	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
India	68.84	31.16	46	29	33	20	12	8
Odisha	82.32	16.68	43	21	30	17	13	4

Source: NFHS-4 (2015-16)

Data from Table 4.2 show that IMR, NMR and PMR are high in rural areas than urban areas in Odisha.

Figure 4.1c shows that the gap in rural and urban areas is more in Odisha than in India in term of IMR and PMR. The gap between rural and urban areas in neonatal mortality is same in India and Odisha. The gap between rural and urban is higher in IMR i.e. 22 points in Odisha and 17 in India, and the gap in PMR is 9 points in Odisha and 4 points in India. The rural and urban gap is same in case of NMR in Odisha and India i.e. 13 points.

Figures 4.1c: Gap between rural and urban areas in term of IMR, NMR and PMR from NFHS-4 data.



Source: NFHS-4 (2015-16)

Thus, it was found that IMR, NMR and PMR are lower in urban areas of Odisha. This reflects the fact that a larger portion of Odisha's population is deprived of good health. The poor health

indicator in rural areas shows the poor socio-economic and environmental conditions of rural areas. Odisha is a state with 82.62 percent of the population reside in rural areas and the health condition of rural areas reflects the socio-economic condition of Odisha.

4.2 Disparity in social, economic, environmental, maternal and child health factors in the districts of Odisha

Disparity in various social, economic, environmental, maternal and child health factors is measured by regional divergence within districts and among the districts of Odisha.

Table 4.3: Percentage of Women's literacy, Women married before the legal age and Women work participation from the age of 15 years and above at district level

Districts	Women's literacy			Women married before the legal age			Women work participation from the age of 15 years and above		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Anugul	76	86	78	7	4	6	31	25	30
Balangir	65	89	67	3	0	3	26	19	25
Baleshwar	86	94	87	4	2	3	14	19	15
Bargarh	77	90	78	3	5	3	45	26	44
Cuttack	86	94	88	2	1	2	10	12	10
Ganjam	61	90	66	7	0	6	31	19	29
Jharsuguda	78	84	80	1	3	2	38	19	31
Kendujhar	71	81	73	7	4	6	45	31	43
Khordha	88	93	91	2	2	2	9	15	12
Koraput	24	69	32	16	10	15	52	19	46
Puri	86	86	86	1	3	1	6	13	7
Rayagada	34	80	43	8	9	8	49	18	43
Sambalpur	73	84	77	2	2	2	55	29	45
Sundargarh	69	89	76	3	2	2	34	24	31

Source: AHS 3 (2012-13)

Data from Table 4.3 show that the percentage of women's literacy is higher in urban areas among all the districts. In case of rural and total areas, it is less than 50 percent in Rayagada and Koraput.

The percentage of women married before the legal age is higher in rural areas except for Rayagada, Jharsuguda, Bargarh and Puri. It is higher in the Koraput as compared to other districts. In case of total areas, it is more than 5 percent in Rayagada, Koraput, Kendujhar, Anugul and Ganjam. In case of rural areas, it is more than 5 percent in Rayagada, Koraput, Kendujhar, Anugul and Ganjam. In case of urban areas, it is more than 5 percent in Rayagada and Koraput.

The percentage participation of women in work from the age of 15 years and above is higher in rural areas among most of the districts except for Baleshwar, Khordha, Cuttack and Puri. It is more than 40 percent in the rural areas of Rayagada, Koraput, Kendujhar, Sambalpur and Bargarh. It is more than 20 percent in the urban areas of Sundargarh, Kendujhar, Sambalpur, Bargarh and Anugul.

Table 4.4: Percentage of Women with at least 3 ANC visits,Women with at least 1 TT and Women consumed IFA tablets for more than and equal to 100 days at district level

Districts	Women with at least 3 ANC visits			Women with at least 1 TT			Women consumed IFA tablets for more than and equal to 100 days		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Anugul	87	83	86	97	96	97	21	29	22
Balangir	86	91	84	99	100	99	24	21	24
Baleshwar	89	95	87	99	99	99	19	27	20
Bargarh	93	96	87	99	99	99	26	25	26
Cuttack	88	87	83	98	97	98	36	55	41
Ganjam	85	91	80	95	98	96	31	46	33
Jharsuguda	92	91	95	99	100	100	45	38	43
Kendujhar	73	68	72	98	95	98	28	34	29
Khordha	88	88	82	97	96	97	33	48	39
Koraput	49	66	75	97	96	97	21	27	22
Puri	90	94	83	98	98	98	28	43	30
Rayagada	58	86	76	98	99	98	40	41	40
Sambalpur	83	90	87	98	99	98	24	26	25
Sundargarh	78	89	84	98	99	98	34	34	34

Source: AHS 3 (2012-13)

Data from Table 4.4 show that the percentage of women with at least 3 ANC visits is more in rural areas among the districts, except for Kendujhar. It is more than 50 percent among all the districts in total, rural and urban areas. There are less differences in rural and urban areas. The percentage of women with at least 1 TT is more than 90 percent among the districts. It is low in the districts of Koraput, Anugul and Khordha as compared to other districts.

The percentage of women who consumed IFA tablets for more than and equal to 100 days is more in urban areas among most of the districts except for Jharsuguda, Balangir and Bargarh. It is highest in the urban areas of Cuttack followed by Khordha, Ganjam and Puri.

Table 4.5: Percentage of Children health check-up after birth, Children birth weight taken and Low birth weight children at district level

Districts	Child health check up after birth			Children birth weight taken			Low birth weight children		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Anugul	85	87	87	89	87	88	23	19	23
Balangir	83	89	87	90	96	90	17	16	17
Baleshwar	86	93	89	91	95	91	24	16	23
Bargarh	86	92	93	92	95	92	18	19	18
Cuttack	82	88	88	90	89	90	23	21	23
Ganjam	78	91	86	89	95	90	26	23	26
Jharsuguda	95	95	92	95	94	95	19	18	19
Kendujhar	72	67	72	76	71	75	19	20	19
Khordha	81	85	88	92	92	92	22	18	21
Koraput	74	80	52	60	77	63	34	30	33
Puri	82	92	90	94	92	94	21	24	22
Rayagada	74	91	62	87	96	88	22	19	22
Sambalpur	85	92	86	86	93	89	21	15	19
Sundargarh	82	90	81	86	92	87	20	19	20

Source: AHS 3 (2012-13)

Data from Table 4.5 show that the percentage of children taken for health check-up after birth is higher in rural areas in the districts of Kendujhar, Anugul and Cuttack. it is less than 50 percent in the rural areas of Koraput, except this all the districts having more than 50 percent of Children taken for health check up after birth in the rural, urban and total areas.

The percentage of low birth weight children is higher in rural areas in all the districts except for Bargarh and Puri. It is more than 20 percent in the rural areas of Rayagada, Sundargarh, Sambalpur, Anugu, Baleshwar, Khordha, Cuttack, Ganjam and Puri. In case of urban areas, it is more than 20 percent in the district of Koraput, Cuttack, Ganjam and Puri. In case of total areas, it is more than 20 percent in Rayagada, Koraput, Anugu, Baleshwar, Khordha, Cuttack, Ganjam and Puri.

4.3: Results and Discussions:

The present section examines the determinants of IMR,NMR and PMR in odisha using Multiple linear regression analysis.

The dependent variables in the regression analysis are IMR, NMR and PMR and the independent variables are:

1. Percentage participation of women in work from the age of 15 years and above
2. Percentage of women who are literate
3. Percentage of women married before the legal age
4. Percentage of women with at least 3 ANC visits
5. Percentage of women with at least 1 TT
6. Percentage of women consumed IFA tablets for more than and equal to 100 days
7. Percentage of low birth weight children
8. Percentage of children taken for health check-up within 2 days of birth

The hypothesis for the regression analysis is:

H0: There is no effect of socio-economic, environmental and maternal factors on IMR, NMR and PMR.

HA: The IMR, NMR and PMR in the districts of Odisha are determined by the socio-economic, environmental and educational factors.

4.3.1 Results:

Table 4.7: Factors affecting IMR in total areas- District level

Independent variables	Coefficient	t value
Children birthweight less than 2.5kg	-3.794	-3.76**
Women with at least 3 ANC visits	-.5300	-.90
IFA tablets for more than and equal to 100 days	-.6602	-1.71
Participation of women in work from the age of 15 years and above	-1.224	-3.76**
Women's literacy	-.9884	-2.92**
F value P value Adj. R square	3.94* 0.0424 .5306	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.8: Factors affecting NMR in total areas- District level

Independent variables	Coefficient	t value
Child birthweight less than 2.5kg	-2.600	-3.17**
IFA tablets for more than and equal to 100 days	-.6975	-2.21*
Participation of women in work from the age of 15 years and above	-.6162	-2.34*
Women's illiteracy	-.5449	-2.14
F value P value Adj. R square	3.18** 0.0068 .4020	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.9: Factors affecting PMR in total areas- District level

Independent variables	Coefficient	t value
Participation of women in work from the age of 15 years and above	-.4829	-3.53**
Women consumed IFA tablets for more than and equal to 100 days	-.2663	-.99
Women's literacy	-.7317	-3.25**
Women married before legal age	-2.300	-2.28*
F value P value Adj. R square	3.93* 0.0411 .4737	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.7, 4.8 and 4.9 gives the results of multiple linear regression model in total areas for districts of Odisha. All table are good fits. The table 4.7, 4.8 and 4.9 shows 53 percent, 40 percent and 40 percent variation in dependent variables IMR, NMR and PMR respectively by independent variables. There is a linear association between dependent factors and independent factors. Hence rejecting the null hypothesis. The variables are free from multicollinearity.

The IMR in total areas for the districts of Odisha is negatively associated with percentage of childbirth weight less than 2.5kg (B = -3.794), percentage participation of women in work from the age of 15 years and above (B= -1.224), percentage of women's literacy (B= -.9884), percentage of women consumed IFA tablets for more than and equal to 100 days and percentage of women with at least 3 ANC visits (B= -.5300). The negative relation between percentage of low birth weight children with IMR is unexpected. The percentage of women's literacy, percentage participation of women in work from the age of 15 years and above and percentage of child birthweight less than 2.5 kg are significant at 1 percent.

NMR is negatively associated with percentage of childbirth weight less than 2.5kg (B = -2.600), percentage of women who consumed IFA tablets for more than and equal to 100 days (B = -.6975), percentage of women's literacy (B= -.5449) and percentage participation of women in work (B = -.6162). The negative relation between percentage of low birth weight children and NMR is unexpected. NMR is statistically significant with percentage of child birthweight less than 2.5kg, percentage participation of women in work and percentage of women who consumed IFA tablets for more than and equal to 100 days. The percentage of Child birthweight less than 2.5 kg. is highly significant at 1 percent and other two variables are significant at 5 percent levels.

PMR is negatively related to percentage of women's literacy (B = -.7317), percentage participation of women in work from the age of 15 years and above (B = -.4829), percentage of women consumed IFA tablets for more than and equal to 100 days (B= -.2663) and percentage of women married before the legal age (B = -2.300). The negative relation between percentage of women married before the legal age and PMR is unexpected. It is highly significant at 1 percent level with percentage of women work participation, and percentage of women's literacy. The percentage of women married before the legal age is significant at 5 percent.

Table 4.10: Factors affecting IMR in rural areas- District level

Independent variables	Coefficient	t value
Child birthweight less than 2.5kg	-3.3094	-3.22**
IFA tablets for more than and equal to 100 days	-.5840	-1.39
Participation of women in work from the age of 15 years and above	-.8956	-3.32**
Women's literacy	-.8030	-2.82*
F value P value Adj. R square	3.78* 0.0452 .4611	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.11: Factors affecting NMR in rural areas- District level

Independent variables	Coefficient	t value
Children health check-up after birth	1.607	2.71**
Women with at least 3 ANC visits	-1.598	2.12*
Women with at least 1 TT	5.372	2.12
Women's literacy	-.6612	-2.02
F value P value Adj. R square	2.58** .0194 .3272	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.12: Factors affecting PMR in rural areas- District level

Independent variables	Coefficient	t value
IFA tablets for more than and equal to 100 days	-.2663	-.99
Participation of women in work from the age of 15 years and above	-.4829	-3.53**
Women's literacy	-.7317	-3.25**
Women married before legal age	-2.300	-2.28*
F value P value Adj. R square	3.11* 0.0411 0.4737	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.10, 4.11 and 4.12 gives the results of multiple linear regression in rural areas for the districts of Odisha. The 4.10, 4.11 and 4.12 are a good fits and represents 46 percent, 33 percent and 47 percent variation in dependent variables respectively by independent variables. There is a linear association between the dependent factors explained by independent factors. Hence rejecting the null hypothesis. These variables are free from multicollinearity.

IMR is negatively related to percentage of women illiteracy (B= -.8030), percentage participation of women in work from the age of 15 years and above (B= -.8956), percentage of women who consumed IFA tablets for more than and equal to 100 days (-.5840) and percentage of children birth weight less than 2.5 kg. (B= -3.3094). The negative relation between percentage of children birth weight less than 2.5 kg and IMR is unexpected. The percentage of Women's literacy is significant at 5 percent. It is significant at 1 percent with percentage participation of women in work from the age of 15 years and above and percentage of children birth weight less than 2.5 kg. The percentage of women consumed IFA tablets for more than and equal to 100 days is not significant.

The NMR is negatively linked with percentage of women with at least 3 ANC visits (B= -1.590) and percentage of women's literacy (B= -.6612). NMR is positively related with percentage of women with at least 1 TT (B= 5.372) and percentage of children health check up after birth (B= 1.607). The positive relation between percentage of children taken for health check-up after birth and percentage of women with at least 1 TT with NMR are unexpected. The percentage of children health check-up after birth is significant at 1 percent and percentage of women with at least 3 ANC visits is significant at 5 percent.

PMR is negatively associated with percentage of women who consumed IFA tablets for more than and equal to 100 days (B = -.2663), percentage participation of women in work from the age of 15 years and above (B= -.4829), percentage of women's literacy (B= -.7317) and percentage of women married before the legal age (B= -2.300). The negative relation between percentage of women married before the legal age and PMR is unexpected. PMR is highly significant at 1 percent with percentage participation of women in work from the age of 15 years and above, percentage of women's literacy, and significant at 5 percent with percentage of women married before the legal age.

Table 4.13: Factors affecting IMR in urban areas- District level

Independent variables	Coefficient	t value
IFA tablets for more than and equal to 100 days	-1.066	-2.98**
Women with at least 3 ANC visits	-2.697	-3.09**
Participation of women in work from the age of 15 years and above	-2.570	-3.56**
Children taken for health check-up after birth	1.009	1.37
Low birth weight children	-1.519	-1.57
F value P value Adj. R square	4.04* 0.0397 .5393	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.14: Factors affecting NMR in urban areas- District level

Independent variables	Coefficient	t value
Child birthweight less than 2.5kg	-.8560	-1.04
IFA tablets for more than and equal to 100 days	-1.033	-3.22**
Women with at least 3 ANC visits	-1.322	-3.09**
Participation of women in work from the age of 15 years and above	-1.625	-2.54*
Women married before legal age	-1.579	-1.71
F value P value Adj. R square	3.47* 0.0578 .4876	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.15: Factors affecting PMR in urban areas- District level

Independent variables	Coefficient	t value
Child birthweight less than 2.5kg	-1.158	-3.14**
Women with at least 3 ANC visits	-.3933	-2.17*
Participation of women in work from the age of 15 years and above	-.9929	-4.41**
Women married before legal age	1.199	3.00**
F value P value Adj. R square	5.98** 0.0125 .6051	

Note: * significant at 5 percent, ** significant at 1 percent

Table 4.13, 4.14 and 4.15 show the multiple linear regression results in urban areas for the districts of Odisha. There is three model. The regression results of table 4.13, 4.14 and 4.15 shows that the models are a good fits. Table 4.13 show 54 percent, table 4.14 show 49 percent and table 4.15 show 60 percent variation in dependent variables respectively by independent variables. There is a linear relationship between the dependent factors and independent factors. Hence rejecting the null hypothesis. Also, the variables are free from multicollinearity.

In case of urban areas, IMR is negatively related to percentage of women who consumed IFA tablets for more than and equal to 100 days (B= -1.066), percentage of women with at least 3 ANC visits (B= -2.697), percentage participation of women in work from the age of 15 years and above (B= -2.570) and percentage of low birth weight children (B= -1.519). IMR is positively related with percentage of children taken for health check-up (B= 1.009). The negative relationship between percentage of low birth weight children with IMR and positive relationship between percentage of children taken for health check-up with IMR are unexpected results. The percentage of women consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 3 ANC visits and percentage participation of women in work from the age of 15 years and above are significant at 1 percent. Other variables are not significant.

NMR is negatively associated with percentage of women who consumed IFA tablets for more than and equal to 100 days (B = -1.033), percentage participation of women in work from the age of 15 years and above (B = -1.625), percentage of women married before the legal age (B

= -1.579), percentage of low birth weight children (B = -.8560) and percentage of women with at least 3 ANC visits (B = -1.322). The negative relation between percentage of low birth weight children and percentage of women married before the legal age with NMR are unexpected. NMR is significant at 1 percent with percentage of women who consumed IFA tablets for more than and equal to 100 days and percentage of women with at least 3 ANC visits. NMR is significant at 5 percent with percentage participation of women in work from the age of 15 years and above.

The PMR is negatively related to percentage participation of women in work from the age of 15 years and above (B= -.9929), percentage of women with at least 3 ANC visits (B= -.3933) and percentage of low birth weight children (B= -1.158). The PMR is positively linked to percentage of women married before the legal age (B= 1.199). The positive relation between percentage of low birth weight children and PMR is unexpected. The percentage of women with at least 3 ANC visits is significant at 5 percent and other variables are significant at 1 percent with PMR.

4.3.2 Discussions:

The Multiple linear regression results in total areas, rural areas and urban areas (Table 4.7, Table 4.8, Table 4.9) show that the factors affecting IMR, NMR and PMR are different. Again, the factors affecting IMR, NMR and PMR in rural and urban areas are different.

Women's literacy negatively affecting IMR. Education creates economic growth by reducing poverty and increasing productivity. Education promotes health awareness among mothers. Therefore, an educated mother can make positive behaviour, habit and better knowledge of child health, which can affects child health. Women's education can be useful for accessing health care and capable of using health care needs of children. They can better manage the household's socio-economic conditions. This may be the reason that the chances of IMR, NMR and PMR are less in case of percentage of women who are literate.

Participation of women in the work from the age of 15 years or above is a proxy variable for women empowerment. It reflects the status of women participation in a household in decision-making and their control over the household's resources. They have the independence of taking decision toward child health. Women empowerment are legitimate as a key indicator of both child and maternal health. It may be because women can better understand the child health and she can take better decision toward the child health issue. This may be the reason that IMR,

NMR and PMR are inversely relate to percentage participation of women in work from the age of 15 years and above.

Women married before the legal age are mentally and physically not fit to give birth and nurturing the children properly. They are mainly school dropout and face the problems of nutritional deficiency like anaemia and taking proper care of children in post-neonatal periods. This may be the reason that percentage of women married before the legal age is having high chances of PMR.

Women with at least 3 ANC visits are negatively related to IMR, NMR and PMR. ANC visits provide the health check-up for women and prevent as well as control the diseases and health-related problems to mother and children. Also, women take IFA tablets for 100 or more days reduce the nutritional deficiency in mother and children. It reduces the problems of low birth weight among children and nutritional deficiency. This may be the reason that percentage of women taken IFA tablets and percentage of women with 3 ANC visits are negatively related to IMR and NMR.

4.4 Conclusions:

The IMR in total areas is determined by the percentage of low birth weight children, percentage participation of women in work from the age of 15 years and above and percentage of women's literacy. The NMR in total areas is determined by the percentage of low birth weight children, percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage participation of women in work from the age of 15 years and above. PMR in total areas is determined by the percentage participation of women in work from the age of 15 years and above, percentage of women's literacy and percentage of women married before the legal age.

In case of rural areas, IMR is determined by the percentage of low birth weight children, percentage participation of women in work from the age of 15 years and above and percentage of women's literacy. The percentage of children taken for health check-up after birth and percentage of women with at least 3 ANC visits are the determinants of NMR. PMR is determined by the percentage participation of women in work from the age of 15 years and above, percentage of women's literacy and percentage of women married before the legal age.

The IMR in urban areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 3 ANC visits and

percentage participation of women in work from the age of 15 years and above. The NMR in urban areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 3 ANC visits and percentage participation of women in work from the age of 15 years and above. PMR in urban areas is determined by the percentage of low birth weight children, percentage of women with at least 3 ANC visits, percentage participation of women in work from the age of 15 years and above and percentage of women married before the legal age.

Chapter 5

Conclusions and Policy Suggestions

5.1 Conclusions:

Infant mortality is a major factor used to identify the economic development of a country. Infant mortality reflects the socio-economic and environmental situation of a country. It shows the health outcome and health condition of children within the age one years.

India IMR has been gradually declining over time, but it has not met the MDG-4 i.e. reducing IMR to 29 by 2015 and as compared to the neighbouring countries, IMR is higher in India. The IMR has declined in both rural and urban areas from 85 to 46 and 56 to 29 respectively. But the gap among the rural and urban is still persisting in India.

The NMR is higher than the PMR in India and the gap is still high. The rural and urban gap for IMR is prominent in almost all the states, but in Kerala, Jharkhand, Mizoram and Uttarakhand the gap is much narrow. IMR is more than 40 in 14 major districts of Odisha. The districts of Odisha have higher NMR than PMR (except for Rayagada).

Data on IMR, NMR and PMR for all the states were collected from NFHS- 4 (2015-16) and data for the 14 districts of Odisha was collected from AHS-3 (2012-13). Data on independent variables for the states were collected from the NFHS-4 (2015-16) and for the districts of Odisha was from AHS-3 (2012-13).

Multiple linear regression analysis was applied to find out the determinants of IMR, NMR and PMR in total, rural and urban areas of the states separately. The results of the regression show that, the IMR in total areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits, percentage of women with low BMI and percentage of women up to 10 years of education and above. The percentage of women with low BMI, percentage of households with lowest wealth index and percentage of women with PNC are the determinants of NMR in total areas. PMR in total areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits and percentage of women up to 10 years of education and above.

The IMR in rural areas is determined by the percentage of children taken for health check-up after 2 days of birth, percentage of households with proper sanitation facility, percentage of

women with at least 4 ANC visits and percentage of women with PNC. The NMR in rural areas is determined by the percentage of women with at least 4 ANC visits, percentage of households with lowest wealth index and percentage of women with PNC. PMR in rural areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 4 ANC visits, percentage of women up to 10 years of education and above and percentage of women married before the legal age.

The IMR in urban areas is determined by thepercentage of women with at least 4 ANC visits, percentage of women with low BMI, percentage of women upto 10 or more years of education, percentage of women married before legal age and percentage of households using clean fuel for cooking. NMR in urban areas is determined by the percentage of women with 10 or more years of education, percentage of women married before legal age and percentage of women with caesarean section delivery. PMR in urban areas is determined by the percentage of women with at least 4 ANC visits, percentage of women up to 10 years of education and above, and percentage of women married before the legal age.

Multiple linear regression analysis was applied separately for district level analysis of Odisha. The results of the regression show that, the IMR in total areas is determined by the percentage of low birth weight children, percentage participation of women in work from the age of 15 years and above and percentage of women's literacy. The NMR in total areas is determined by the percentage of low birth weight children, percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage participation of women in work from the age of 15 years and above. PMR in total areas is determined by the percentage participation of women in work from the age of 15 years and above, percentage of women's literacy and percentage of women married before the legal age.

In case of rural areas, IMR is determined by the percentage of low birth weight children, percentage participation of women in work from the age of 15 years and above and percentage of women's literacy. The percentage of children taken for health check-up after birth and percentage of women with at least 3 ANC visits are the determinants of NMR. PMR is determined by the percentage participation of women in work from the age of 15 years and above, percentage of women's literacy and percentage of women married before the legal age.

The IMR in urban areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 3 ANC visits and percentage participation of women in work from the age of 15 years and above. The NMR in urban areas is determined by the percentage of women who consumed IFA tablets for more than and equal to 100 days, percentage of women with at least 3 ANC visits and percentage participation of women in work from the age of 15 years and above. PMR in urban areas is determined by the percentage of low birth weight children, percentage of women with at least 3 ANC visits, percentage participation of women in work from the age of 15 years and above and percentage of women married before the legal age.

5.2 Policy Suggestions:

From the above analysis, the following policy suggestions were given for both states of India and districts of Odisha.

1. Education of girl till 10^{th} class must be encouraged and given priority at the state level of India for reducing PMR, NMR and IMR.
2. To reduce NMR, PMR and IMR, ANC visits must be encouraged at the state level of India.
3. To reduce the NMR, PMR and IMR, women should be given balanced nutrition that their BMI will improved at the state level of India.
4. Women's literacy and work participation must be encouraged to reduce PMR, NMR and IMR in the districts of Odisha.
5. The use of ANC visits and consumption of IFA tablets for 100 or more days must be encouraged to reduce NMR, PMR and IMR in the districts of Odisha.

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