SOCIAL DIMENSIONS OF CHRONIC ARSENICOSIS IN A VILLAGE OF PATNA DISTRICT

Dissertation submitted to Jawaharlal Nehru University in partial fulfilment of the requirement for the award of the degree of

MASTER OF PHILOSOPHY

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DECLARATION

This is to certify that the dissertation titled **"Social Dimensions of Chronic Arsenicosis in a Village of Patna District"** submitted by me under the guidance of Prof. Ritu Priya Mehrotra in partial fulfillment for the award of the degree of **MASTER OF PHILOSOPHY** is my original work and has not been previously submitted for any other degree of this University or any other University.

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CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation.

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Research is a process or a journey, starts from first encounter with the problem if it bothered or stuck in our mind to the final version of work after going through different phases of it. At the end of learning and reflective journey, it is time now to express my gratitude to the people and situation that have been with me through this journey of completing my research study. Without all of helping hand, it would not have been possible for me to this destination of my journey.

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Dedicated to

the one who would discover an alternative of water for human kind

and I believe there would be.

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Abbreviations

BC: Backward Class

BIS: Bureau of Indian Standard

EBC: Extremely Backward Class

GMB: Ganga Meghana and Brahmputra

HH: Household

IARC: International Agency for Research on Cancer

NGO: Non-government Organization

OC: Other Class

PDS: Public Distribution System

PHC: Primary Health Centre

RMP: Rural Medical Practitioner

SC: Schedule Caste

UNICEF: United Nations International Children's Emergency Fund

USA: United States of America

WHO: World Health Organization

As: Arsenic

ft: Foot (measurement scale)

Km: Kilometre

µg/l: Micro gram per litre

Introduction

Arsenicosis is an emerging problem in several Indian states over the last two decades. However there are countries like Bangladesh, Taiwan and Chile where people have been affected since a long time. The common manifestations of arsenicosis develop in severity over several years, from skin discolouration that may be viewed as a cosmetic issue, painful skin lesions that can be disabling, to involvement of various internal organs. Rarer, but most serious, is the fact that cancers have been linked causally to the chronic arsenicosis. It is evident from literature and my experience on the ground in rural Bihar, that the problem has, in addition to the bio-medical dimensions, causal environmental linkages and economic, social and psychological ramifications. To understand the complexities of arsenicosis and deal with it as a public health problem, therefore, requires an interdisciplinary examination.

The relationship between humans and arsenic is complex in nature because, while it was known as a poison and used as homicidal agent in ancient times, it has also been in use for the treatment of leukaemia, psoriasis, chronic bronchial asthma, antibiotics for treatment of spirochetal and protozoal disease. Arsenic and its compounds have had commercial purposes in the form of wood preservative, agricultural chemical (pesticides, herbicides, and insecticides), leather preservative, and in the glass making and semiconductor industries (IARC, 2012). But now it has become one of the biggest factors for mass poisoning, causing chronic arsenicosis and carcinogen for human being, affecting about 200 million people around the world (Chakraborti, D., et al. 2016, Murcott, 2012, Naujokas, et al. 2013). The problem, spreading across new region, is raising questions that require us to understand its physical, chemical, toxicological, and medicinal properties in a different light as well as its biogenic, geogenic and anthropogenic sources, and its health and social implications. To understand these various dimensions and their complex relations we need to study it through a microscope in which different lenses have been fitted means interdisciplinary approach is needed.

According to Repko. A. F. (2012), there are two major forms of interdisciplinary work: *instrumental interdisciplinary* (problem driven) and *critical interdisciplinary* (society driven). However regarding the study where environment and health care are

integrated, he mentioned that *"research on systematic and complex problems such as environment and health care often reflects a combination of critique and problem solving approaches* (Repko, A. F., 2012: 23) means bridging these two forms of interdisciplinary study can be better approach for such study.

While evidence on the multi-dimensional nature of the problem and its social implications are available from studies in various parts of the world and from West Bengal in India, they are lacking for the specific context of Bihar. Bihar is a state with a very special geographic location, specially in relation to water, at the foothills of the Himalayas and includes the Gangetic plains. It is perennially faced with the twin problems of '*baadh* and *sukhaad*' (floods and drought), with rivers draining from the higher reaches. Now arsenicosis is being found in several districts along them. Further, it was found that most studies have focused on adult manifestations and their social implications, with little on children. This study, therefore, was focused on the implications for children of a village in Bihar.

Published evidence of arsenic contamination of ground water in the village and the prevalence of manifestations of arsenicosis led to selection of the study site. A small sample survey and participatory methods of social mapping, innovations for capturing the children's perceptions and eliciting information about responses to deal with the problem, were all used to capture the present ground reality. Analysing these allowed me to develop a narrative of the social dimensions of arsenicosis in the study village.

This dissertation, presenting the outcomes of this effort, is organized in five chapters:

Chapter 1 presents the literature review of available knowledge about chronic arsenicosis, globally, in India and more specifically in Bihar.

Chapter 2 builds on the literature review to develop a conceptualization of the problem for this study, and the objectives and research questions formulated. Then the chapter explains the methodology adopted and the process of data gathering as it unfolded. Mixed methods, primarily qualitative but also quantitative, that were used to develop an understanding of the problem and meet the research objectives, given the ground realities encountered during field work, are discussed.

Chapter 3 describes the study village, Haldi Chhapra, its geographic characteristics, social, demographic and health profile.

Chapter 4 presents findings on social dimensions of arsenicosis in the village. The environmental and social determinants, morbidity profile as well as social consequences of the physical manifestations are presented. Also presented are the findings about the villagers' and official as well as civil society responses to the problem.

Chapter 5, the final chapter, discusses the findings and shows how the social determinants are critical to understand for instituting preventive measures and building adequate responses to the problem. It highlights questions for further research.

The dissertation is written in first person with a reflective style of writing. Reflective writing is a form of writing research which has emerged out of Gibs model of reflection (Gibbs, G., 1988). With the limitations of a study conducted by a single researcher within a limited time period as an M.Phil research, it has highlighted the value of social science approaches in the study of a public health problem such as arsenicosis.

Chapter - 1

Arsenicosis: Available Knowledge

Background

The origin of the word arsenic can be traced in Arabic word *(al) zarnik* from Persian word *zarnikh* which later adopted in Greek as *arsenikon,* in Latin as *arsenicum,* and then in French and English it become *arsenic* (Oxford Dictionary). The mineral form of arsenic was known as early as fourth century BC but later a Greek physician Dioscoride described arsenic as a poison in first century in the court of Roman Emperor Nero. Historically from the period of Roman Empire till the Renaissance, arsenic was known as king of poison. (Smith, R. P., n.d) In the late middle age, Paracelsus, a physician alchemist, founder of modern toxicology (Borzelleca, J. F., 2000:1) has written about arsenic but the German scholastic Albertus Magnus is usually credited with the discovery of element around 1250. Many historically important personalities such as Nepolian Bonaparta and Charles Darwin are known to have suffered from arsenic poisoning.

Arsenic poisoning can be acute or chronic based on the quantity of arsenic consumption and time period of exposure. Though acute arsenic poisoning has been reduced in recent century, chronic arsenic poisoning has been widely reported (WHO, 1981). The long term exposure of inorganic arsenic (WHO, 2017) or the continuous consumption of arsenic through drinking water and food sources may lead to chronic arsenic poisoning, known as 'arsenicosis' (WHO, 2011; Ghosh, S. K., et al, 2014). Arsenicosis through ground water has been found in almost all continents in 105 countries with more than 200 million people exposed to concentrations of the element greater than the defined value by World Health Organization (Chakraborti, D. et al. 2016, Murcott, 2012, Naujokas, et al. 2013). Among these affected peoples, most of the vulnerable populations are from South East Asian countries especially from the Ganga, Meghana and Brahmaputra (GMB) plains, an estimated 50 million in Bangladesh, 30 million in India and 2.5 million in Nepal (Chakarborti, D., 2016; Brammer, H., 2008). Groundwater Arsenic contamination in the Ganga plains of West Bengal was first reported in 1984 (Garai et al. 1984; Chakraborti, et al. 2002) and later

in 2003 the harmful effect of arsenic was reported from Bhojpur in Bihar (Chakraborti, et al. 2003).

The sources of availability of arsenic can be biogenic, geogenic and anthropogenic, exposure to humans being through dietary and non dietary means. Health implications in the form of common manifestations, rare manifestations or effects on different parts of body including, liver, kidney, respiratory systems, gastrointestinal, cardiovascular, neurological system, genitourinary system, respiratory system, endocrine and haematological system have been studied along with social implications.

This chapter will discuss scientific properties of arsenic, its sources, theories around contamination of ground water, exposed population, manifestation of arsenicosis and its social implications.

1.1 Chemical Properties of Arsenic

Arsenic is a chemical element of Nitrogen family whose atomic number is 33, symbol is As and situated on period 4 in p block of the Periodic table. The atomic weigh of arsenic is 74.39, specific gravity is 5.73 at 25º C, and melting point is 81.7 º C at 28 atmospheric pressure and boiling point 613 º C. It's a silver grey colour brittle metallic looking substance but their properties are intermediate of metallic and non metallic which is called as metalloid or semi metal. Arsenic can be found in organic as well as inorganic forms where inorganic form is more dangerous and toxic than the organic form (WHO, 2017). This element makes compounds with various metals like Iron (Fe), Copper (Cu), Nickel (Ni) and also arsenic sulphide and oxide. While it is insoluble in water in the natural state, its oxidised forms are soluble and can contaminate water. Arsenic exists in four oxidation states: -3, 0, +3 and +5 in which arsenide, arsenic (III) and arsenate, arsenic (V) are predominate oxidation state (IARC, 2012). Arsenite is more dangerous than Arsenate which means that the trivalent form of arsenic is a greater threat (Ray, S. 2003) and 60 times more toxic than pentavalent form (Ratnaike, R. N., 2003).

1.2 Sources of Availability

Arsenic is available in the earth's crust, often in the form of arsenic sulphide or as metal arsenates or arsenide (WHO, 2011). The concentration of arsenic varies in different sources but availability has been reported in water, air, soil and in food

especially rice, meat, fish. Arsenic presence has been recorded in animal and plant products. From all this available knowledge it can be said that there is natural presence of arsenic and through chain of arsenic consumption or transition from one source to another it spreads other sources. For example cattle milk contained high concentration of arsenic if the cattle consumed plants or grass grown on soil containing high concentrations of arsenic (WHO, 1981, Navarro, M., 1993). Arsenic uptake in rice is high because it is grown in flooded fields where topsoil in strongly reduced as well as anaerobic which is better condition to accumulate arsenic in it's root and also because more water is required to produce rice than other crops (Brammer, H., 2008: 80). Besides this, the other sources of arsenic are: processing plants, chemical works, and coal combustion (Thornton, I., 2015: 3) i.e. various industrial wastes as the anthropogenic sources of arsenic. The other man made sources of arsenic are pesticides, mineral extractions, poultry and swine feed additives (Nordstrom, D. K., 2002:1).

Many scholars have claimed that the contamination of ground water is due to industrial waste. It was also reported that the arsenic was present on Himalayan rocks in the form of arsenic pyrite, which later reached to plain areas of Himalayan river basin through flood or huge water catchment. It took time to sediment on the river basin and when river changes their path the arsenic found their ways in beds of rocks later leached into ground water.[1] The theories and the process of arsenic dissolution in water will be discussed in next section of this chapter.

Arsenic can be found in surface water as well as in ground water but the arsenic compound is different and the toxicity is high in ground water. A study done in Peru where 86% of ground water sample was exceeding the standard value of WHO (10 µg/l) whereas only 50% surface water sample was contaminated (George, C. M., et al. 2014: 567). In the water bodies like lakes, rivers, and wells arsenic has been found but the pentavalent compound of arsenic in these sources which is less toxic than trivalent arsenic compounds. Arsenic has been found even in rain water.

The geo-physical structure of the earth and metrological condition also influence the availability of arsenic in above mentioned biogenic, geogenic and anthropogenic sources of arsenic which further contaminate ground water. For example Nordstrom,

[1] Two key informants, one from the village and other from Mahaveer Cancer Institute, Patna has elaborated the arsenic contamination of ground water through this theory of contamination. They also shared that the Ganga at the site where this village has changed their path and the sangam which is now near the village was near Patna centuries ago.

D .K., (2002) has mentioned that *"two other environments can lead to high arsenic: (i) closed basins in arid-to-semiarid climates (especially in volcanogenic provinces) and (ii) strongly reducing aquifers, often composed of alluvial sediments but with low sulfate concentrations"* (Nordstrom, D. K., 2002: 1).

1.3 Arsenic in Ground Water

Arsenic contaminated ground water started being reporting in different part of the world from early 20th century. The process of releasing of arsenic in to ground water has been discussed and studied.

1.3.1 Theories and Process

Arsenic dissolved in to water through different sources or means, be it from deposits in rocks, mineral in the sediments, industrial affluent, ores, mining or atmospheric deposition but the mechanisms of release of arsenic in water are same. According to Ghosh, A. K et al. (2007), there are two main theories to explain the process of arsenic released into the ground water. First is pyrite oxidation where they explained "*In response to pumping, air, water with dissolved oxygen penetrates into the ground, leading to decomposition of the sulphide minerals and release of arsenic*" (Ghosh, A. K., et al. 2007: 1). Another theory is **oxyhydroxide reduction**, a much accepted theory in the scientific world. The river basin naturally transports arsenic from different sources to the flood plains, where iron or manganese oxyhydroxides sediment on the plain and later get buried into the layers of soil. The creation of reducing condition in the sediment and groundwater makes favourable condition for release of arsenic into ground water.

Two important explanations of arsenic contamination of ground water in Indian Gangetic plain have been discussed by Thornton, I. (1996) and widely accepted by many other scholars. Earth is made up of rocks, minerals and different levels of aquifer and the beds of rocks have arsenic deposition on it. During the green revolution, the water has been over extracted for the purposes of irrigation which leads to depletion of water level. The lowering of water level has exposed the arsenic deposited in the beds of rocks, with oxidation of arsenic made final way of arsenic to the water. Another possible explanation is over use of arsenic water for irrigation

which accumulates the arsenic on soil (Thortan, I., 1996) and then to the human bodies through various means either it is dust, food or direct contact with soil.

One more important point made by Indian ecologist Ghosh, S. N. (1985) regarding the lowering of water table which has not been given sufficient recognition (Jain, L. C. 2012), has potential value in considering the rationale behind depletion of water table and arsenic contamination of water in Gangetic plain. According to Ghosh, S. N. (1985) the primary yield of forest is water and if forest cover will decrease, the water table will also lower down (Ghosh, S. N., 1985). Now there are two theories explaining the reason of depletion of water table, first over exploitation of water during green revolution and second is the deforestation in some areas. And the arsenic contamination of ground water is the problem within 5 km near the river on both banks, though there are cases recorded up to 10 km of range. The over exploitation of ground water for irrigation purposes has less possibility in river basin geographical areas due to availability of surface water (river, tributaries, canal) for irrigation. In this case deforestation could explain the reason of water depletion in such areas. Villagers have also informed about the decline of tree cover in Haldi Chhapra village. The validity of the theories can be verified or refuted by the scholars based on the evidences but there are possibilities of both the theories having their role in explaining the lowering of water table which later leads to contamination of water due to chemical process.

1.3.2 Permissible level

The quantity of arsenic in ground water varies from place to place. There is evidence from different studies which reported the differences of arsenic level in the ground water within short distances. The reason of this variation is the aquifer and rock in the earth's structure. Based on the evidences and scientific studies of adverse effect of arsenic on human body, US Public Health Service advised in 1962 to set the permissible level of arsenic in drinking water to 10µg/l from earlier standard of 50 µg/l (Smith, A. H., et al. 2002: 2145). The debate and political tussle has took a long way to 2001 for the final adaptation of water standard to 10µg/l by US Environment Protection Agency, simultaneously WHO has also recommended and revised their standard values to 10 µg/l (ibid: 2145, WHO, 1992) however India and Bangladesh

where a large section of the population are affected has their own institutions to define the arsenic value in ground water known as Bureau of Indian Standard (BIS) and Bangladesh standard, both have also fixed the standard value 50 µg/l.

1.3.3 Contamination of Ground Water

Above mentioned sources of availability of arsenic contaminate ground water in different part of the world is based on the theories and process of contamination. This section is an account of world scenario, India and then focused on Bihar.

1.3.3.1 World Scenario

Globally around 28% of population are consuming water that is not fit for drinking according to WHO defined standards. (Hutchings, P. et al 2016 cited Onda et al. 2012). However arsenic has been found in 105 countries in almost all continents and more than 200 million people are consuming arsenic contaminated water higher than the permissible level (Chakraborti, D., et al. 2016, Murcott, 2012, Naujokas, et al. 2013). The first case of arsenicosis was found in 1898 in Poland (Ratnaike, R. N., 2003) and then other part of the world has seen the worst effect. Four worst affected countries in the world are in Asia, with India and Bangladesh being most affected (Ratnaike, R. N., 2003) and other two are Taiwan and China. However other parts of the world like USA, Chile, Peru, Africa, London, Mexico, Iran, Hungary and Argentina have also found arsenic contamination of ground water.

During 2000 to 2005 there were many countries in Asia like Nepal, China, Mangolia, Myanmar, Afghanistan, Combodia, DPR Korea and Pakistan that have reported arsenic contamination of ground water (Sarma, S. D., et al. 2008: 1). Saha, D. (2009) has analysed these affected areas including Bangladesh and India and found that lower flood plains and delta regions in south-eastern Asia prone to high arsenic contamination of water (Saha, D., 2009).

1.3.3.2 India

South East Asian countries specially India, Nepal and Bangladesh among the Asian countries are highly affected regions. The plain area of Ganga, Meghana and Brahamputra (GMB) due to its geo-physical structure and river basin in these three countries has high concentration of arsenic in the ground water. India stands second in

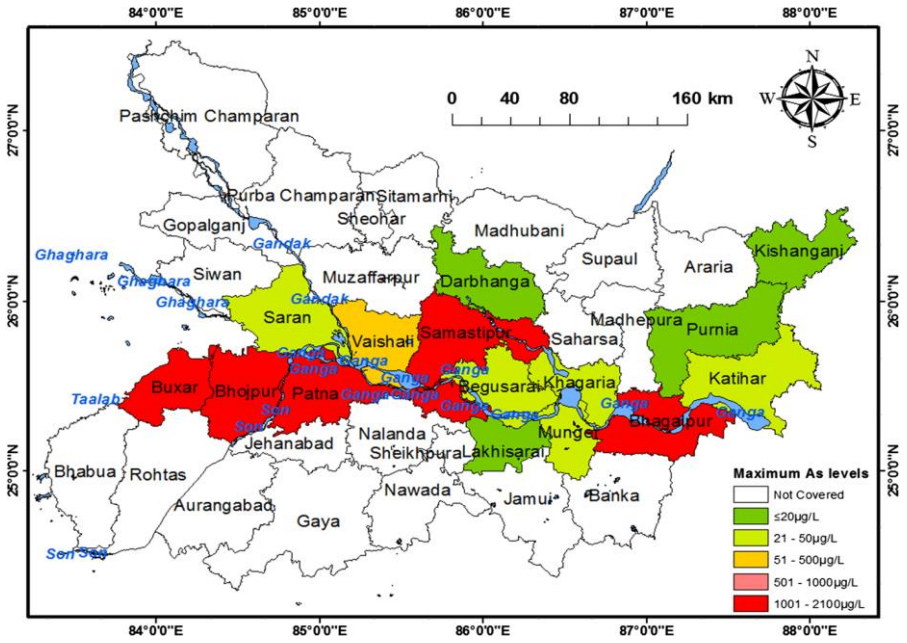
exposed population (30 million) of arsenic exceeding the permissible level. West Bengal is the first state where arsenicosis was reported in India in 1984 on large scale (Garai, et al. 1984; Chakraborti, et al. 2002) however earlier to this in 1976 arsenic contamination of ground water was reported in Chandigarh. Later many parts of the country including Bihar have seen its harmful effect and reported arsenic content in ground water (Chakraborti, et al. 2003). Till now different states including Uttar Pradesh, Jharkhand, Punjab, Assam, Tripura, Arunachal Pradesh, Nagaland, Manipur, Haryana, Himachal Pradesh, Chhattisgarh and Andhra Pradesh have reported arsenic contamination. A recent controversial site of protest where 11 citizens have been killed in Tuticorin (Thoothukudi) who were registering their demand of dismissal of Sterlite company due to which nearby population are being highly affected. Many local and national media has published environmental and health issues including arsenic contamination of ground water in nearby villages due to effluents of Sterlite. Beside these reports, Maran, M and Manimaran, G (2013) has done a study along the Thambraparani River of Tuticorin and Tirunelveli district in Tamilnadu and found arsenic contamination at Kilpattam, north Villanadu located near the river however Akanayakkanpatti, Melpuvani and Kilpuvani located away from the river. They identified pesticides used by farmers and diesel waste material directly discharged into the river as factors for arsenic contamination but not the industrial effluents. However they themselves recommended to impose restrictions on industrial sites along with other suggestions (Maran, M., & Manimaran, G., 2013).

Recently with the discovery of arsenic in groundwater in other states of India including Uttar Pradesh, Jharkhand and Assam (Chakraborti, et al. 2004) and combining these with previously reported arsenic incidents in northern India (Datta 1976), West Bengal and Bangladesh, it appears that some areas in all states and countries of India and Bangladesh in the Ganga- Meghna-Brahmaputra (GMB) plain, with a population of over 450 million and area 570,000 km might be at risk from groundwater arsenic contamination.

1.3.3.3 Bihar

First case of arsenicosis in Bihar was reported in Semaria Ojha Patti village in Bhojpur district in 2003 (Chakraborti, et al. 2003). As earlier studies have already pointed out the Ganga, Meghana and Brahamputra (GMB) plain is highly affected

with arsenic contamination and Bihar was already in the zone of many other heavy metal contaminations like fluoride and iron. Bihar is falling in the middle Ganga plain. The socio-economic, geophysical condition including sediments types and Himalayan Rivers like Ghaghra, Gandak as potential source of arsenic beside Ganga is putting all together Bihar into danger of high arsenic menace. Taking into consideration condition of the state and peoples, scholars have warn the authority through predicting possible situation worse than West Bengal if early steps were not taken and if same mistake will be repeated as it was done in West Bengal (Saha, D., 2009).



Map: 1 Arsenic Vulnerability Map, Source: Singh, S. K. and Vedwan, N. (2015)

This figure was made on the basis of studied done by SOES (2006); Ghosh, et al. (2007); Saha (2009); Singh (2011) based on more than 30000 drinking water sources tested.

According to Singh, S. K. and Vedwan, N. (2015), 57 community development blocks in 15 districts out of 37 districts in the state had found arsenic contamination of ground water. They used vulnerability framework to analyse vulnerability of the district based on exposure (Arsenic, Fluoride, Iron, Nitrate, Flood/Drought), sensitivity (Socio-economic Components, Demography Components, Health Components, Geological Components) and adaptive capacity (Rural Literacy Rate, Female Literacy Rate, Total Literacy Rate, Income, Social Capital, Trust). Based on this framework, arsenic vulnerability map has shown in the figure: 1 indicating that Buxar, Bhojpur, Patan, Samastipur and Bhagalpur district in the state is highly vulnerable due to high concentration of arsenic (1001 µg/l to 2100 µg/l). The same

study found Katihar and Patna as highly vulnerable due to very poor health condition as poor health condition increases the susceptibility to arsenicosis due to lack of coping mechanism. However Katihar, Bhagalpur is more vulnerable due to its socio-economic and geophysical location. After first case found in Bhojpur district in 2003 now just after one decade, 72 community development blocks (out of 532) in 17 districts of the state has been found with arsenic contamination of ground water (Singh, S. K., 2015). However, according to Public Health Engineering Department, Government of Bihar; only 13 districts are affected with arsenic contamination (Public Health Engineering Department, Govt. of Bihar, 2018). From many studies it can be conclude that around 10 million of the population from 17 districts are exposed to arsenic beyond the permissible level.

1.4 Arsenicosis

Long term exposure of arsenic especially inorganic form of arsenic beyond the permissible level through different sources on human being leads to the condition of chronic arsenic poisoning or arsenicosis. Arsenic is group 1 carcinogen and WHO has listed it as top ten dangerous chemical, a serious matter of public health concern.

1.4.1 Sources of Arsenic Exposure:

The availability of arsenic in the biogenic, geogenic and anthropogenic sources can exposed the human beings through two main sources, Dietary sources and Non Dietary sources, as mentioned by Rahman, M. A., et al. (2018). To clear the confusion between sources of availability arsenic and sources of exposure, it is necessary to mention that both have different connotation. Former is the sources of arsenic and later is in-fact the means through which human consume arsenic either dietary or non-dietary sources. Dietary sources are through the consumption of rice, vegetable, meat, fish and other sources which can be eat whereas non-dietary sources are ingestion of soil, dust, inhalation of air, arsenic gases from the burning biogas, residue, tobacco smoking. (Rahman, M. A., et al. 2018: 337- 339) While consumption of arsenic through water has been consider as separate but major sources of exposure.

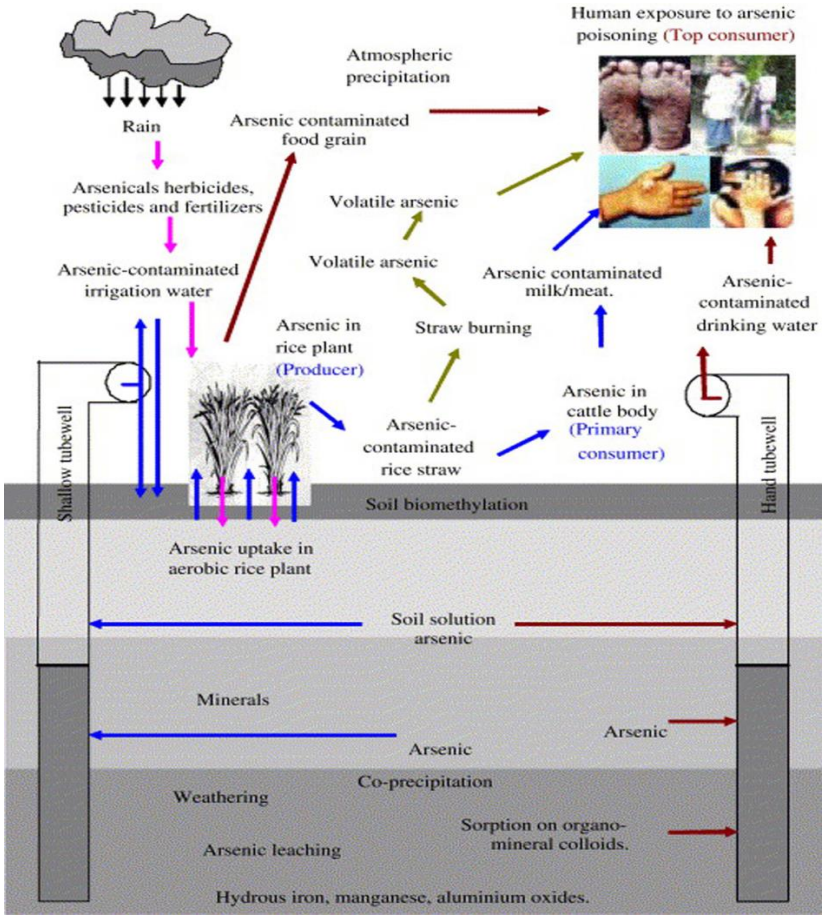


Figure: 1 A Cyclical Representation of Arsenic from Different Source to the Human, Source: Rahman, M. A., et al. (2008)

Through these sources of exposure, arsenic enters into human body where intestine is the major site for absorption through electrogenic process. The absorbed arsenic in human body undergoes hepatic biomethylation to form monomethylarsonic acid and dimethylarsinic acid. Total arsenic consumed by a human is eliminated up to 50% through urine within 3 to 5 days of arsenic consumption. Arsenic accumulates into liver, kidney, heart and lungs primarily but muscles, nervous system, gastro intestinal tract and spleen are the site where small amount accumulate. However final residual of arsenic remain in keratin rich tissues, nail, hair and skin (Ratnaike, R. N., 2003). The clinical diagnosis for arsenicosis is done through testing arsenic content in hair, nail and skin.

1.4.2 Manifestations

Clinical manifestation of arsenicosis is based on individual susceptibility, dose and time course of exposure[2] as well as socio-economic condition, nutritional status and other social factors. Abdominal pain, diarrhoea and sore throat are initial non specific symptoms of chronic arsenicosis (Ratnaike, R. N., 2003). Arsenicosis affects most systems of our body however till now scholars has confirmed skin, gastrointestinal, cardiovascular, neurological system, genitourinary system, respiratory system, endocrine and haematological system (Ratnaike, R. N., 2003). The common manifestations (Ratnaike, R. N., 2003) are skin pigmentation, keratosis, hyperkeratosis, conjunctivitis and melanosis (Das, D. et al. 1994) however uncommon manifestations like cancer (Bowen's disease, squamous cell carcinoma, basal cell carcinoma) has also been reported especially in Asia (Mazumdar, D. N.G., 2000). Skin related manifestations are found to be the commonest and earlier manifestation in the case of arsenicosis.

Arsenic induced cancer was report at different sites of body mainly skin, lung, bladder, liver and lymphatic tissue.

1.4.2.1 Children

The foetus, infant and new born baby is exposed to arsenic toxicity through breast feeding of exposed mothers (Ratnaike, R. N., 2003) and with time children starts consuming arsenic through different sources.

Das, D. et al. 1994 has done a study in different schools of six districts of West Bangal and found that 51 hand pumps were arsenic contaminated and around 30,000 students were consuming the arsenic poison. They also found that children were excreting more arsenic through urine than adults. JD. Hamdani, et al. (2011) found that early life arsenic exposure decreases intelliegence quotient (verbal and full scale).

1.5 Social Dimensions of Arsenicosis

The concentration of arsenic in water, food and other sources of exposure is only one factor to influence manifestation of arsenicosis however other biological activities and duration of exposure also influence. Beside these factors, social dimensions of exposed individuals and population also influence the manifestations of arsenicosis.

[2] Not less than 6 months (Sengupta, S. R et al. 2008)

Poor socio-economic conditions, nutritional status and food habits affect prevalence and severity of the manifestations (Ahmed, Sk. A., et al. 2015). A study done by Ahmed, Sk. A. et al. (2015) found that among the low income and medium income households the prevalence of arsenicosis was high which was 78.6% and 70.0% respectively, while the prevalence was low among the high income households (27.3%). Similarly the nutrient intake through the group of food of milk and milk product which were the major sources of calcium also found to be significantly ($p<0.05$) high among the high income (39.2%) group of households. Another analysis done by Ratnaike, R. N. (2003) based on large number of surveys done in Bihar has shown that socio-economic and demographic condition magnified the vulnerability of populations exposed to low level of arsenic contamination compared to the population with high levels of arsenic but better socio-economic condition.

The social implications of arsenicosis have been widely studied in Bangladesh but not in Bihar though studies are available for West Bengal. Many scholars have pointed out the need of social science research in the context of Bihar on arsenicosis. Based on literature available on social implications, the conceptual framework for this study has been designed (section: 2.1).

1.6 Mitigation Options

According to Alam, M. G. M. et al. (2002) there are two approaches to minimize health impact of arsenicosis on human being*: preventing furtther dispersion of arsenic in a physical environment and curing already affected population* (Alam, M. G. M., et al. 2002: 246). Broadly it can be preventing and curative measures including accessign arsenic free drinking water.

There are mitigation programmes and technological advancement has been achieved to purify the water for instance arsenic can be remove from water through lime-softening, ion exchange, selective membrane method and nano-filtration technology. But for third world countries it is costly to avail for personal use and the low level of investment on health by the state is also leading to high cost technology being to avail.

In case of Bihar, where multiple metal contaminations has been found which makes difficult to eliminate the metal from the water which is why operation and maintenance of filtration is doubling the cost (Saha, D., 2010, Saha, et al. 2010).

However, the recent initiative of '*Har Ghar Nal Har Ghar Jal'* is in the process to provide safe drinking water to the villagers by the state government.

One attractive and inexpensive option that is widely available is to harvest rain water and harness surface water. Ratnaike, R. N. (2003) has also given suggestions to promote good will among the community and encourage well sharing culture which is not contaminated.

The literature is suggesting that shallow aquifer of ground water is contaminated with arsenic and other metal however deep aquifer ranges from 64.88 m to 82.00 m is yet not contaminated as hydraulic conductivity is indicating. That is why Saha et al. (2011) have also suggested accessing water from deeper aquifer can help in the mitigation programme.

1.7 The Background Study

Singh, S. K and Ghosh, A. K. (2012) had done a study in two *panchayats* of Maner block - Rampur Diara and Haldi Chhapra in Patna district of Bihar. They had conducted field work in 2012 and taken a representative population of 1556 from the same village which is not exact figure of the *panchyat's* population. The authors had mentioned that Haldi Chhapra was not updated on block level map till the date research was concluded and, as per the recent information gathered by this researcher, Haldi Chhapra is not a *panchayat*, it is a village, falling under the jurisdiction of Kitta Chauhattar (West) *panchayat*. The objective of the study was "*to do health risk assessment of the exposed population due to the consumption of arsenic contaminated water used for drinking and cooking in two panchayats of Maner block*" (Singh, S. K., & Ghosh, A. K., 2012: 753). They collected 20 water samples from the tube wells, 10 from each *panchayat* and tested on a UV-spectrophotometer by a standard silverdiethyledithiocarbamate (SDDC) method. A survey was conducted to assess the per capita consumption of water and food as well as close and open ended questionnaire and personal interviews were done to record the health symptoms due to arsenic contamination. The health risk assessment was calculated through finding out average total dose, chronic daily intake, cancer risk and hazard quotient (HQ).

The main findings of the research were: 100% of tube wells in Haldi Chhapra were arsenic contaminated exceeding the standard value of WHO and BIS. The depth of hand pumps was found to be between 80 to 155 ft with mean of 108 ft in both of the

panchayat. The range of arsenic contamination was found to be 8µg/l (Rampur Diara) to 498µg/l (Haldi Chhapra). The average arsenic concentration in Haldi Chhapra was 231µg/l which is four times higher than Rampur Diara (52 µg/ l). Mean value of per capita water consumption is 5 litre in Rampur Diara and 5.2 lit in Haldi Chhapra. The per capita consumption of water in Haldi Chhapra is higher or equal to Rampur Diara (2.5 litres, 5.3 litres, 5.8 litres, and 6.4 litres for children, youth, adult and elderly respectively). The daily consumption of vegetables is 4 times higher in Haldi Chhapra (141gram/day) than Rampur Diara (33gram/day) however rice and pulses were a little higher. The per capita consumption of arsenic through drinking water was higher in all the categories in Haldi Chhapra - 577 µg/l (children considered 5-10 age group), 1224 µg/l (youth considered as 11-20 age group), 1351 µg/l (adult was considered between 21 to 40 years of age) and 1468 µg/l (elderly above 40 years of age). The hazard quotient (HQ) of Haldi Chhapra due to only consumption of arsenic contaminated water was found between 58.3 (youth) to 192.5 (children) which is also higher than Rampur Diara in all the categories. While the HQ and cancer risk indices of Haldi Chhapra due to consumption of arsenic through drinking water and consumption of cooking food was found to be 65.5 to 219.5 and 29 to 99 in 1000 respectively which is higher than Rampur Diara. The health survey of both the *panchayats* was also significantly important for this study because during the field work I found that Rampur Diara is dominated by upper caste whose socio-economic condition is better than Haldi Chhpara and located nearby urban market to avail the services and facilities whereas Haldi Chhapra is educationally, and socially lagging behind, stratified into different caste groups though economic condition was not easy to estimate. The authors have also mentioned some of these explanations behind the deteriorating condition of Haldi Chhapra. According to the health survey done on 264 and 222 sample size across the four groups in Rampur Diara and Haldi Chhapra respectively, 0.9% of the population were suffering from diarrhoea, 5.8% had gastric problem, 4% had itching and 2.3% had pigmentation on the body in Haldi Chhpara whereas in Rampur Diara, only occurrence of diarrhoea is higher (1.1%). The important finding here to consider is that the concentration of arsenic in drinking water was four times higher in Haldi Chhpara though the manifestation is six times higher (Singh, S. K., & Ghosh, A. K., 2012: 755-762).

This study has highlighted the high risk of children in Haldi Chhapra as the HQ is highest in child among all the four groups. The HQ less than 1 is consider as safe but the HQ of children is 192 and 219 due to consumption of only arsenic contaminated water and from water and food both respectively. In the above findings, the cancer risk of the children and youth is 99 in 1000 and 29 in 1000, which is also higher as against the range between 1 in 10000 to 1 in 1000000 is considered as safe. This study has not shown the separate figures of physical manifestation of arsenicosis on children; however 2.3% of the studied sample, that included all age group, had pigmentation. This research was to take forward these findings to find out social implications of arsenicosis on school aged children specifically and exposed population of Haldi Chhapra in general.

1.8 Rationale

Haldi Chhapra village is situated on the bank of confluence of two rivers- Ganga and Son (detail in chapter 3) but inhabitants reside toward south bank of Ganga River. It was established fact that population, geographical located on the bank of Ganga is most affected and the level of arsenic decreases as one moves away from the bank. As this village is on the bank of Ganga coupled with near location of the confluence of two rivers increases the vulnerability of the population. There is already well documented evidence of Maner block in Patna district being highly affected (Ghosh, A. K., et al. 2007), with high concentration of arsenic in ground water and very high health risk in Maner block of Patna (Singh, S. K., et al, 2014). The research gap pointed out by many studies on arsenicosis has been of a social science study to capture the social reality related to arsenicosis.

During the process of searching for preliminary literature review too, I came across dearth of literature of social science studies in the field of arsenicosis in the context of Bihar though literatures was available on biomedical and geochemical studies on arsenicosis. The need for the research to understand social implications of arsenicosis, inter connection with social life in the context of Bihar has also been realised. This rationale has been supported by a key person during the field work and express the sadden reality of the fact that no one wants to work in Bihar.

Chapter 2

Conceptualization and Methodology

Background

The study of "Social Dimensions of Chronic Arsenicosis in a Village of Patna District" is to create understanding of social dimensions of chronic arsenicosis on school aged children in specific and exposed population in general in Haldi Chhapra village of Patna district in Bihar. The study done by Singh, S. K and Ghosh, A. K (2012) was taken as a ground work for this research. The idea of this research has emerged out of curiosity to understand the issue of arsenicosis empirically through an interdisciplinary lens of Social Sciences and Public Health as well as to give meaning to my childhood memories of the harmful effect of contaminated ground water in neighbouring villages of native place.[3] Darbhanga, a district of Bihar from where I belong, falls under the zone of arsenic (Abhinav, S., et al. 2016), and fluoride contaminated area (TOI, 2009). The study turned specific to school aged children during the preliminary literature review of the topic when I came across a video clip of DD News on Youtube and found that a child was sharing his experience of discrimination in school because of dermal issue due to arsenic problem of the same block where this study was done (DD News, 2005). Literature review of the studies on the subject showed the need of interdisciplinary research and an empirical exploration of the social science dimensions was warranted.

This descriptive study was designed using mix methods to understand the social dimensions, including social determinants, social implications, and social response to it. A *House Hold Survey*, *In-depth Interviews*, *Social Mapping*, *Observation*, *Informal Discussions and Participatory Interaction* with youth and children, as well as *Key Person Interviews* was used as research methods. *Essay Writing* by the children was devised as a participatory method during the field work. This chapter will discuss the conceptual frame work and methodology used for this study.

[3] I have seen few cases of arsenicosis and effect of fluoride contaminated water in Biraul block of Darbhanga district and in relative's village in Kosi region of Saharsa district. The utensils and cloths would soon become yellow after using contaminated water and taste was different.

2.1 Conceptual Framework

In the earlier chapter, the process and theories of arsenic contamination of ground water have been discussed in detail. It's biologic and social dimensions as per the available information has also been mapped. Based on the same knowledge, this conceptual frame work has been designed for this study (Figure: 1).

The arsenic contamination of ground water and food exposes the population to arsenic and creates the risk of arsenicosis. If the socio-economic condition of exposed population is poor and they consume high levels of arsenic through drinking water and food for a long period of time, this increases the chances of manifestation of arsenicosis on the human body (Ahmad, S. A., et al. 2007: 1950, WHO, 2011; Ghosh, S. K., et al, 2014). The detrimental socio-economic condition leads to malnutrition, inaccessibility to avail safe drinking water by digging hand pump in depth of aquifers which is very costly, and problem in accessing health services (Ahmad, S. A., et al. 2007). This complex of factors becomes a cause of high arsenic exposure turning into manifestation (Das, D., et al. 1994). The socio-economic condition in the context of India and Bihar in particular means caste, class and gender. Many scholars have linked caste and class as somewhat similar characteristics on the ground of social status and quality of life. Though gender aspect has been investigated earlier in relation to arsenicosis but caste has not been studied in relation to arsenicosis.

The affected individuals can be categorized by age as adults and children since the effects on the two are likely to be of different nature. The affected adult member of the household may have common manifestations like skin pigmentation, keratosis, other skin lesions, melanosis etc and rare manifestation like cancer. The presence of these common physical manifestations on human body can create physical and social disabilities and social stigma which further translates in to a range of personal, social and economic problems (Rahman, M. A., et al. 2017) starting from self care to poor health conditions. The social stigma related to the common physical manifestation of arsenicosis creates conflict in marriage, sometimes divorce and social discrimination as well which hinders the individual's to interaction with society (Sarkar, M. M. R., 2010: 3649). Disability and social stigma related to arsenicosis among adult member of the family reduce their economic activity (Rahman, M. A., et a. 2017), which drags the children into child labour to support the family, loss of education of the children and poor health condition of the family. The economic loss due to arsenicosis

(Ahmad, S. A., et al. 2007: 1950) creates a cycle where the family is forced to lower socio-economic condition which in turn increases the vulnerability of arsenicosis.

The arsenicosis affected child, who has visible physical manifestations may be stigmatized and discriminated in different social spheres (Rahman, M. A., et. al. 2017). However the specific social implication of arsenicosis on children has been less studied although ground realities, few Bangladesh based studies and news paper articles have reported social discrimination of children in school, isolation, work load of the family due to affected adult member and drop out of the children (Sarkar, M. M. R., 2010: 3649; Sarkar, A., 2004). A study done in Bangladesh reported that *"affected school aged children are prevented from attending schools and are avoided by their friends and classmates"* (Alam, M. G. M., et al. 2002: 245).

Thereby, for this study it was conceptualized that the impact of chronic arsenicosis on children may be varied depending on the individuals affected in the household, which could possibly be of four types- a) Family members in households in an affected village are without any effects, b) Child/children is/are affected but not adult family members, c) Child/children is/are not affected but adult family members are, d) Child/children and adult family members, both are affected.

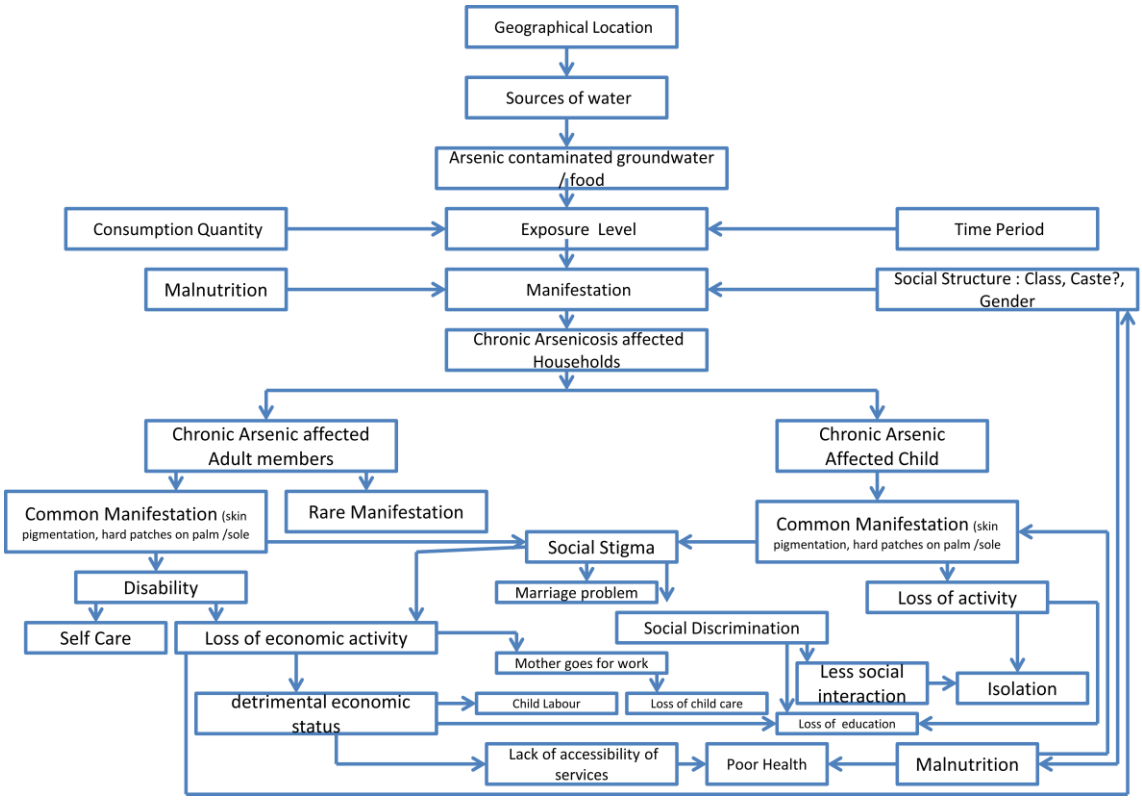


Figure - 1: Conceptual Framework of the Study

2.2 Objective

To understand the social implications of chronic exposure to environmental arsenic on the school aged children in Haldi Chhapra village of Maner Block, Patna district, Bihar.

2.3 Research Questions

(i) What is the distribution of manifestation of chronic arsenic related health issues in Haldi Chhapra village of Patna district in Bihar?

(ii) What is the impact of chronic arsenicosis on the school aged children of Haldi Chhapra village in Patna district of Bihar where

a) All family members are without any effects of arsenic exposure.

b) Child/children is/are affected but not adult family members

c) Child/children is/are not affected but adult family members are

d) Both child/children and adult family members are affected

(iii) What factors and processes have shaped the effects of arsenicosis in the village?

2.4 Data Required

According to the objective and research questions of the study, the required data and information was the following:

a) General information of the district and block where study village falls.
b) General information of the village (geo-physical information, demography, literacy, culture and tradition, social stratification, occupation, and oral history)
c) Information regarding sources of water and food as well as health services available for the villagers.
d) Information on the prevailing manifestation of the arsenicosis in general, specific to children and adult, caste, class and gender.

e) Information on the distribution of arsenicosis in different groups and geographical locations within the village.
f) Understanding of the arsenicosis, problem and its impact among the children.
g) Social implications of arsenicosis on general population and specific to children in four condition of households in the village – family members are without any effects, Child/children is/are affected but not adult family members, Child/children is/are not affected but adult family members are affected and both are affected.
h) Experiences and perceptions of the village residents regarding the arsenic problem, it's causes, mitigations measures, physical and social implications.
i) Responses from the government, community and individual to deal with the problem of arsenicosis.

2.5 Research Design

This research is fundamentally based on the primary data, collected from the field whereas secondary data has been used for the evidences and information as complimentary facts for the findings and also to develop understanding about the research site. Most importantly this research is based on previous scientific study done in the same research site. This meant expanding the knowledge base on specific social dimensions of arsenicosis for the particular area. The research in its nature is descriptive based on both qualitative and quantitative data. Participatory research approaches were adopted to collect primary qualitative data by involving children in essay writing and adult members of village in social mapping.

2.5.1 Methods Used

Primary qualitative and quantitative data has been collected from the field through using different research tools and methods. A Mix Methods approach was used for this research; however the time order decision and paradigm emphasis decisions (Johson, R. B., & Onwuegbuzie, J., 2004: 22) of both types of data were different. The qualitative and quantitative data were collected concurrently in the field however qualitative data has been given dominance during the field work as well as in the analysis of the data. Based on the time period and paradigm emphasis, the research

method for this study is Concurrent Qualitative Dominant Mix Methods (QUAL+quant). The simultaneous collection of data through using both of the methods gave opportunities to shape up the questions of interviews and interactions with the key persons, children and villagers which in-fact helped in probing various elements of the information.

To collect the required data according to research questions, the data collection methods used for the study were - *Social Mapping*, *Household Survey*, *In-depth Interviews*, *Observation*, *Informal Discussions and Participatory Interaction* with youth and children, *Key Person Interviews* and *Essay Writing.*

2.5.1.1 Village Selection

Haldi Chhapra as a study village has been selected purposively. A study done by Singh, S. K. and Ghosh, A. K. (2012) in two *Panchayats* of Maner block of Patna district had found higher consumption of arsenic contaminated water, cancer risk and higher hazard quotient in the village as earlier mentioned. On the basis of these following criteria this village was selected:

- Available bio-medical and environmental studies in the area
- The size of village
- The concentration of the arsenic in the ground water of the village.
- The level of prevalence of manifestations in the village.

The level of arsenic concentration in ground water, prevalence of manifestation arsenicosis, studied done in Haldi Chhapra, has been mentioned earlier in this chapter. However the size of the population and current situation has been observed in pre field visit and decided to continue the study in the same village. It was earlier planned that if manifestation of arsenicosis among the children or adults has declined in Haldi Chhapra then for the selection of other village, the same criteria would be applied.

Preliminary Field Visit: The preliminary field visit of tentative proposed research site Haldi Chhapra, a village in Maner block of Patna district in Bihar was done on 13th and 14th of September 2017. A two days exploratory visit was carried out with the objective to confirm the physical manifestation of arsenicosis in the village as earlier

study has reported. It was decided earlier that based on the observations and interaction during pre field visit, the research site would be confirmed or rejected. If research site would be rejected, I had planned to search for another village as per the village selection criteria (Section 2.5.1.1) for this study. I interacted with head of the *panchayat*, key persons including care taker of water filter and few villagers from the village. The observation and findings of the preliminary field visit was drawn as following:

The preliminary information of the village has given the idea of social stratification, socio-economic, demographic and geographic detail of the village (Detail in Chapter 3) which was helpful to select the village.

Water Plant: Water is an issue for inhabitants as key informants and villagers complained about the changing nature of colour of water. Even though the administration is well informed about the arsenic contamination of water in the area but government has done nothing. The key informants were aware about the arsenic issues whereas common villagers were saying it is unfit to drink water because it becomes yellow.

Picture: 1 Water Plant

On first day of the visit, researcher was informed at Maner about the non functionality of water plant. But on the second day when researcher visited the site got to know that it is working though the filter has not been changed since a long time. The utilization of water plant by the villagers was under question as few of the villagers informed with the promise of keeping confidentiality that they are not allowed to use the water. However the care taker has claimed that people are using water from the plant.

Picture: 2- The sign board of water plant

As per the sign board, this water plant was installed by Saga Foundation, Pennsylvania, USA in collaboration with A. N College, Patna. This water plant is far below the capacity to serve the huge population of the village and it is situated at the end of the village in the courtyard of the *dalan* of an upper caste household.

Arsenicosis: Informal discussions in the campus with friends those are hailing from Bihar and a phonic conversation with a student from the same block got to know that arsenic, fluoride, iron contaminated water is a serious issue in Bihar, specifically in Ara, Buxar, Bhojpur districts but government as well as people are not serious about the issue.

During my first day of the visit I observed 4 people has visible physical manifestation of arsenicosis but through conversation with villagers got to know that there are many people affected with skin disease in every *tolas*. They call this problem as *daad* (ringworm), *khujli*, they apply lotions, take medicine prescribed by doctors but less effective. They also use traditional methods of treatment like applying papaya's milk over the skin lesions. I also observed that no one has complaint that only I have arsenicosis in my family, whoever has complaint, they informed two members of us, three or four members in my family are affected means if one has Arsenic related issue other member may also have or high chance (assumption). I observed that no hand pump has been marked as red or yellow and villagers also not have that information so they use water from whichever hand pump is nearby.

Conclusion: Based on the observations, interactions with villagers and discussion with supervisor after the preliminary field visit, I decided to continue the study in the same village.

Map: 1 Google Map of Haldi Chhapra

Map: 2 Satellite Map of the Village

2.5.1.2 Data Collection

The data collection was started from 30th of November, 2017 and ended on 7th of January, 2018 but prior to the main data collection phase preliminary field visit has been done in September, 2017. The detail of main data collection phase is as follows:

Main Phase of Data Collection: The main phase of data collection was started in last days of November. I stayed in the village for the purposes of data collection in accordance with the data collection methods to include observations, informal discussions and participant interactions. Daily routine, interactions, observations and activities, I have recorded in my diary.

2.5.1.2 Population

The population for quantitative data collection was all households in the village which is 1427 according to the local voters' list. In this way the distribution of arsenicosis can be generalize in the village. The research question of social implication and responses was addressed by qualitative data and for this the population was all the affected adult and children as well as key informants in Patna District of Bihar.

2.5.1.3 Sample and Sample Size

The sample size for household survey was planned to take 120 households according to stratified systematic random sampling, 30 from each categories however 5 (2

households in SCs, 1 household each in EBC, BC, OC) has denied to take part in survey. During the survey in the village, around 20 households were included on request of people as they were keen to include their households in such surveys though I informed them that it is not government survey for any scheme or benefits.[4] In these extra surveys forms, 5 were half filled but 15 were complete and have been included in the sample which means total 130 household surveys have been considered for the analysis.

Through the household survey 33 persons with manifestation of chronic arsenicosis were identified and among them 6 were taken into the sample for in depth interview. The total sample size of affected individuals including children and adult were 9 with whom in-depth interviews were conducted and 7 key informants were interviewed.

Sample Selection Technique: The sample selection technique for qualitative and quantitative data collection was distinct from each other. The sample selection technique for household survey was *Stratified Systematic Random Sampling* where whole village was stratified into four categories – *Schedule Caste (SC), Extremely Backward Class (EBC), Other Backward Class (OBC) and Other Class (OC)* including one Muslim household. The caste was included in these different categories according to the Bihar list of caste (Appendix- 5). The households from these strata were selected on the basis of systematic random sampling.

Category	Caste included	Total Number of Households	Sample Size
Schedule Castes (SCs)	*Dom, Dusad, Dhobi, Chamar*	100	30
Extremely Backward Class (EBC)	*Kahar, Kumhar, Sao, Mahato, Mali, Thakur*	120	34
Other Backward Class (OBC)	*Yadav*	1116	31
Other Class (OC)	*Rajput, Brahmin, Muslim*	91	35

Table: 1 Details of Sample Selection and Sample Size

The exact number of households with the family members was not clearly mentioned in the voter list[5] that is why I tried to find out the total number of households of the

[4] The survey for the villagers is for some scheme or from any government side that why they wanted to be included in the survey.

[5] I have tried to select the household systematically through voter list provided for Kita Chauhatter (west) *panchayat* from the community development block (Maner) but couldn't find out as a relevant source for the selection of households because it did not provide accurate information of the villagers,

particular stratified categories through transect walk and interactions with the villagers before the execution of survey.

There were around 100 households of SCs (*Dom, Dusad, Dhobi and Chamar*), located at one geographical location of the village (see the social map). It was decided to take 30 household from each of the categories that is why for the SCs category every 3rd household was selected in the sample. Whereas the households belong to EBC category (*Kahar, Kumahar,Mahato, Mali, Thakur, Sao*) was scattered in the village except one cluster in Haldi Chhapra Saat Ana tola, where large number of families reside and over all estimated number of households of the category were around 120. Every fourth household was taken in the sample from this category. The OBC (*Yadav*) was the dominant caste and highest number of households among the categories. It was very difficult to estimate the exact number of households in the village belonging to this category because of scattered and large population. To find out the number of

Figure: 2 – Formula to find out total number of BC household

Total Number of BC Households = Total Number of Household in the village - (Total Number of SCs household + Total Number of EBC household +Total number of OC household + One Muslim household)

= 1427 - (100 + 120 + 90 + 1)

= 1116

Interval for systematic selection of household = total number of household ÷ 30

= 1116 ÷ 30

= 37.2

households of this particular category, total number of households was taken as 1427 as provided by the voter list of the *Panchayat* and subtracted from this the total number of households of three categories and one household of Muslim (Figure: 2). By this calculation it was estimated that there were 1116 households of BCs which means every 37th (37.2 is according to formula) household was taken in the sample to

their family members and house number however total number of households has been considered in the study. According to a teacher of Primary School of the village, the voter list of the district is under amendment process due to error at large scale. This is the reason to go for empirical information to select the household.

get a sample size of 30. In the fourth stratification, there were 90 estimated numbers of households and every 3rd households came under the sample.

The sample selection technique for key informants, affected children and adults for in-depth interview was purposive. Seven key informants were interviewed and nine affected individual was taken for in-depth interview. The participants for social mapping and essay writing were based on convenience i.e availability and their interest in participating.

2.5.2 Research Tools and Process of Data Gathering

I stayed in the village for 40 days, from 28th of November 2017 to 7th January 2018.

2.5.2.1 Social Mapping

Social mapping synonymously used for community mapping has vital role in social work practice to understand the community assets, spatial differences, geographical position of different groups and social institutions in a particular community which helps in intervention. The process of doing social mapping has potential strength to capture intangible assets of the community like culture, tradition, history, pattern of changes happened in the community. It is also used in action research as well as qualitative research in general for analyzing participant's understanding about community, recommendation and participation for actions.

The early days of data collection were spent on community visits with the objective to understand the village, different wards, lanes, resources, social groups in the village before the household survey was executed.[6] During the transect walk and community visit in different wards/*tolas* of village, I involved many groups at different locations of village[7] to make a map of the village and if possible to indicate different

[6] I entered the village on 28th of November, 2017 and started visiting the community since 30th of November whereas the quantitative data collection (household survey) was carried out since 8th of December, 2017 till 5th of January, 2018. Need not to confuse with concurrent quantitative and qualitative data collection claim as qualitative data collection was carried out till 7th of January, 2018 however it was started since 30th November, 2017 a little earlier to quantitative but both of the data collection was done simultaneously.

[7] Different location here means the places where villagers interact with each other like outside of tea shops, *chaupal, baithak* of some key persons, *chowk* for men whereas for women, the usual location where they interact are water sources (well in this village), animal shed or in the field as I observed in this particular village.

community resources (Picture: 3). The process of making social map was interesting for some people while some did not take interest to draw. For those who were interested but not ready to put their hand to drawing I helped by drawing the map on their behalf but on the directions of the participants. All the participants would not usually stay in the group till the completion of the map but the fluidity of the location where villagers usually come and go has made possible for mapping the community and provided diverse nature of information from different participants.

Picture: 3 – During transect walk with a group of youth for the purpose of social mapping

Picture: 4- Villagers are sitting on tea shop at the chowk.

2.5.2.2 Observation

Observation as a tool has been used in the study as I stayed in the village since 28th of November 2017 to 7th of January, 2018. I started teaching the children of care taker of the building as it was a *Krishi Bhawan* (store house for crops) under the charge of a leader of farmers. However the dynamics between the care taker and other villagers was not favourable to allow other children to join. Initially I allowed other children but later decided to go with the decision of the care taker however opened the option for all the children to ask any problem related to study wherever they find me in the village. The process and experience of staying in the village has allowed me to observe daily life of the villagers, their social interactions, conversations, culture and traditions of the community. I have maintained diary of every day except 4 days in whole field work. Staying in the village also gave me ample opportunity for informal

interaction and discussion with different social groups, including their youth and children.

2.5.2.3 Informal Discussion and Participatory Interaction

Quantitative and qualitative data was collected over the 40 days through various data collection tools which has been generated while preparing for the field work-survey schedule, check list and in-depth interview guides. Informal discussions and participatory interactions with youth, children and villagers were undertaken spontaneously as the opportunity arose. Informal discussions or participatory interactions was unprepared, unstructured because it flows spontaneously with the group's conversation, interests and their wish to continue the interaction. The conversation was totally in the hand of the groups as per their will of having conversation related to any hot topics of the village or small query if I have in between the conversation. Besides the natural and spontaneous conversations, there were some conversations and interactions with youth and children in village which I have initiated informed by my research questions. The informal conversation was carried out wherever I found afavourable situation to have interaction or joined the conversation if it is going on between some groups of villagers. One of the favourable situations was created due to misunderstanding by the villagers particularly by the women. They misunderstood me as a street seller might be due to get up or a new face in the street. Initially I felt humiliating for few days, but later I turned it as a positive opportunity to have conversation with the person whoever asks me "what are you selling?" This is the only option to have conversation with women otherwise it was little difficult to interact with women in the village besides household survey.[8] The conversation has happened at temples, *chowk*, tea shops, *ghat, chaupla (baithak)* and during teaching of the children at *Krishi Bhawan*. Sometimes I interacted with particular individuals in isolation after the group conversation if he/she was found to have interesting information or was contradicting the general information given by villagers or that particular group. The observations and important points have been recorded in the field note or daily diary.

[8] To have interaction with women is also depending on socio-economic condition of the women. I found difficult to interact with upper caste women compare to lower caste women in the village. However this technique has helped me to communicate with women across socio-economic groups.

Interaction with the affected children has also been carried out with the consent of the parents to understand their experiences, and perceptions of daily life, school life and social interactions. I interacted with friends of affected children and classmate to know their school life and peer group dynamics.

2.5.2.4 Interviews

Interviews other than for the survey were conducted with the key persons/informants in the village as well the persons who had earlier done research in the village on arsenic issues. Key persons/informants includes head of the village, teachers, local doctors/healers/quacks, water plant care taker, researchers and other individual who has in-depth understanding about the village or arsenic related issues. A *Semi-Structured Interview* was conducted using an *open ended Schedule* (Appendix- 3) which included questions related to the village, health services available in the village or nearby, water quality, the arsenic problem, social problem due to physical manifestation of arsenicosis and responses from the community or government.

Household Survey: The primary quantitative data was collected through a household survey conducted 130 households in the village through using stratified systematic random sampling technique. The schedule prepared for information sought through the household survey was divided into three main categories:

a) **General information regarding the family:** This section seeks information regarding the family size, types, sex ratio, caste, religion, income, occupations, land holding, health issues and education of the family.
b) **Water related information:** In this section information was asked about the sources of water, ownership of the water source, distance of the sources, responsible gender for fetching water, depth of tube well/hand pump, water quality, functionality and knowledge about the water filter in the village, awareness of arsenic contamination and consumption through water.
c) **Arsenic related information:** This section was about profiling of the arsenicosis if case(s) was found in the family. Profiling included- name, age and sex of the affected individual, mode of identification of arsenicosis (diagnosed by physicians with or without prescription, patient complaints, researcher has seen), symptoms, body parts affected, common manifestations

and rare manifestations, number of individuals affected, and socio-economic impact on adult and children.

The household survey had close ended as well as open ended questions. During the survey, I interacted in local dialects of Hindi (mix with Magahi) and filled up the form in English as per the convenience however sometime used Devnagri (Hindi) script to write on the survey but later rewritten in English.

In-depth Interview was conducted with the adult members of the family in all the categories of the families to understand social implications of arsenicosis and its impact on the children. The schedule for in-depth interviews carries questions related to:

a) **General information:** This section sought information regarding the general information of the patient (child/adult) such as age, sex, caste, religion, education (in case of children he/she is regular to school or not), occupation.
b) **Family Profile:** In this section information was seek to understand the family size, type, occupational detail of the head of the family.
c) **Health Profile:** The health profile was made to understand the health history of affected individual, when the manifestation was seen, when he/she diagnosed, treatment history and other health issues in the past.
d) **Arsenicosis related:** This section carries questions to probe information from first sign of manifestation of arsenicosis on children or adult to its social implications. The questions were related to family level intervention for arsenicosis, previous life style, current physical or socio-economic problem, discrimination in school, in peer group, social interaction, neighbour's attitude and perception of the affected individual. Water related information and arsenic related information has also been asked.

Interviews from these key persons/informants and affected adult member or adult family members of affected children was not carried out in single sittings as rural context is not favourable for formal interviews in a closed room setting. It was carried

out in many sittings, sometimes in the house and sometime outside of the house like *chowk* or tea shops[9].

2.5.2.5 Essay Writing

Reading and writing is core component of knowledge production based on any kind of human investigation. Writing is the process to develop ideas, information, data and observations into knowledge. The reading of the same piece of knowledge for understanding to develop new arena of investigation is actually giving a sense of wheel of a cycle where social phenomenon and world around us connects to these two points- centre (reading) and circumference (writing) for developing new knowledge which runs the human existence. The diverse nature of writings such as creative writing (story, poetry and other literary work), essay writing, diary writing, freewriting, academic writing etc. can be a means or a process or a source of knowledge generation or information transaction. If writing is the means of discovery then the notions of writing as a research method can be accepted (Cook, J., : 204). Freewriting as a tool in the academic writing (Hounsell, D., 1984), photo essay in many researches (Amsden, J., & VanWynsberghe, R., 2005: 367) has been used in social sciences investigations. The diary writing and analyzing previous dairy written by many personalities or common person have been used in history or other disciplines earlier.

A research done by Hounsell, D. (1984) among the students of a university to investigate the meaning of essay writing for them, has mentioned arguments, viewpoints and arrangement by history student whereas analysis of history and psychology student's response gave three themes – data, organization and interpretation (Hounsell, D., 1984). Based on this it can be said that essay writing is a form of writing where argument, viewpoint, data, and interpretation can be arranged and organized on certain topics. The essay writing gives opportunity to display learning, experiences and viewpoints of the writer, which can be a tool for assessment. Keeping in mind this strength of the essay writing and reflection from earlier experience, I have devised essay writing as data collection method in this study to

[9] In case of confidential information for ethical concern (interview with adult affected member or adult family member of the affected children), I tried not to ask such questions in the open spaces whereas in conversation with key persons, there was less chance of such confidentiality issues though the personal responses to specific questions may affected but in rural setting, I found openness in revealing personal opinions and less chance of such space where I can interact in total secluded space. This is the reason to go for such interaction in open space even in presence of other villagers.

assess the meaning and viewpoints of the children regarding village, water related problem and arsenicosis. As I already mentioned, during stay in the village I started teaching the children of my host. This gave me ample opportunity to interact with these children and indirectly to others. The stories shared by these children, narratives of incidents happened in the village as well as anecdotes about religious and festival celebrations compelled me to think that one can get to know much from these children as they are honest enough to reveal whatever they have seen. The idea of essay writing came in to my mind when I was travelling from Maner market to the village in an auto with around 10 other villagers as co-passenger where few women were fighting each other on some issue. The ambiance of the auto has made me to think about life and then I reflected up on my visit some year ago to Dharaji, a village on the bank of Narmada where children has drawn real incident happening in the village when we asked a group of children to draw something.[10] We were amazed to see those drawing as they reflected upon the real story of the village. Same strength of drawing, I thought to capture through essay writing as I found children can reveal their life stories of the village as well as related to arsenicosis. Since most of the children could read and write, this seemed possible and worth trying.

Level	Standards	Topics	Number of Participants
First	Below 6^{th} standards	My village	14
Second	7^{th} and 8^{th} Standards	Water relater problem in my village	4
Third	9^{th} and 10^{th} Standards	Arsenic problem in my village	2

Table: 2 Details of Essay Writing Participants

The head of village and school teacher was approached for permission to organize essay writing in a primary school. After getting permission for using space to organize

[10] We, a group of friend from IIT, Jamia and DU have planned to visit Dharaji again after an exposure visit organized by Pravah and Narmada Bachao Andolan in 2011. The story of the village has attracted us to come again and objective of this visit was to document (short documentary and writing).

the event; date, time and venue were informed to the children who can read and write through teachers, coaching centre, parents and direct communication with them. On the day of the program, the parents and children were reminded to come to the venue on time. Total 18 children participated on the spot whereas 2 children[11] has already informed to write it later who wrote at *Krishi Bhawan* on the same day at the time of teaching and I gave them opportunity to write. The participating children were divided in to three levels: *first level* considered the children below six standards, *second level* was of 7th and 8th standards and *third level* was for 9th and 10th grade students (Table: 2). The topics and total number of participants is given in the table. The participants were asked to write whatever they think and reflect related to the topic and no time limitation was given.[12] During translation of the essay writing 3 had to be rejected as the writing was unreadable. This meant that the total number of essays considered for the study was 17. Among those rejected, 2 were from first level and 1 from the second level.

Picture: 5 & 6 – Children are participating in essay writing in primary school, Badal Tola

[11] These two children have informed their excuses earlier because they have to join their parents in the field to carry peas bundle from the field to home.

[12] The copy of the writings was checked on the spot and 7 best writings was mentioned in-front of the participants with extra rewards to encourage however everyone got some reward in the form of chocolate, copy or pen.

2.5.2.6 Identification of Arsenicosis Manifestation:

An important aspect of this phase was mode of identification of arsenicosis manifestation as I was not a medical doctor and the skin lesions could be due to various other causes as well as due to arsenicosis. During the household survey those who had been diagnosed by a physician, with or without available prescriptions, were included as persons identified with manifestation of arsenicosis, but undiagnosed affected individuals had to be identified and neither their complaints nor researcher's understanding could be relied upon. The authentication of these cases as arsenicosis was taken from Prof. Ashok Ghosh, at Mahaveer Cancer Institute, Patna who has done extensive work in the village on arsenicosis. Photographs of the suspected arsenicosis lesions were taken during the data collection and shown to Professor Ghosh who confirmed or rejected the cases. Besides this the photographs of arsenicosis which were confirmed were taken as illustrative to identify further cases (Picture: 9, 10, 11, and 12).

Picture: 7 – Melanosis (rain drop)

Picture: 8 – Skin Pigmentation

Picture: 9 – Keratosis

Picture: 10 – Skin Pigmentation

2.5.1.6 Data Analysis:

The quantitative data was analyzed through Excel while qualitative data was transcribed and translated. The thematic analysis was done for essay writing.

2.6 Ethical Concern

- Informed consent was obtained from each participant and in case of children the consent was taken from the parents and assent from the children. They will be informed about the purpose and objective of study.
- Participants will be free to refuse to answer any question or to withdraw from the study at any point of time
- There is a chance of new cases being identified during household survey among the children who has not been identified in the community or in the school. I have an ethical responsibility to keep the case confidential to avoid or minimize the possible psychological and social harm.
- I will maintain confidentiality of information given by every respondent.
- The data would be used for academic purpose only.

2.7 Limitations

One major limitation for this research was identification of arsenicosis manifestation as I am not medical doctor. This was somehow managed by the help of Professor

Ashok Ghosh, Mahaveer Cancer Institute, Patna. He has given his confirmation on most of the cases after seeing photographs of manifestations although I have identified based on the confirmed photographs of arsenicosis.

After main phase of data collection, I have long discussion with my supervisor on the data that I have gathered. Two points came into light from this discussion, which need further investigation for comprehensive understanding. First was regarding testing of dug well and hand pump water from major three locations where cluster of arsenicosis was found. Second was regarding few more survey in *Yadav* community as in this caste group cases has been found less, compare to total number of households sample size was less as well as not a single cases was found near *Mahato toli* whereas *Mahato* and *Sao* has arsenicosis. Based on this, supervisor has suggested me to revisit the field for doing survey in *Yadav* community and also for water test. However I couldn't go because of financial constraint as I couldn't get my fellowship on time however when I consulted from the bank they mentioned technical problem.

District Census Handbook of Patna District has not mentioned the detail of village and related data (except land related information) which was also one of the limitations for my research.

Chapter 3

The Village: Haldi Chhapra

Haldi Chhapra is a village in Patna district of Bihar situated on the confluence of Sone and Ganga however two Himalayan rivers Ghaghra (Sarayu) and Gandak also meets Ganga at nearby locations. The Ganga flows from west to east throughout the state and divides Bihar into two major parts - North and South Bihar. The Sone originates from Maikal range near Amarkantak in Madhya Pradesh whereas Ganga originate from Gaumukh in Himalaya and these two rivers together fragment Bihar into three physiographical region – North Bihar, South East Bihar, South West Bihar and fourth region is plateau of Chhotanagpur and Santhal Parganas. These divisions are also related to agro climatic zone of the state which is in three major parts as well as source of geo-morphological information.

River is not just a body of water, source to carry sediments, silt, sand and flood but in-fact it is connected to socio-economic, historical, political, cultural and religious aspect of our life. It is also the source of irrigation, fertility of agricultural land and arsenic contamination of ground water in middle and lower Gangatic plain. This Chapter will cover all these aspects of Haldi Chhapra village, situated west of the capital of Bihar on the confluence of Ganga and Sone believe to be female and male rivers along with general information of Patna district.

3.1 Patna

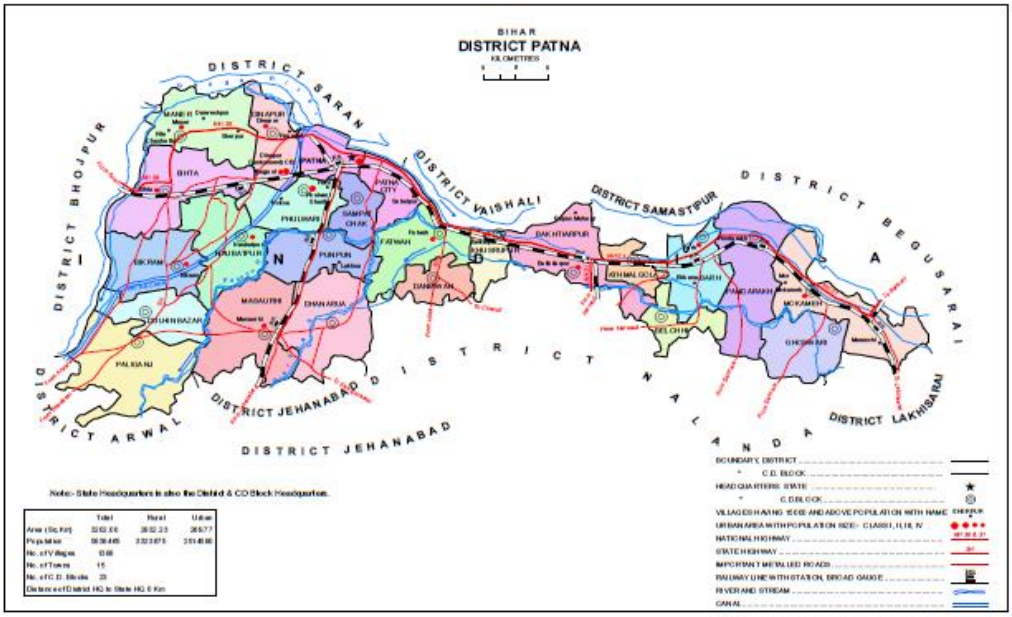
Patna, the most populated, large sized district (Census, 2011) and the capital of Bihar situated on right bank of Ganga which has series of *ghat* on the bank alongside the river. It was 26th of November, 2017 a normal day at well furnished *NIT Ghat*[13] where huge crowd has came for spending their leisure time, for religious believe and some of them for their livelihood. The *feriwala*, with their buckets and tea cattle are roaming around, fisherman are fishing on the bank of Ganga and others have boat to provide a

[13] NIT *ghat* is on the bank of Ganga, behind National Institute of Technology, Patna. The renovation work has been done at this ghat as this was the part of 20 ghat beautification project by National Ganga River Basin Project supported by the World Bank.

ride to the visitors. However few small ships with all the modern facilities are also standing on a part of same bank but well furnished, equipped with restaurants and cafeteria in the premise. Adjacent to the recently renovated *NIT ghat* is a *Gandhi ghat*, where people has started sitting calmly on concrete furnished steps waiting for *Aarti*[14] of holy Ganga under the tight security of police personal on the boat in river as well as among the crowd on *ghat*. A shocking incident of boat sink with 43 people in Ganga near Patna in the month of January has alerted the administration to tighten the security in the river. Ganga flows normally in the month of October, November and December however with the rainy season and snow melting at Himalaya; it starts over flow in July, August and September. When Ganga carries huge catchment of water, it creates flood and submerge both side of the river however north part become much affected. April, May and June is the month of summer in the state, when Ganga reduced to main course of the river. On the *Gandhi ghat*, office of the Central Water Commission has been set up in 1965 for regular testing of water quality and also for gathering information on gauge, discharge and silt of the river.

The process of *Aarti* has started with chants of Sanskrit *shlokas* by the priest as sun set in the west. The *shlokas* along with fragrances of rituals is creating an ambiance of amusing and spiritual environment for the believer. Amidst of these similar chanting words, priest repeats *Ganga Maiya ki*, *Bharat Mata ki*, *Gau Mata ki* and devotees replies *Jai* on every loud chant of those words. One of my friends with whom I came to visit has said to me that he never heard *Bharat Mata and Gau Mata ki Jai* earlier here but the political environment has made so. Ganga is being worshipped by these devotees at the *Gandhi Ghat* however around 200 meter away from the same *ghat* towards east, one big pipe has opened it's mouth to vomit out the effluent of the city and toward west, a huge machine is in the Ganga to make a hole in the river surface for a pillar to construct 20.5 km long road by the name of Ganga Path Project. The construction of the road along with Ganga is going on since 2013 which connect Digha to Deedarganj including 11.3 km elevated road. We discussed the possible impact of the elevated road construction on the Ganga and now recent news has reported that Ganga has shifted 2.5 to 3.5 km away from most of the ghat and reason

[14] *Aarti* derived from Sanskrit word *Aratika* which means removing darkness (*ratri*). It is a ritual of worship in *Sanatan Dharam* (Hindu) in which a metallic plate carries light, flower, rice and ghee waves around the deities with humility and respect. It may perform with song, also called as *Aarti* in praise of the deity or chanting Sanskrit *shlokas* and later the plate will move around the devotees to gain the blessing.



Map: 1 District Map of Patna, Source: District Census Handbook Patna, 2011

were sited regarding debris, concrete, and sand of the ongoing construction work (Third Pole, Down to Earth, 2018).

Ganga, once the reason for the establishment of the city now is shifting away from the city and arsenic poisoning has also been found in middle Gangetic plain which includes Patna as well. Patna district situated alongside the south of Ganga and East of Sone, making a map resembles to sea horse, an aquatic animal and these two rivers make the boundary from district Saran, Vaishali, Samastipur, in north and Bhojpur in west whereas the south part of the district touches Arwal, Jehanabad, Nalanda, Lakhisarai and Begusarai in east (Map of the District). The district has spread their inhabited area (occupy 3202 square kilometre) along with both the rivers between 25º12' and 25º44' North latitude and 84º42' and 85º48' East longitude. Sone and Ganga is the source of sand for house building in the district on which recent ban has been imposed by the current government. This is the step to compensate the revenue generated by alcohol which was also banned in recent years and also a political game to demoralize the activists and supporters of Rashtriya Janta Dal as most of the people are involved from the *Yadav* community, a common argument given by key informants and villagers when I enquire about the reason.

Patna district has three major divisions: high land, low lying land and *Daira*[15] land however the middle Gangetic plain in Bihar has alluvial fertile land in general. Along with the Ganga, the land or carried away sand is called as *Diara* land which is very fertile for the crops. The farmer resides in rural areas along with the Ganga produce early *kharif* (rice) before the river rise and *rabi* (wheat, pea, vegetables, mustard) crop in the winter. Among total workers in rural areas of the district, 73.39% of them are in agriculture sector including cultivator (21.35%) and agriculture labour (52.04%) whereas this figure is 68.26% (cultivators: 20% and agriculture labourers: 48.26%) in Maner, the block under which the study village fall under (Census, 2011). The rural and urban sharing in the district is 56.93% in rural and 43.07% in urban areas whereas rural and urban sharing in the whole state is totally opposite, 80% is rural and 20 % is urban.

Patna is extensively cultivated district in the state contributed through 1468004.4 hectare irrigated land. Irrigation of agriculture land is still depends on rainfall as the main source of irrigation however artificial irrigation system has also been developed in the district. The average annual rainfall varies between 733.8 mm to 1492.5 mm and the average rainy day varies between 37. 9 to 62.9 during 2006 to 2009. During the Vedic period the *Varshaman* is the rain measuring tool was used and if rain fails they have *Yajna* ritual to perform for rainfall.

During Vedic period, Mughal period and first half of British period the artificial irrigation system has not been developed in north Bihar because of devastating nature of Gandak, Ghaghara, Kosi (Sorrow of Bihar) and other Himalayan streams. Although there were some traditional irrigation methods like *Rahat, Dhenki*, well water and creating obstacle on stream to divert the water were used but South Bihar including Patna has different terrain and that's why they developed irrigation methods more extensively than North Bihar. The streams descend from Chhotanagpur plateau, river Sone, Punpun are the surface water sources for the irrigation as well as to develop canal system in the district. During British period Sone was the first river on which small dam was made for irrigation purpose and it was one among the initial irrigation

[15] *Diara* is local term use for the land or village surrounded by the river or alongside the river. The soil of the area is sandy as the river carries silt, sediment and sands with the catchment which is very fertile.

systems in the country. Now the district has medium irrigation schemes, minor irrigation schemes, open borings, irrigation well and tube well.

Patliputra was the Vedic period name of the region which was kept on the name of princess Patali, most accepted story behind naming of the city. This period has seen a glorious history of education, cultural and religion and became the centre of spiritual and learning. The name was changed to Azimabad during Mughal period by the name of a king Azim-us-shah. Azimabad was one among the four centre of Urdu poetry in the country named as *Dehli* (Delhi), *Dekkin* (Hyderabad), Lucknow and Azimabad (Patna). Shad Azimabadi was one of the famous poets of the time. During this period Maner became the centre of spirituality because of sufi saint Makhdum Saheb. The 18th century was the year of tussle between Afghan, Maratha, Mughal and British on the land of Patna. The next was important role in freedom struggle when Pir Ali, a book seller led the uprising of 3rd July 1857 revolt and Indian Military at Danapur cantonment proceeded to Ara to join Babu Kuar Singh.

The district Patna was constituted in the year 1865 and became state capital in 1911. Based on three major language divisions of Bihar, Patna is in the region of Magahi language.[16] However based on the jurisdiction, Patna district is divided into six sub divisions- Patna City, Patna Sadar, Dinapur, Barh, Masaurhi and Paliganj. The total population 5,838,465 is divided in to 23 Community Development Blocks, 1388 village and 15 towns (Census, 2011).

Maner is one among 23 Community Development Blocks, connected through national highway 30 from Patna city, crossing a military cantonment area in Danapur. Maner is located west of Patna and further west to the town is Haldi Chhapra village.

3.2 Haldi Chhapra

Haldi Chhapra is a village situated on the right bank of river Ganga and east bank of Sone means the village is on the confluence of these rivers. It is a riverine village locally called as *Daira*, because the village is situated on the bank of river on fertile

[16] Three major language of Bihar is Maithili, Bhojpuri and Magahi. These three languages belong to eastern group of modern Indo-Aryan language. Bhojpuri mainly speaks in west Bihar, Maithili in east and Magahi in south Bihar.

sandy soil. This riverine village is around 20 km upstream the Ganga from Patna and 35 km by road. The village is situated on coordinates of 25º40'58.8''N 84º52'22.7''E.

Haldi Chhapra falls under the administration of Maner block and Kita Chauhatter (West) *Panchayat.* The village is surrounded by Dudhaila in east, Islamganj and Kita Chauhatter in south, Sone and Ganga is in north and west respectively. The nearest post office is in Dudhaila. Haldi Chhapra village is divided into 14 wards and 5 *tola,* named as Puranka Tola, Nayaka Tola, Badal Tola, Ramnagar and Haldi Chhapra Saat Ana (see the social map). These *tola* are not based on caste however Nayka tola and Ramnagar are dominated by *Rajput* and Puranka Tola, Badal Tola, Haldi Chhapra Saat Ana are dominated by *Yadav*. Whereas all the castes of SC category is concentrated in a small piece of land in Nayka Tola near *chowk* and EBCs are scattered in the village although *Mahato* from EBC category resides toward extreme south of the village in Haldi Chhapra Saat Ana. BC (*Yadav*) and EBC except *Mahato* is making the *tola* heterogeneous in their caste character but the caste character can be seen in *toli* like *Harijan Toli, Bint Toli, Kumhar Toli*. *Toli* represents a small segment of a *tola*.

Total population of the village is 14000 to 15000 according to the villagers however 8438 registered voters are in the village as per ward wise voter summary report prepared for *panchayat* election 2016, provided by the block. The census data of the village has not been mentioned in the District Census Handbook of Patna except few data related to land utilization (District Census Handbook, 2011: 254). Even the *panchayat* level information has not been included in the census handbook by the name of Kita Chauhatter (West) however the information about Kita Chauhatter *panchayat* has been given without mentioning east and west *panchayat*. The earlier study has also highlighted such problem in availing the data and other information of the village. One study has included this village in Mangerpal *panchayat* however it is in Kita Chauhatter (West) *panchayat* as per voter list of *panchayat* level election 2016, key informants and essay writing of the children. The ambiguity related to the village information is due to flooded area as some part of the village devastation is usually happens in every few years and it takes time to update on government documents. I have visited Maner block during my stay in the village and had conversation with in-charge of *panchayat* branch who also has confirmed the ambiguity and reason for missing information.

3.2.1 Social Resources and Social Positioning

I stayed in the village for 40 days in a building of *Krishi Sahyog Samiti* by the permission of farmer's leader who was in-charge of the building. This building is use to store crop if farmers sell their production or seed for farmers from higher institutions. However one of the rooms has been given to a local doctor (quack) to run a small clinic. This clinic is one of the eight clinics in the village including one RMP at the *chowk*. In absence of a Sub Centre or PHC in and around the village, people come at these clinics in large number. I have seen people come with serious health issues even late in the night or early in the morning. Once I assisted the local doctor when an elder couple has visited in the late night for serious respiratory problem in the same clinic and there was no electricity. When local doctors came to know that they have visited someone else for the treatment earlier to this visit, he was reminding them for serious outcomes of consulting less educated doctors and creating fear in their mind. In response to this I tried my best to console them of not any mishappening. Every clinic in the village has somehow fixed customers.

"There is building in my village where panchayat happens. All innocent gets justice here" [Essay Writing Participant, C-03].

A 4th class student writes about the village, mentioning the *panchayat bhawan*[17] and its utility. The analysis of the essay writing has given the idea of social resources as per the understanding of the children. They have included play ground, schools, *Panchayat bhawan*, temples, S*angam*, *Dharamshala* and medical hall in the village.

There are four primary schools and one middle school run by the state government and two private schools till 6th standard in the village. Out of these seven schools in the village four are in upper caste dominated *tola* whereas three schools are in *Yadav* locality. Besides these education institutions, there are few coaching centres in the village where children go in the evening. The analysis of the essay writing by the children has not informed me about the water filter in the village however they have talked about contamination of water and related problem. Two water filters are at the extreme east of the village in Ramnanagar Tola (detail in water sources section).

[17] A community building dedicated for local justice system (*panchayat*) or for other community purposes build by the state government.

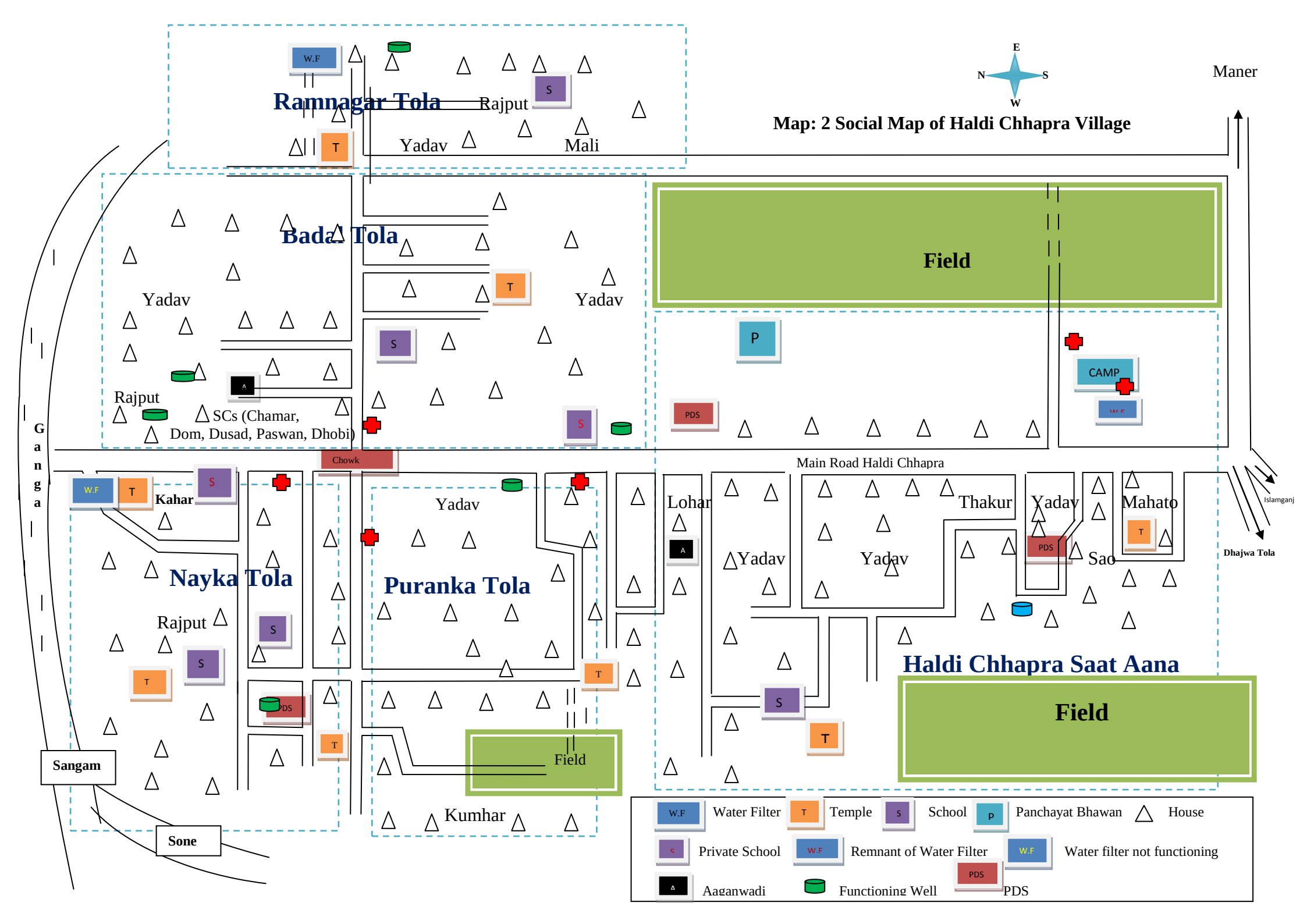
I have been informed by many respondents and villagers during the survey the people residing far away from the main road or interior to the village are marginalized in the sense of accessing the sources of water filter, benefiting restructuring scheme of dug well, exclusion in cultural events and also hand pump has been extensively tested along side of the main road but not the interior village. The community on circumferences feels neglected and less connected to the village. In the same way villagers collectively feel that they are being discriminated and neglected by the leaders because most of the development works are going on other side of the dam. The dam near Maner market is the land marks to identify the neglected community as villager says *"bandh ke is par ke log"* are discriminated. I have visited some part of other side of the dame which is connected to high way and comparatively developed.

The Public Distribution System (PDS) and *Aganwadi* are also in the village. Two PDS is in *Yadav* dominated *tola* and one in *Rajput* dominated whereas *Aganwadi* is in every tola. The *chaupal* culture has been mentioned by the children in their essays where close group people sit to discuss local politics, chit chat, shares their *dukh sukh*[18] or sometime watch T.V together. *Chowk* is the common place for everyone where I have seen people from all the communities and castes sits together on tea shops. There are around 30 shops ranges from general store, stationary, barbers, vegetable, and sweets to hardware shops. This is the place where auto stands and auto is the only means of communication to Maner block, nearby main market. However I have seen the road was always busy in the day time as the *ghat* and Haldi Chhapra Sangam attracts faraway people for cremations process of dead bodies.

3.2. 2 Haldi Chhapra Sangam

Sone originates from Maikal range near Amarkantak in Madhaya Pradesh from where another important river Narmada also emerges. It crosses Madhya Pradesh, Uttar Pradesh, Jharkhand and meets Ganga at Haldi Chhapra, west of Patna. This meeting point of two important rivers Sone and Ganga is known as Haldi Chhapra Sangam.

[18] Children have written *dukh sukh*, literal meaning is sorrow and happiness however this denotes the culture of sharing personal as well as family problems and utilizing social capital to resolve it.


Map: 2 Social Map of Haldi Chhapra Village
E
N
S
W
Maner
Ramnagar Tola
Rajput
Yadav
Mali
Bada Tola
Yadav
Yadav
Rajput
SCs (Chamar, Dom, Dusad, Paswan, Dhobi)
Field
CAMP
PDS
Chowk
Main Road Haldi Chhapra
Kahar
Yadav
Lohar
Thakur
Yadav
Mahato
Sao
Islamganj
Dhajwa Tola
Nayka Tola
Rajput
Puranka Tola
Yadav
Yadav
Haldi Chhapra Saat Aana
Field
Field
Kumhar
Ganga
Sangam
Sone
W.F Water Filter
T Temple
S School
P Panchayat Bhawan
House
Private School
Remnant of Water Filter
Water filter not functioning
Aaganwadi
Functioning Well
PDS

According to the local people this Sangam is the confluence of three rivers Sone, Ganga and Ghaghra (Sarayu). The literature and Google Earth search revealed that Ganga Originates from *Gaumukh*, crosses Himalayan valleys, Rishikesh, Allahabad (Confluence of three rivers Ganga, Yamuna, Saraswati), Varansi and meet another Himalayan river Gharghar (Sarayu) near Rasalghanj. Rasalganj is just before Chhapra district, around 15 km of upstream of Haldi Chhapra. If we consider these two rivers together meets Sone at Haldi Chhapra then it can be confluence of three rivers. Another important belief about the confluence I have described by the following piece of words written during the field work which were informed by key informants and villagers.

"…Haldi Chhapra Ghat is on Sangam of Nad and Nadi (male and female river) and this Sangam is unique in it's kind which were near Patna in ancient time but shifted here because of natural shifting of the rivers route and confluence" [Field Dairy, 4th December 2017].

People believe that Sone is male river (*Nad*)[19] because of its destructive nature during flood and Ganga and Ghaghra is female rivers. In this way it is unique confluence of male and female rivers. The people also believe that lord Ram has crosses this confluence while going to Janakpur. District Census Handbook of Patna has mentioned that Lord Ram and his marriage party halted near Maner during going and returning from Janakpur while Valmiki Ramayan chapter 23 mentioned that Lord Ram and Lakshaman took bath at the confluence of Ganga and Saryu (nearby confluence). These mythological anecdotes added the importance of this unique confluence of male and female rivers.

The importance of *Sangam* and religious belief of cremation on the confluence of rivers, attracts people from other districts as well. Every day six to ten dead bodies are cremated with the belief of *Moksh* at the Haldi Chhapra Sangam. I have closely observed whole process of rituals of death and cremation in the village. The rituals of dead bodies vary with age group of died individual. If an elder people die, the family calls *Vyas*[20] who sing *Nirgun*[21] however on the death of young members, they peacefully cremate the body. The news of death brings flock of neighbors and

[19] There is another male river in India is Brahamputra which is only river believe to be male however villager believe Sone as male river as well.
[20] *Vyas* is the person who sings *Nirgun* in the memory of dead person and reminding every individuals about the life hereafter and philosophy life and death.
[21] *Nirgun* is type of folk song, Vyas sings on death of some one.

relatives with water in hand to pour it in the mouth of dead body with rice. Shaving hair and *Mirtya Bhoj*[22] has also been observed in the village. Dom is the caste to burn the dead body at the *ghat* and in return the family rewards them with some amount of money. I have observed caste based occupation and role in the process of rituals such as cremation of dead body and *Mirtyu Bhoj*. Haldi Chhapra is not immune from caste based social stratification.

3.2.3 Caste Structure in the Village:

The information regarding castes in the village during preliminary field visit was limited to *Yadav, Rajput,* Dalit (*Chamar*), *Vishwakarma* (*Lohar*) however the main phase of data collection has extended my knowledge. The initial days of community visit, interview of key informants, participants interaction and social mapping has informed me about *Rajput, Yadav, Chamar, Dhobi, Dom, Paswan, Kahar, Kumhar, Sao, Nai, Thakur, Dusad* and *Mahato* castes and two more castes I added into the list - *Mali* as 4 households were explored and *Churihar* (Muslim) during the process of doing survey. According to the categorization of caste in Bihar, these castes have been divided into four groups EBC, BC, SC and Others (Table: 1 in Chapter: 2 and Appendix).

The geo-physical location of these castes can be seen from the social map. Dalits reside near the *chowk* on the north side of the village and south bank of Ganga whereas around 20 households belong to upper caste are also residing nearby Harijan *toli*[23] however a *Gabra*[24] divides both fragments of the *tola* and less social interaction has been observed between these two communities except labor related communication. The Harijan toli is the part of Nayka tola, comprises of *Chamar, Dusad, Dom, Dhobi, Paswan* and one household belongs to Muslim (*Churihar*).[25] *Chamar* in the Harijan tola is in majority and comparatively better off than the *Dusad, Dhobi* and *Doms*. Within Harijan *toil, Doms* are on the circumference but *Dusad* are

[22] A ritual to provide food to the villagers.
[23] A small fragment of *tola* is called as *toli*.
[24] A deep pond like structures can be found in the village which is not use to store water or for fish raring but this had been created due to soil extraction for making house on high as this area is flood prone.
[25] Name of the caste is not to demean anyone. It is for the purpose of identification and academic analysis the word *Chamar, Dom, Dusad* has been used.

scattered in two small patches and *Dhobi* resides in middle of the *tola*. My field dairy has described the situation of the Dalits in the following manner:

"It was pathetic, hard hitting and heart wrenching to see the condition of Harijans in this tola. Small houses, small streets, few fallen houses, kachcha houses with small and dark rooms and people's visible health condition specially skin related disease has some time made me so sad and it is tough to mention and describe the situation" [Field Dairy, 9th December 2017].

Rajputs resides in Ramnagar Tola and Nayka Tola in close vicinity of most of social resources like schools, temples and two working water filter. Their housing pattern is embellished with alleys, courtyard and well furnished *chaupal* which have been found in common to every household. Despite being differential housing pattern from other caste in the village, the differences in Ramnagar Tola and Nayaka Tola within *Rajput* can be seen. Ramnagar is more close to the Ganga, makes more vulnerable during flood. After knowing the contamination of water, well off family has installed bore well in their courtyard. The main occupation of the *Rajput* is Agriculture however second major sources of income is government job.

EBC and BC (*Yadav*) are scattered in the village except *Kumhar* and *Mahato* are concentrated at extreme west and extreme south of the village respectively. The main occupations of *Yadav* is agriculture whereas EBCs are involved in labour, including sand labour, although there are households in EBC category who practice caste based occupations like black smiths, barbers etc.

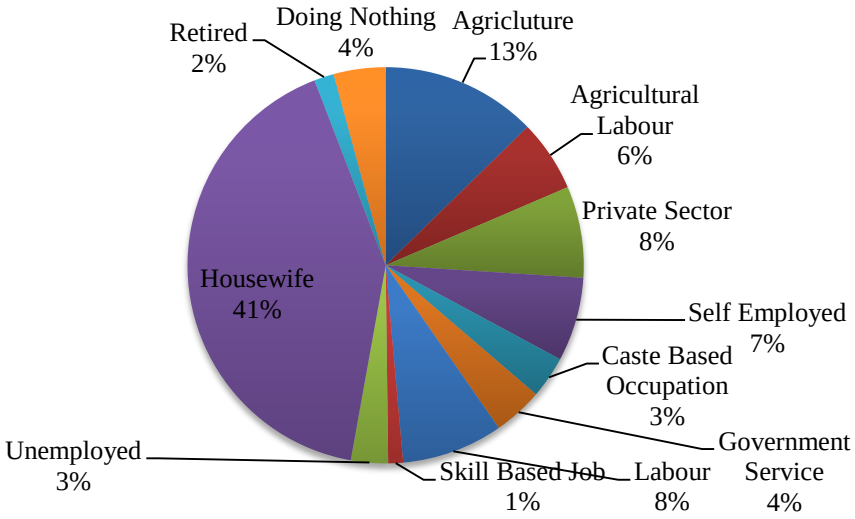
Interesting information was shared by villagers regarding the sub caste system in the village. As per the villager every caste has seven *kori*[26] means seven further strata within the caste. For example *Sao*[27] has seven sub castes and those are: *Kanu Madesia, Kanu Halwai, Kaund, Bhediyar, Kanujiya, Korant, Dhaudad.* These seven sub caste are divide into two major group based on a story of allowing first night of a women to *Ghaninath*[28]. Those who allowed, called as *Gharandar* and those who didn't allow, named as *Gharbahar.* These two major divisions of *Gharbahar* and *Gharandar* are for Sao caste however seven *kori* sub caste stratification is based on

[26] *Kori* is regional dialect, meaning cluster or division.
[27] *Kanu, Bhunsar* are synonymously used for Sao caste, which is in the EBC list.
[28] A mythological character or an imaginary character from upper caste to whom the first night of lower caste women are allowed.

above mentioned name. The seven *kori*, sub caste stratification is applied to all the caste.

I have been reported caste based discrimination (read in water source section) and occupation during the field work. Among the total studied members of 130 households, 3 % of them are engaged in caste based occupations. Caste based occupation includes black smith (*Lohar*), barber (*Nai, Thakur*), milking (*Yadav*), burning dead body (*Dom*) and washing cloths (*Dhobi*).

Figure : 1 Occupation Chart



3.2.4 Socio- Economic Status:

I got opportunities to interact with people outside the village and tried to know their views about the village. According to the outsiders, the village is well off because of its location on *Diara* land which is fertile land for crop production and also due to sand related economic opportunities. This opportunity ranges from sand labourer to the sand trader. If a boat is running in the river with 10 laborers[29] means it runs family belongs to boat makers, labourers, boat sailor (*Mallah*)[30], boat owner, business man

[29] Depend on size of the boat, small size boat carries 10 to 12 labourers and big size boat carries 15 labourers.

[30] *Mallah* is a caste who catches fish or depend on pond, river or boat based economy. Despite being riverine village I have not found *Mallah* caste in the village however villagers have said they live in neighbouring village.

and indirectly shop keeper on *ghat*. The finding says that 8% members of the studied households of the village are involved in labour work which includes sand labourers (Occupation Chart). This figure is based on reported information by the respondents at the time of ban imposed on sand mining in the district. There were households who have informed me about the unemployed (total unemployment 3%), doing nothing (total 4%) and migration to Delhi, Hyderabad, and Punjab in search of job after this ban.[31] I have written doing nothing and unemployment[32] in two separate category in the column of occupation of the members of the household in the survey based on response given by the informants and continued this category during the process of analysis.

There was general impression on me during initial days of data collection about the occupation of the villagers that most of the people are involved in agriculture and sand related occupation. After analysis of the data, the findings reveals that 13% of the people are in agriculture, 6% in agricultural labourer (together 19%), 8% in private sector job, 7% are self employed and 4% of them are involved in government sector job however only 1% in skilled based job (Occupation Chart). This figure was made with inclusion of housewife in the occupation chart as it was per the information provided by the respondents.

The income was recorded during the survey as reported by the respondents or it was estimated with the respondents depending on the sources of income and occupation. The income quartile of the four different categories (SC, EBC, BC and Others) are showing that *Yadav* is most unequal category as their income quartile varies from 16500 per month to 2500 per month (Table 1). The lowest income quartile is in the category of SC and highest in Others category. It is also showing that the lowest income quartile of Others category is somehow equal to highest quartile of SC and EBC (Table 1).

[31] Total unemployment, doing nothing and migration is not only caused by the ban but it is complexity of different cause and effect.

[32] This category was based on the respondents reporting. If someone has said *kuch nahi karta ha ii* wrote it doing nothing and if some said *berozgar hai,* I wrote it unemployed.

Table: 1 Income and Land Holding of different caste in the village*

Category	Number of HH in the Study	Caste	Average Income/Income** (Monthly)	Income Quartile of the Category (Monthly)				Avg. Land Holding (in Acre)	Number of Landless HH***	Percentage of Landless HH in the Category (%)	Percentage of Landless HH in total Landlessness (%)
				Quartile 1	Quartile 2	Quartile 3	Quartile 4				
SC	30	*Chamar* *Dhobi* *Dom* *Dusad* *Paswan*	6921.05 5000 2000 6000 4000	1500	4000	5000	7000	0.77	27	90	32.93
EBC	34	*Mahato* *Kumhar* *Lohar* *Mali* *Nai* *Sao* *Thakur*	4555.55 5333.33 8000 10500 5250 6000 4000	3000	3250	5000	7000	0.17	30	88.24	36.59
BC	31	*Yadav*	13258.06	2500	5000	7000	16500	1.66	17	54.84	20.73
Others	35	*Rajput* *Brahmin* Muslim	44878.78 30000 15000	6000	25000	30000	55000	2.12	8	22.86	9.76
Total	130								82		100

*The income is as reported by the respondent.

**In case of single HH in the caste, total income of household has been taken (Brahmin and Muslim).

***Less than one *bigha* and no land at all have been considered as landless household.

The types of occupation and income quartile based on caste and category has been shown in the table and chart which differs across the socially stratified groups. The differences in expenditure and organization of income in different course of life based on social stratifications have been reported during informal interactions. One important aspect of economy of oppressed I got to know from a villager, whose quote written in my diary is as follows.

*"Domes are like **'loot ke laya koot ke khaya'** means they get money to burn dead bodies and it also means they do loot but their income distribution on different courses of life is not organized. He said as we have organized way of using of income like some amount of money we spend on education, some on health and so on but they don't have such way of life"* [Field Diary, 6th December 2017].

The term *'loot ke laya koot ke khaya'* is used for the oppressed class who earns on daily basis and spend on their daily need. I consulted few villagers and friends regarding the meaning of terminology and got to know that this doesn't mean they do loot it means the one who earn on daily basis, spend the whole money on their food, survival need and can't save for future need. They don't have organized sense of earning and expenses.

During household survey, I observed that it was difficult to make respondents and villagers understand the purpose of doing survey and research. They have their fixed understanding in their mind regarding such surveys and if they couldn't understand the meaning of academic social research explained by me, they say out the meaning they have pre understanding.[33] It was totally surprised for the socially, economically and educationally backward respondents to know that I am doing survey for education purpose and difficult to make them understand. The exposure from education and literacy in the family may give some understanding about research work or education. I found little easy to explain my research purpose among upper caste in the villager because as per data gathered during survey 24% of the members have higher education in this category (Table: 2). However only 4.5% of adult members of BC category, 7.8% in EBC category and 8.7% in SC category have a higher education degree. The highest illiteracy percentage is in SC category (57.7) and lowest in Others (8.8%).

[33] It was easy to make them understand the scientific meaning of water related research but difficult to explain meaning and importance of social research.

Table: 2 Education Status of Adult and Children in Different Castes

Category	Total Adult Member	Average Size of the Family	Type of the Family		Total Number of Children (5 to 15 yr.)	Number of Drop Out Children	Adult Education Level				
			Nuclear	Joint			Primary (%)	Secondary (%)	Sen. Sec. (%)	Higher Education (%)	Illiterate (%)
SC	104	6.97	18	12	59	8	48 (46.1)	25 (8.7)	4 (3.9)	9 (8.7)	60 (57.7)
EBC	129	7.59	13	21	78	20	21 (16.3)	28 (7.8)	2 (1.6)	10 (7.8)	69 (53.5)
BC	132	7.54	11	20	69	12	25 (18.9)	25 (4.6)	12 (9.1)	6 (4.5)	64 (48.5)
Others	181	7.63	26	9	46	1	12 (6.6)	68 (24.9)	40 (22.1)	45 (24.9)	16 (8.8)

While doing survey in *Harijan Toli*, I came across a family who got 1 acre of land during land reform period and now their social and economic status is better than other households in *Harijan Toli*. The general information about the land holding in the village is restricted to *Rajput* and *Yadav* community and my findings is also showing that the average land holding of these two categories are 2.2 and 1.66 acre of land per households respectively. The land holding in SC (0.77 acre per HH) and EBC (0.17 acre per HH) categories are far less than Others and BC categories in the village (Table 1). The landlessness is also higher in SC (90%) and EBC (88.24%). These two communities are involved in labour work, majority of SC in Agricultural labour and EBC in labour work including sand labour. The landless SC and BC (*Yadav*) are also involved in *batai* (share crop). The major occupation of SC, BC and Other is agriculture and allied work.

3.2.5 Agriculture and Irrigation

Haldi Chhapra is one among those villages where people are still rearing horses for purposes related to agriculture. The villagers use the horse to carry bundles of paddy, wheat and vegetables from field to their houses and then to the market. The paradox is that people use, cycle, bike and tracker to carry agricultural products as well. In the essay writing, children have mentioned the increasing number of vehicles and culture to have bikes in the household.

The net area sown is 55.9 hectare out of total 541 hectare of land (Census, 2011). The land used for agricultural purposes is spread over all directions of the village but major cultivable land is towards the Sone (west) and Ganga (north). The land falls in *Diara* area, carried away sand with flood and river water which is fertile in nature and need less water to produce crops.

The farmers cultivate early *kharif* (rice) before river rise and winter crop (wheat, vegetable, mustard, pulses). The villagers cultivate vegetable like peas, tomato and radish to sell in the market. The cash crop production has increasingly come in to practice in last decades. The elders of the village remember the old days when they used to produce *Bajra* and *Makai* for personal use. These crops are hard to digest that's why the present generation has left those crops and started producing cash crop like peas at a large scale. Cash crops are the result of market intrusion in the village. I

have observed every day *feriwala* (vendors) and advertisement vans with different range of products roam in the village. People even buy *datoon* (a twig to clean the tooth) from the local seller in the village which was surprising for me.[34] One old man has shared his young days and said *"we were used to drinking milk with full of glass and now people don't give milk to their children instead they sell to make money."* The cattle (cow) rearing for milk and crop production is to sell for money and buy rice and flour from the market which is soft to digest. Despite being market oriented, people still consume milk and milk product in the village.

In the month of December, the district goes through dense fog with low temperature. This year the fog continued for a week in the village which brought stress among farmers whose pea crop was still in the field however the fog is crucial for wheat crop which moist the soil for good production. According to the farmers, the long duration of fog may spoil the crop or white spot in the peas which reduce the price in the market. The white spot is fungal disease of the crop. The crop production is not only to sow the seed in the field but it is continuous process of irrigation and safe guarding from wild animals. Farmers used to roam in the night in nearby fields or use torch or loud voice to keep away the wild pigs and bull as these wild animals are high in number in the village forest.

The artificial source for irrigation system in the village is privately owned bore wells and hand pumps. The nearby fields are irrigated by hand pumps if the field is small or crop needs less amount of water. Big farmers own bore wells for irrigation of their own land and also to irrigate small farmers land for profit. Early *kharif* depend on rain water and it is compensated with bore well water.

3.2.5 Health in Village:

During preliminary field visit, ringworm or fungal related skin disease was found as a major health issues in the village. The same health issue became a barrier for me to identify arsenic induced skin lesion during household survey. However cases of arsenicosis were reconfirmed from the expert. From the data, the cases of skin related

[34] I was misunderstood as a sell boy and the market orientation of the people made them to understand me as sell boy however I positively turned this as an opportunity to have informal discussion.

disease including ringworm, tenea corpus, itching, eczema and other fungal disease was found 58 (20.42%) and 3 cases in combination of other diseases. Among all the categories, SC and EBC was most affected group in the village. Some of the key informants and villagers have point out flood as the main reason for the ringworm. According to them the previous year flood has contaminated (fungal or microbial) tube-well and dug well of the village which resulted into large scale problem. As I already mentioned SC and a section of EC (*Mahato*) resides in a small portion of land and living condition is substandard which made them much vulnerable.

Ringworm or skin related diseases look like ringworm is locally called as *Khujli.* According to an old man *Khujli* has seven brothers: *khujli, sivhuli, daad, dinao* and rest he could not recall. The villagers has tired off such skin related disease, they apply lotions, take medicines prescribed by local doctors but less effective. They also use local or tradition method of treatment like applying papaya milk on skin lesions.

Another important finding is high prevalence of gastrointestinal disease (total 73 cases) including stomach related disease (55, 19.37%), haemorrhoid (8, 2.82%) and combination of other disease (10, 3.52%). Total number of the gastrointestinal disease is 73 which is making 7.62 % of total number of individuals included in the survey however sharing of this category of disease is 25.7% among all kind of disease found in the village (Table: 3). If I consider skin related disease and gastrointestinal disease together, the figure will increase to 48% of the individuals affected with any kind of health issues. Beside these two major diseases, pain (back pain, body pain, joint pain, and leg pain, 29, 10.21%), diabetes (11) and cardio vascular disease (6 and 6 in combination with other diseases) are other sets of diseases which are high in number.

Earlier I have mentioned, there are 8 small private clinics including one RMP in the village. The total population of the village is 14027 but no sub centre in the village and PHC is in Maner at 7 km of distance from the village.

An old man of the village has shared his views about the health services in the village. According to him, during 1960s there was a Primary Health Centre in Ramnagar Tola, which was running in a rented house. A doctor was appointed here who were residing in the same house. His son fall in love with a girl from a neighbouring house and both of them run away as their caste was a barrier for their marriage. This incidence has crumbled this PHC because doctor took transfer and land owner has denied permission for PHC.

Table: 3 Disease Profile of the Village

Health Issues in the Village	Diseases include	Number Individual Affected	Percentage	SC	EBC	BC	Other
Skin Disease	Ringworm, Tenea corporus, Itching, Eczema, Fungal Disease	**58**	20.42	**15**	**19**	12	12
Combination of Skin Disease and other Diseases	Other Includes: Gastric, Haemorrhoid, Watery Eye	3	1.06	2	1	0	0
Stomach Related Disease	Gastric, Abdomen Pain, Abdomen swollen, Digestion Issues, operation for Stomach problem,	**55**	**19.37**	7	**16**	**14**	**18**
Stomach Related Disease and other disease	Joint pain, Cardiovascular Disease, Respiratory issue, Diabetes, Cough, Ring worm, Body Swollen, Alcoholism	**10**	**3.52**	1	3	3	3
Common Manifestation along with other arsenic related disease	Gastric, Liver operation, Respiratory issue, Cardio Vascular and also with Common manifestation	6	2.11	3	1	1	1
Arsenicosis and other disease	Joint Pain, Ring worm, Blood in cough, Headache, Watery eye Body Swollen	**5**	**1.76**	2	3	0	0
Cardio Vascular Disease		6	2.11	1	0	3	2
Cardio Vascular Disease and other health Issue	Thyroid, Diabetes, Respiratory, Gastric, Headache	6	2.11	1		1	4
Pain	Body Pain, Joint Pain, Pain in Leg, Pain in Thigh, Back Pain	**29**	**10.21**	5	6	11	7
TB		1	0.35	1			
Cancer		1	0.35				1
Haemorrhoid		8	2.82	2	1	4	1
Common Disease	Cold, Cough, Fever	20	7.04	7	3	7	3
Alcoholism		4	1.41	0	1	2	1
Diabetes	Not in combination with Arsenicosis though included in combination with Cardiovascular disease, ringworm, joint pain	11	3.87	1	1	0	9
Total	Including all Health Issues	284		63	68	72	81

The geographical location of Haldi Chhapra in one hand making one this village privileged to access fertile land for better production of crop, economic opportunity on sand based occupation, religious importance due to *sangam* and *ghat* but at the other hand arsenic contamination of ground water has made this village vulnerable. The vulnerability increases because it is situated on confluence of two rivers and nearby confluences of other rivers. The phenomenon of erosion towards south side of the Ganga making a turning point, engulf part of village. This turning point may be based on water dynamic and tectonic friction because of nearby three confluences and this need to further investigation. The flood by these rivers is devastating for the villagers. My field work diary based participant interaction with the villagers says

"...six (6) tolas of the village gradually devastated by Ganga and those inhabitants of the tola's have migrated to Maner and other places. And those who have migrated from here, they named the tola in Maner as same as here ... [Field Dairy, 4th December 2017]

The destruction of village situated on the bank of river has created condition to migrate other places mainly to the Maner where these displaced people has named the place on the name of previous village from where they have migrated. The people also shifted to new location in the village after erosion of the bank and this is the reason of heterogeneous nature of village. Beside flood there are other social problems mentioned in the essay writing by the children such as alcoholism, violence on women, garbage issue, open defecation and superstition but the water related issue has made this village much more vulnerable (Table of Thematic Analysis in appendix). One children has written that

"These days this river has got polluted. The people who mostly bath in the Ganga, they also become prey to disease" [translation from Essay Writing, Participant A-02].

The Ganga has got polluted and arsenic contamination has been found alongside the Ganga in the ground water of the village. The physical manifestation and its social implications will be discussed in the next chapter.

Chapter 4

Arsenicosis in the Village

"Often people bully and discriminate to say them about different kind of disease like cancer and leprosy to the person who has pigmentation on face, hand, leg that's why people keep distance from them. Often people from city come and tell the villagers that government is doing work on it, you give them vote, I will eradicate the water problem from the village" [Essay Writing Participant: C- 14, 7th January 2018]

A twelve years old school going children from the village has written above mentioned paragraph in the essay. This signifies that water contamination of the village has created physical manifestation of arsenicosis as well as social implications to the extent that the children can also sense the web of interconnected socio-political issues related to arsenicosis. The villagers misunderstand physical manifestation of arsenicosis on different parts of people's body like face, hand, leg as leprosy and that is why people discriminate and keep distance from the affected individuals. I have also observed during the survey that respondents have mistakenly counted leprosy affected individual as arsenicosis manifestation. Another important part of the paragraph is politicization of arsenic contamination to gain vote in favour of, is also an important aspect to understand.

In this chapter, all the above mentioned aspects of arsenicosis from source of water to its distributions, different implications including social determinants, spatial distribution, and opinions for possible mitigation program given by the key informants, children and villagers will be discussed.

I have written this chapter primarily based on household survey done in the village however reflection from field dairy based on participant interactions, informal discussion and analysis of interviews and essay writing by the children has also been considered.

4.1 Respondent Profile

The respondents in the 130 household surveys were between 15 and 86 years of age with proportion as given in table 1 with median age of 45 years. The gender composition of the respondent (35.38% female) and head of the household (9.23% female) is quite significance in the case of this village with reference to interaction with new persons and women's positioned in the village (Table: 1). I observed it was difficult to interact informally with women in the village, especially in upper caste households, however for the household survey I didn't face any difficulty. When you speak to the women to know their view point (even to elder women) and somehow if men have noticed they will call you at *chaupal* to have a conversation. In this context, the composition of the respondents in the table is significant for findings.

Total number of children in the studied households is 369 and number of average children in the family is 2.84.

Table 1: General Information about the Respondent and Household

Age Group	**Frequency**	**Percent**
15-30	32	24.62
30-45	**40**	30.77
45-60	26	20.00
>60	32	24.62
Median Age of the Respondent	**45**	-
Total	130	100.00
Sex of the Respondent		
Male	84	64.62
Female	**46**	**35.38**
Total	130	100.00
Sex of the HH Head		
Male	118	90.77
Female	12	9.23
Total	130	100.00
Age Group of HH Head		
Less than 50	57	43.85
50-60	30	23.08
More than 60	43	33.08
Median age of the Respondent	55	-
Total	130	100.00
Average No. of Children in the HH	2.84	-
Total children in Studied HH	369	-

4.2 Sources of Water

My initial days of field visit, participant interactions, informal discussion and social mapping has amused me to know the presence of large number of dug well in the village. As per villagers and my field visit observation, more than 100 dug wells exist in the village. The dug well water was the major source of drinking and other usage in the village before 1980s though other sources, such as river water, were also in practice. In a span of time people shifted to hand pump to use ground water and now hand pump is the major source of water for drinking and other usage. However 6 dug wells are still functioning, with bore well installation for personal use and private supplied water for drinking purposes are increasing in number.

The contemporary sources of water and its transition from one source to another in Haldi Chhapra village are connected to the drastic shifting from surface water to ground water globally. The widespread propagation of hand pump use and large scale intervention of international bodies like UNICEF, World Bank, WHO in developing countries in the 1970s and 1980s resulted in mass level changes even in distant villages. The effort was to change people's water utilization from dug wells, ponds and rivers as these sources were considered major causes of diarrhoea, cholera and other water born diseases. The elders of the village have clear memory that they were only using dug well water for cooking, bathing and drinking till 1980s however occasionally river water utilization was also in practice but later government has started installing hand pumps in the village which were easier for water collection. This easiness, comfort in use, proximity to the house and less consumption of time made hand pump utilization common on a large scale within a short duration of time. People used well water for few years along with hand pump because they were habitual of dug well but then finally shifted to hand pump alone. In this transitional phase one villager remembers that when hand pump water utilization was not at extensive level, somehow women of the village found that hand pump water easily cooks the food especially *saag* (a leafy vegetable), and then whenever any member of the village fetched hand pump water people got to know that in this house *saag* is being cooked. With the practical comfort it brought, according to the villagers now every household, has minimum one hand pump and there are families where two or three hand pumps have been installed for different purposes.

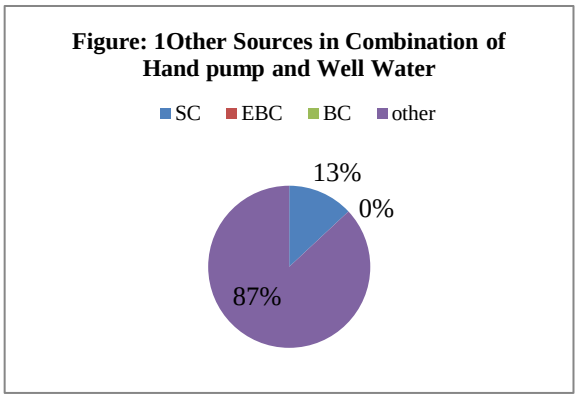
Data from the household survey in the village shows that 115 households (88.5%) are using only hand pump, 5 households (3.8%) are using both hand pump and dug well, 2 households (1.5%) are using hand pump and river water, 5 households (3.8%) have options of hand pump and others sources however only 2 households (1.5%) are using only other sources of water for different purposes. The important point here is that the other sources of water in the village means people have started installing bore wells.

I have considered sources of water and sources of drinking water as two different questions in the household survey. Out of total households in the survey 76 (58.5%) households are using hand pump as source of drinking water. If I consider total unfit sources of water (91) as reference then the percentage of hand pump use will be 83.5% (76 HH). The sources of drinking water other than only hand pump is combination of other sources and well water (1 HH, 0.8%), hand pump and other sources (3 HH, 2.3%), and third combination is hand pump, well water and other sources (1 HH, 0.8%). Second important sources of drinking water is other sources (18 HH, 13.8%) which includes private supplied water from Maner market and bore well more than the depth of 250ft in the ground (Table: 2). The use of other sources as drinking water is 87% in other category and 13% in SC category however EBC and BC are not using other source for drinking water (Figure: 1). Besides the household survey, I have visited houses in *Yadav* (BC) who have installed bore well and using private supplied water but didn't find any household in EBC category. The utilization of other sources for drinking water is positively linked to awareness of arsenic related information in the household.

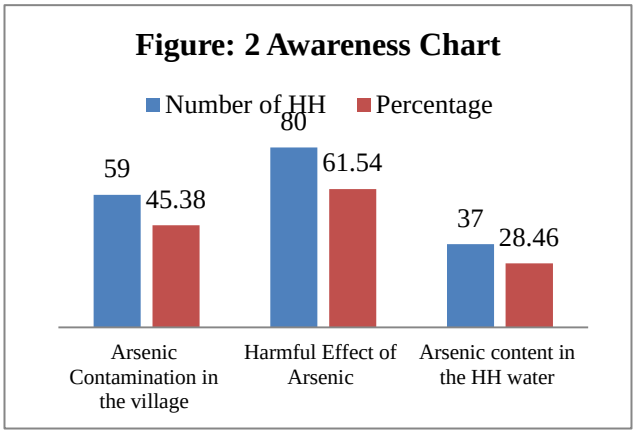
On asking about water quality (fit or unfit) as per respondent's views, the sources of water were found fit to drink by the respondents in 39 households (30%) and 91 households (70%) said unfit to drink (Table: 2). I asked the respondents during survey

Picture 1 & 2: A villager is demonstrating local method to contamination of water.

and other villagers through participant interactions about the reason of why they assessed it as unfit to drink and their process of assessment of saying fit or unfit to drink. They said that they assessed fitness to drink through colour and taste of the water as well as through presence of visible particles, such as dust in the water. One respondent even demonstrated a local method to show me the process of assessing water quality. He took two water samples in two different glasses, one from a hand pump and the other from a water purifier and puts a guava leaf in each of the water samples. In few seconds the water from hand pump turned black which means the water is contaminated while the other didn't change the colour (Picture : 1 and 2).



The awareness of arsenic contamination was among 45.38% of the respondents, its harmful affect was known to 61.54% and arsenic content in drinking household water was in the knowledge of 28.46% respondents (Figure: 2). The response on unfit sources of water to drink (70%) lead to further investigation to know the source of drinking water. It was found that there are households where even though the source of water is fit to drink but they choose to drink from other sources. The category Other and SC are more aware than EBC and BC and share of utilization of other sources of drinking water is high in these category (Figure: 3). The combination of awareness and socio economic condition of different caste based category as established in previous chapter is also showing that better economic condition can avail other sources of drinking water more than socio economically deprived section. The ownership of the sources of drinking water is high in Other category however in SCs government ownership is high (Table: 2). Which means SCs are accessing drinking water from government owned hand pumps



which is mostly *Hathi Kaul*[35] in local language however old hand pump are regular sized but recent installed hand pumps are bigger in size.

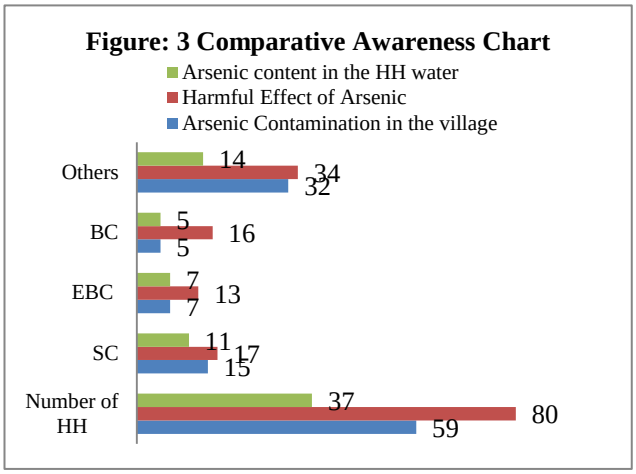


Figure: 3 Comparative Awareness Chart

Now the story has changed, one study shows that 100% hand pump of the village is arsenic contaminated higher than permissible level (Singh, S. K and Ghosh, A. K. 2012) and government has marked the hand pump with green, yellow and red colour to indicate its toxicity. The colour is not visible during the field visit (28th November 2017 to 8th January 2018) but people have their own way of assessment of water quality. That is why they try to fetch water from the hand pump which seems to have better water quality. Sometimes the ownership of the hand pump becomes hindrance due to personal relationship issues. The social implication of contaminated water has also been found (see the section of social dimensions).

Some dug wells have been renovated 5 years ago by UNICEF in the village and it was suggested to use dug well water after ground water had been reported as arsenic contaminated. Among all these dug wells only 6 are functioning and people are using their water. The villagers know that dug well water is better than hand pump water. According one of the key informants:

"Well are not contaminated because the water of these wells comes in contact with sunlight. And this is the reason government once tried to promote wells in the village through some scheme but times have changed and people prefer tube well/hand pump which are affected with Arsenic" [Field Diary, 4th December 2017].

The studies show that the well water contains pentavalent arsenic which is less toxic than trivalent arsenic. The people of the villagers as well as children who wrote essays has also mentioned that well water is better than hand pump and Prof. Ashok Ghosh has also supported this view point of the villagers. The utilization of well water is not

[35] *Hathi Kaul* is local term to identify a hand pump with big handle and filter, installed by Bihar Government.

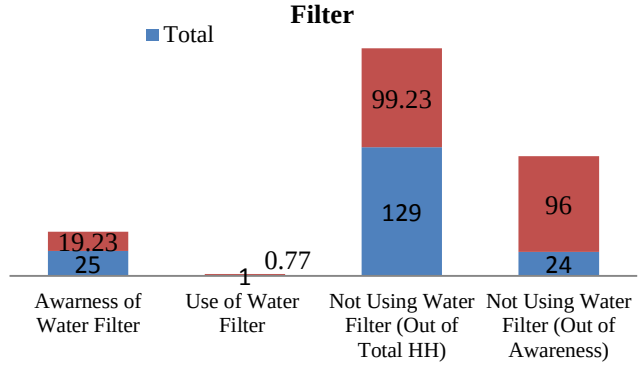
in practice because after renovation the dug well has been half covered which is creating difficulties in doing *Upaachh*[36] of the well (Photographs in Appendix). When someone goes into the dug well to take out the water or garbage to clean the well they feel suffocation in absence of oxygen. The use of dug well water was in practice in the village a decade ago but the top down intervention has changed their behaviour and now again they are being advised to return to dug well.

4.2.1 Water Filter

There are two functional water filters on east extreme of the village in an upper caste household, installed by foreign agencies in collaboration with A. N. College, Patna. Both of the filters are under charge of the same household, one in front of the *chaupal* and other inside the house premises. I came to know about the second water filter on third visit to the care taker, although about the first water plant I came to know in Maner market, 7 kilo meter away from the village during the preliminary field visit, besides the information in literature. As per the sign board on the first water filter (outside of the house), it was installed by the sponsorship of Saga Foundation, Pennsylvania, USA in collaboration with A. N Collage, Patna. I couldn't get much information about the second water filter except to know some Switzerland agency has installed in collaboration with A. N. College. I got same information from the professor who has done study in the village and played a key role in installing these filters. The nearest household is around 150 meters away from the water filter installed households, which means the area is neither densely populated. Nor is it the location where arsenicosis is high according to my findings.

According to my data only 19.23% (25 HH) of surveyed household are aware of the water filter in the village and only 1 (0.77%) household is using water from it, that of the care taker. If I consider total households than 99.23% is not using water filter and 96% (24 HH) among the

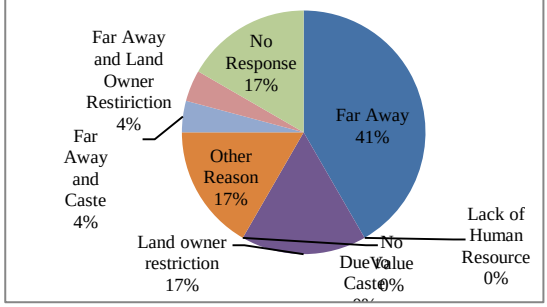
Figure: 4 Awareness and Use of Water Filter



[36] ***Upaachh*** is the process of taking out all the water from dug well and left behind for oozing out fresh water from ground which happens once in year by the collective labour of the villagers.

household who are aware of the water filter are not using it (Figure: 4). I asked about the reasons for not using the water filter. Highest percentage (41%) of the respondents has reported far away as the reason for not using water filter, land owner restriction, other reason has share of 17 % each as the reason whereas same percentage of the respondents have chosed not to respond. In the category of other reasons, respondent has said abusive nature of the care taker, bad relations and water filter is not working. Two categories emerged out of analysis of multi-ole reasons, far away and land owner restriction (4%) and far away with caste based restriction (4%) (Figure: 5). One young respondent belonging to Schedule Caste narrated a story of discrimination when I asked why they don't fetch water from water filter, as given below.

Figure: 5 Reason of Not Using Water Filter



"Once I was hired for a work at his house. At the time of lunch I asked for permission to come for lunch at my house, they denied and said to have lunch at his house so that I can't waste time but when they gave me lunch, the plate in which lunch was served was dirty as it was for some animal . . . so how I can imagine, I can take water from that house" [Field Diary, 6th December 2017].

After half an hour of our interaction during household survey, young man came back to me at another part of the *tola* and asked what I have written in the survey sheet about the story that he narrated. I assured him to make his story confidential and show him my survey sheet where I took notes. I realized his apprehensions and fear.

The first quote of this paragraphs where a child has pointed out political aspect of arsenic is rightly fit into the case of water filter as well. According to neighbour of water filter, care taker has relation with the professor who has facilitated installation of these water filters that's they provided in his ownership however the care taker point of view is that they got water filters in return of hosting guest and researchers. The Professor is happy after setting up water filter in the village which he tests water sample every month and according to him people are utilizing water filter very well however the reality from the ground that I got is totally different.

Table 2: Sources of Water and Ownership

Water Related Information		Number of HH [Total HH 130]	Percentage	SC (%) [30 HH]	EBC (%) [34 HH]	BC (%) [31 HH]	Others (%) [35 HH]
Source of water	Water Tap	0	0	0	0	0	0
	Hand Pump	**115**	**88.5**	**27 (90)**	**34 (100)**	**27 (87.1)**	**27 (77.1)**
	Well	0	0	0	0	0	0
	River	0	0	0	0	0	0
	Pond	0	0	0	0	0	0
	Rain Water	0	0	0	0	0	0
	Hand Pump + Well Water	5	3.8	0	0	1	4
	Hand Pump+ River Water	2	1.5	2	0	0	0
	Hand Pump + other	5	3.8	1 ()	0	1	3
	Others	2	1.5	0 (0)	0	1	1
Source of water fit to drink		39	30	9 (30)	12 (35.3)	11 (35.5)	7 (20)
Source of water unfit		**91**	**70**	**21 (70)**	**22 (64.7)**	**20 (64.5)**	**28 (80)**
Sources of Drinking water	Water Tap	0	0	0	0	0	0
	Hand Pump	76	58.5	20	22	22	12
	Well	0	0	0	0	0	0
	River	0	0	0	0	0	0
	Pond	0	0	0	0	0	0
	Others	**18**	**13.8**	3	0	0	**15**
	Hand Pump + Water Well + other	1	0.8	0	0	0	1
	Hand Pump + other	3	2.3	0	0	0	3
	Others + Water Well	1	0.8	0	0	0	1
Ownership Of Drinking Water	Family	98	75.4	**18 (60)**	27 (79.4)	22 (70.9)	**31 (88.6)**
	Community	3	2.3	1	0	1	1
	Government	26	**20**	**11**	6	5	4
	Neighbour	3	2.3	0	1	1	1
	Relatives	2	1.5	0	0	2	0

4.3 Arsenicosis: Manifestation and Distribution

The first possible indication of physical manifestation of arsenicosis on skin can be assume from the sign boards on electric pole and wall in the village which are painted to advertise medication, lotions of skin disease (see photographs in appendix). I have seen advertisement van in the village, announcing to promote lotions, ointments and medications of skin diseases. I interacted with a medicine supplier to a local doctor of the village, as per him the consumption of medicine related to skin disease is high in the village as well as in the district. My preliminary field visit observation and interaction with the villagers had confirmed few cases of arsenicosis in the village along with other causes of skin disease however the main phase of data collection has explored qualitative and quantitative aspects of arsenicosis in the village.

Thematic analysis of essay writing of the children has shown arsenic menace in the village, its perceptions, problems and social dimensions. The children of the village have understanding about the arsenic in the village and its related health problem. These two lines from the essay is signifying the same and giving clue of skin pigmentation on face and other kind of skin lesion on different parts of body. According to a child *"The Arsenic is very high in the water of my village Haldi Chhapra, from which we drink then spread many diseases in our mouth* [Essay Writing, Participant B- 01]. The children and villagers say teeth became yellow or rot due to arsenic contaminated water. Another child has written *"Due to contaminated water, the spot on face like disease spread and wounds, boils happen* [Essay Writing Participants A- 01]. This sentence signifies that the consumption of arsenic contaminated water manifests into skin lesions.

Besides these general understanding of arsenicosis in the village from essay writing, participant interaction and observations, the household survey found 35 (3.65%) arsenicosis affected individuals in the village excluding 2 individuals of melanosis from another village living in surveyed households during the time of data collection. The common physical manifestations are skin pigmentation (27, 2.81%), keratosis (5, 14.28%) and melanosis (2, 0.52%). The combination of skin pigmentation and keratosis (1, 0.10%) has also been found in the study. The finding specific to the children between the age of 0 to 18 years is showing 12 (3.06%) manifestation however total 7 (2.72%) arsenicosis cases were found in school aged children (between the age of 5 to 15 years). Skin pigmentation was the major (11)

manifestation among the children however one child was suffering from keratosis (Table: 3). Household survey has also found 2 rare manifestation in the village, 1 belongs to obstetric disorder and a cancer patient. There was no cancer death in the surveyed households but 3 cancer deaths have been reported in relatives or neighbours households. The geo-physical location of obstetric patient and cancer are *kumahar toli* (west extreme of the village) and Nayka Tola respectively and among 3 cancer death 2 were in Nayka Tola and 1 in Ramnagar Tola (see Arsenicosis and Health Resource Map).

Table 3: Arsenicosis Manifestation

Total Number of Individual	Arsenicosis (common manifestation + rare manifestation + 2 melanosis)	Percentage	Common Manifestation				Rare Manifestation	
			Skin Pigmentation	Keratosis	Skin Pigmentation and Keratosis	Melanosis (visitors in the household)	Premature Delivery	Cancer
958	33+2+2	3.65	27	5	1	2	1	1

The household survey has given the figure of affected individuals of arsenicosis in the village. I have revisited every households of the individual who has physical manifestation of arsenicosis to reconfirm the manifestation as per confirmed cases from the expert. Based on the list of confirmed arsenicosis, transect walk, interactions with the village, a health map of the village was made mentioning arsenicosis with the geo-physical locations of affected individuals (Arsenicosis and Health Resource Map).

According to arsenicosis and health resource map, there are three geo-physical locations (yellow, blue and red circle in the map) where cluster of arsenicosis affected persons were found. In addition there were sporadic cases across the village. Red circled geo-physical location is circle 1 where Dalits (SC) are living and yellow circle is cluster 2 where *Mahato* and *Sao* (EBC) are living whereas blue circled location is cluster 3 where *Rajput* and *Yadav* are residing. Cluster 1 (11 individuals) and cluster 2

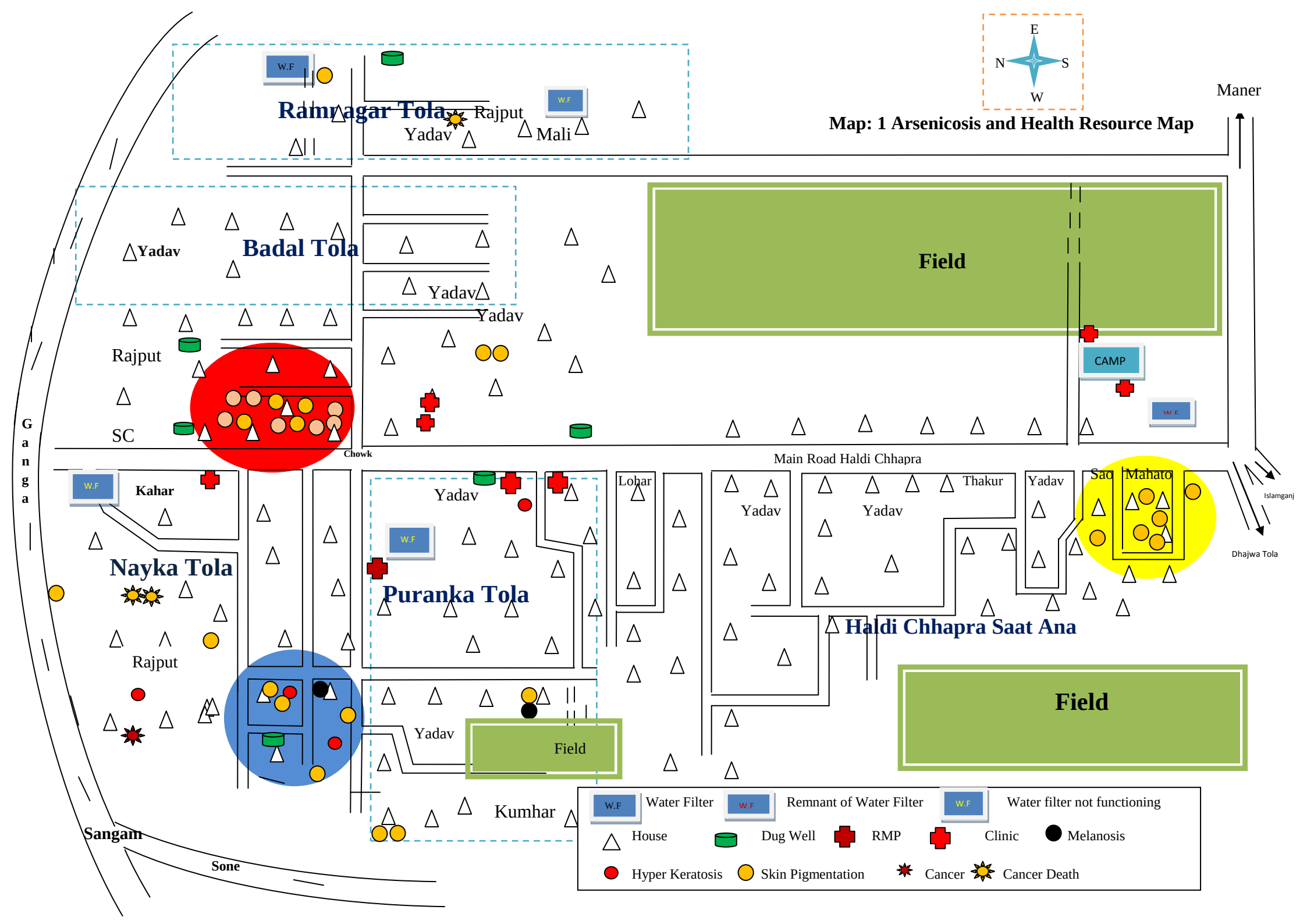
(6 individuals) has the entire affected individuals belonging to SC and EBC category however at cluster 3 (7 individuals) the arsenic affected individuals belong to category BC (*Yadav*) and Other (*Rajput*). Highest number of affected individuals is in cluster 1 then in cluster 3 and cluster 2 is at the bottom (Arsenicosis and Health Map) and if we consider caste wise cases then the 5.46% individuals (11) are affected in SC, 3.89% (10) in EBC, 3% (8) in Others whereas 2.57% (6) in BC category (Table: 4). From this finding geo-physical location and caste is emerging as the determining factors for arsenicosis in the village.

4.4 Social Dimensions:

The socio-economic condition, geo-physical location, depth of hand pump, health services, food and water resources matters in case of manifestation of arsenicosis and the arsenicosis affected individual positioned in a society with structured social groups, different belief systems and social values, has different impact and understanding in our society. The questions like why certain group of people has more number of arsenicosis as this study found and what are the social implications of it can be addressed in this section.

4.4.1 Social Determinants

In the earlier chapter, I have mentioned the socio-economic condition; geo- physical locations, social resource distribution and holding of caste based four categories in the village and now the finding is saying the arsenicosis are highest in SC and EBC and three geo-physical locations where concentration of arsenicosis is high. These three clusters includes SC and EBC however third cluster include Others and BC category. Even though socio economic condition of Other category is better, the manifestation of arsenicosis at cluster 3 (Blue circle) in Nayka Tola has came in to light including cases from BC category. This signify that the concentration of arsenic in the aquifer of that location would be much higher than other locations and consumption of arsenic as well as duration of exposure would be so high where socio-economic conditions doesn’t work.


E
N
S
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Maner
Map: 1 Arsenicosis and Health Resource Map
Ramnagar Tola
Rajput
Yadav
Mali
W.F
Badal Tola
Yadav
Yadav
Yadav
Rajput
SC
Chowk
Field
CAMP
Main Road Haldi Chhapra
Kahar
Nayka Tola
Rajput
Yadav
Puranka Tola
Lohar
Yadav
Yadav
Thakur
Yadav
Sao Mahato
Islamganj
Dhajwa Tola
Haldi Chhapra Saat Ana
Field
Yadav
Field
Kumhar
Ganga
Sangam
Sone
Water Filter
Remnant of Water Filter
Water filter not functioning
House
Dug Well
RMP
Clinic
Melanosis
Hyper Keratosis
Skin Pigmentation
Cancer
Cancer Death

Table: 4 Arsenicosis and Social Determinants

Arsenicosis → / Social Determinants ↓		Percentage	Arsenicosis (Common + Rare)	Common Manifestation			Rare Manifestation
				Skin Pigmentation	Keratosis	Skin Pigmentation and Keratosis	Cancer/ Premature Delivery
Total		3.65	33+2	27	5	1	1/1
Caste	SC	**5.44**	**11**	9	2	0	0
	EBC	**3.89**	**10**	9	0	0	1
	BC	2.57	6	4	2	0	0
	Other	3.00	8	5	1	1	1
Education	Illiterate	**7.01**	**16**	12	3	1	0
	Primary	3.28	9	9	0	0	0
	Secondary	4.18	9	6	2	0	1
	Sen. Sec.	0	0	0	0	0	0
	Higher Education	0	0	0	0	0	0
Gender	Male	3.27	17	14	2	1	0
	Female	4.10	18	14	3	0	1
Age	Children (children 5 to 15)	3.06 **(2.72)**	**12(7)**	11 (7)	1(0)	0 (0)	0 (0)
	Adult	4.06	23	17	4	1	1
Geo-Physical Location	Location 1	-	11	11	0	-	0
	Location 2	-	6	6	0	-	0
	Location 3	-	6 +1∗	4	2	-	0
	Rest	-	10+1∗	8	2	-	1

∗These locations includes melanosis cases of visitors (relatives) from other village

Another important finding from the household survey and connection with arsenicosis is showing that 51.72% (15 HH) household and 57.58% (19) of arsenicosis individual are drinking water from hand pump whose depth are between 100 ft to 125 ft. If I include percentage of less than 100 ft depth of hand pump means all arsenicosis affected individual and affected household will increase to 78.79% (26 HH) and 75.86% (22 HH) respectively. However no cases were found in household who are drinking water from the hand pump whose depth is between 125 ft to 150 ft and more than 150 ft depth (Table: 5). The health status of the village (discussed in previous chapter) is also making villager more susceptible to arsenicosis as it was found that 29.6 % (284) of the surveyed people are suffering some and other kind of health issues.

Table: 5 Depths of Hand Pump and Arsenicosis

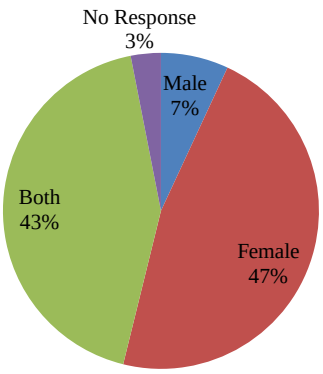
Depth of Hand Pump	Number of Arsenicosis HH	Percentage	Number Arsenicosis Individuals	Percentage
Less than 100 ft	7	24.14	7	21.21
Between 100 to 125 ft	15	**51.72**	19	**57.58**
Between 125 to 150 ft	0	0	0	0
More than 150 ft	0	0	0	0
Don't Know the Depth	7	24.14	7	21.21
Total	29	100	33	100

4.4.2 Social Implications

On first day of my stay in the village, I was advised to fetch water from *Hathi Kaul* (they think better quality of water) for drinking purposes which is around 100 meters away from the building of *Krishi Sahyog Samiti* where I stayed. However for other purposes there was another hand pump just behind the building. Next day when I went to have lunch at *Chaupal* of my host, one child was sent to fetch water from 20 meters away hand pump which they think has better quality of water. Fetching better quality of water from *Hathi Kaul*, bore well or hand pump of relatives or neighbours or even family owned (supposed to good quality water) but a little away from house is not only for drinking purposes but also while cooking rice because contaminated water makes rice yellow which tastes bad as well.

According to the survey only in 7% households male fetches water however female fetches water in 47% households and in 43% household both fetch the water (Figure: 6). This data is indicating that the contamination of water as per the knowledge of villagers and previous study of arsenic contamination based awareness in the village and patriarchal structure of our society burden the women further in the effort required to avail better quality of water. Another angle of availing or process of owning better quality of water emerged through informal interaction with the villagers, which creates stress among the family members especially for the men. This was due to the need for building economic capacity to install either bore well or hand pump of more than 250 ft of depth in the courtyard, as the women often kept reminding them. I was not informed of any direct conflict between the members on this issue but the way gender interaction was informed, it is indicating underlying conflict between the genders.

Figure: 6 Members Fetching Water



The analysis of essay writing, interviews of key informants and informal interaction with the villagers have pointed out that the water become yellow after a few minutes and washing cloths with the water makes them yellowish in colour especially white cloth. This is the reason people don't prefer to use white cloth in the village but those who use white cloth, it's a matter of loss of respect for them. I have also seen water becoming yellow in few minutes and respondents has shown me the cloth, utensils which become yellowish in colour and creates bad feeling to cook food in the utensil (Photographs in appendix). It was also matter of concern for the villager to host the guest in the village. The guest or visitors complains stomach pain in a few days stay and blames the yellowish water for their problem, and this is a matter of embarrassment for the villagers. .

Above mentioned findings on social implications of contaminated water are more of collective in nature but different social implications of arsenicosis are focused on individual, his/her character, social identity and social location. Before going to

individual, his/her social location and identity based social implications; there is a need to understand general understanding of manifestation of arsenicosis. The manifestations in the form of skin lesions are difficult to distinguish with leprosy, ringworm and fungal skin disease for general population although there are villagers like local doctors, person who has knowledge about arsenic and key persons, who have clear understanding about the distinction between arsenicosis and leprosy. This misunderstanding is among the reasons of keeping distance from arsenic affected individuals as leprosy was misunderstood as curse of god and result of his/her *karma* (deed or character). I have already mentioned in initial paragraphs of this chapter with reference to a quote from an essay writing of a child that people keep distance from arsenicosis affected individuals. The arsenicosis affected individuals have not informed me or perceived any kind of distance maintained by the villager, neighbours or relatives however they themselves feel bad because of presence of pigmentations, or hard patches on palm or sole. I have seen arsenic affected individuals working at tea shop, selling omelette (a child suffering from skin lesion)[37], doing agriculture labour, playing with friends. Even though patients didn't perceived or feel, one can't deny that people don't keep distance but it depends on severity of the arsenicosis, its visibility of scariness and the social position. One skin pigmentation patient, I have seen him working well at his own tea shop however another keratosis patient (hard patches on palm) was less interactive to people, his family interaction with other villagers was also lesser than others. The formal have skin pigmentation on his chest however later have hard patches on his palm. Later he has chosen to keep distance from neighbour and wants no interferences from anyone in his daily activities.

One young man has said regarding skin lesion or skin pigmentation on body during informal interaction:

"Rajput has more problem than Yadav or other lower caste because we are upper caste so people are more carefull (sic) and in lower caste there (sic) spot doesn't matter for them as compare to us" [Field Dairy, 14th December 2017].

[37] I have observed this child for few days who has skin lesion. He has no interest in going to school and sells omelette in the evening. Eating omelette in the evening during winter is favourite snack in the village. I have found around 20 small shops along the main road from Haldi Chhapra ghat to other end of village.

Displaying the prevalent caste and class based discrimination, two important points emerge from this conversation, one that skin lesions are seen as a *daag* in local term which is a problem for them and second point is this *daag* is comparative problem in accordance with social position of affected individual. If an upper caste is affected, it's a bigger problem for him compare to lower caste because lower caste lack humanness[38] and that's why spot on body doesn't matter for them.

The spot on body creates problem in marriage as well. One young man again from upper caste has said that:

"Boys have more problem than girl because boys bodies and life is more open than girls. Girls can hide their spot or pigmentation but how can a boy hide because everyone knows about him" [Field Diary, 13th December 2017].

Gender matters in the case of spots on any part of body. Male gender is more vulnerable than female in this case as their body part is more exposed to others. However I couldn't get any narrative from women side or any cases where women has been deserted or divorced or got into problem in getting marriage however the percentage of arsenicosis is higher in women (Table: 4). One lady has shared if someone has any spot on face then they *"boycott food exchange (khan pan) with whoever has, neighbour has and problem in marriage".* I tried to know the neighbour who has spot on face then got to that she has leprosy not arsenicosis. This again signifying that people have misunderstanding and confusion between arsenicosis and leprosy but whatever could be the reason of spot on body either arsenicosis or leprosy people get problem in marriage and face discrimination.

4.4.2.1 Children

The four categories of households with or without affected individual and in combination with or without children mentioned in the conceptual framework have been analysed. The first type of households where no one is affected, are not immune of any of kind of discriminations, embarrassment or any other social implications. As I earlier mentioned that the guest from other village complaint about the contamination of water which collectively embarrasses the villager either affected household or not affected household. There are households where no one is affected

[38] I have conversations with upper caste key informants as well as villagers who use term *Janwar* to indicate the behaviour of lower caste people.

but some members have either leprosy or fungal diseases they also misunderstood as arsenicosis and based on this they faced isolation. However other three type of household where either children or adult or both of them are affected are directly being affected in the form of uncomfortable in public spaces. Such households are also got into problem for searching suitable girl or boys for marriage. If adult member of the household are affected with arsenicosis especially keratosis (hard patches of sole on palm), children got responsibility to help his father in the field or whatever his father is doing. One school teacher has informed me that *"if children got affected we suggest them not to come for few days however if they come we allow them to sit in the class"*. Thematic analysis of essays written by children is also showing that children are being bullied and discriminated in school and other sphere. I have seen children calling arsenic affected as well as ring worm affected children as *ghauwahba* (wounded).

4.5 Responses and Opinions

After first report of arsenic contamination of ground water in neighbouring district, Maner block has also been identified as arsenic contaminated block along with Haldi Chhapra village. Although arsenic content in the ground water were high but manifestation and its social implication was not severe as in West Bengal and Bangladesh. When villagers got to know about the arsenic contamination, they started their own way of assessing water quality and political as well as local leaders also started using this issue for vote gaining strategy at village level. There is a local leader in the village who sat for few days protest at Maner community development block for demanding arsenic free water however he couldn't get proper support from villagers as third person has narrated me. However I couldn't meet him.

Reflection and analysis of interviews, essays, and my diary based on participant interaction and informal conversation to find out the mitigation options and villager's opinion reminds me the days when I visited *Jal Satyagrah* in Devas district of Madhya Pradesh in 2011 with a group of young peoples.[39] After observation and interaction with tribal, one student among us has shared her views in a reflection session that *"I*

[39] This was the group exposure programme organized by Delhi based NGO Pravah in collaboration with Narmada Bachao Andolan.

don't think they want so much things in life, they just wants most basic things like land, electricity and a home nothing like the urban people and even government is not able to provide these basic things. I don't know why?" My analysis is also emerging as same thing that the people from Haldi Chhapra don't want big mall, super market, multi speciality hospitals or big companies for job opportunities; they just want an arrangement for water and a small hospital.

One villager has said *"government has spent so much money on spreading pipe for providing water from a big water plant which has all gone into vain and nothing happened. They should just install few bore well or hand pump more than the depth of 250 ft at different places in the village so that we can get good water."* The villagers are capable enough to decide better plan for themselves as the ground reality make them to choose better option based on common sense. The same option was mentioned in many academic literatures and also given by Prof. Ashok Ghosh as he said *"the deeper aquifer has not yet contaminated, so the villager have option to install hand pump or bore well more than 250 ft to get quality water but there is a chance of contamination in future"*. Many villagers and experts have suggested maintaining dug well water to the villagers and start using as it is better than hand pump water. My result is also showing that the households those are using water from dug well has no manifestation of arsenicosis. This means dug well water is comparatively safer than hand pump water. However there is need of scientific investigation of the well water of the village.

One villager has made a simple water filter by using sand, coal and stones (photographs in appendix). He has suggested many people to make it however I could not find anyone using that technique. Professor Ashok Ghosh and one army personnel in the village has confirmed that this technique may reduce the dissolved solid and arsenic from the water.

Chapter 5

Discussion and Conclusion

Haldi Chhapra is a riverine village (*Diara*), situated at the confluence of two major rivers Ganga and Sone believed to be female and male rivers in Patna district of Bihar. Along with this confluence, two other rivers Ghaghra and Gandak also meet Ganga at nearby locations, making the village vulnerable to flood every year that makes life miserable. Arsenic contamination of ground water in the village, a health profile showing the profile of manifestations of arsenicosis, socially stratified in different caste group (16 castes in the village), positioned at different geographical locations in mixed pattern, makes the village a basket case to study which can be good representation for the state. During the process of searching for preliminary literature review, I came across dearth of literature of social science studies in the field of arsenicosis in the context of Bihar though literature was available on biomedical and geochemical studies. The need for research to understand social implications of arsenicosis, and inter connection with social life in the context of Bihar has also been realised. This rationale has been supported by a key person from the Mahaveer Cancer Institute, Patna during the field work who expressed the sad reality that no one wants to work in Bihar saying that *"no one wants to work in Bihar; scarcity of funding to attract the scholars is also one of the reasons for dearth of literature specially in the context of social science"* [Field Diary, 6th January 2018]. Many scholars have also pointed out the need to study social dimensions of arsenicosis in Bihar and suggested not to repeat the mistakes done in West Bengal (Saha, D., 2009). Vulnerability to toxicity increases in the state because of multiple metal contaminations, poor health status and poor socio-economic conditions of the state. This research has highlighted the importance of considering caste dynamics in rural areas of Bihar for a mitigations program.

5.1 Manifestation of Arsenicosis:

The World Health Organization (WHO) has defined chronic arsenicosis as a "chronic health condition arising from prolonged ingestion (not less than 6 months) of arsenic above a safe dose, usually manifested by characteristic skin lesions, with or without

involvement of internal organs" (WHO, 2003). My household survey data is showing 35 total arsenicosis affected individuals (3.65%) in the village whereas earlier study done by Singh, S. K., & Ghosh, A. K., (2012) is showing 2.3% has pigmentation on the body. This means that in a span of 6 years, cases of arsenicosis have increased about 1.3% in the village.[40] This is an alarming concern for the villager which should be taken into consideration for urgent intervention. The earlier study has shown the high hazard quotient and cancer risk (background study in chapter 1) and now my study has found 1 cancer patient and 3 deaths due to cancer in the village along with 2 cases of small hard round structure on hand and abdomen, that may be possible cases of skin cancer. Among these three cases of death one has confirmed that his relative had been told he has arsenic induced cancer. Another important aspect in manifestation of arsenicosis was that it was confined to skin pigmentation as earlier study found whereas my study has found 5 individuals affected with karatosis besides skin pigmentation in the village.

Manifestations in children have not been specially studied; however hazard quotient was highest among the children (Singh, S. K., & Ghosh, A. K., 2012) and now total 7 children between the age group of 5 to 15 years were found affected with arsenicosis. The prognosis done by study of Singh, S. K. and Ghosh, A. K. (2012) turned into clear manifestations of arsenicosis among the children in my study. All the case seen in the children were not severe but the hazard quotient measured in the previous study within 6 years manifested into arsenicosis that means severity may increase and other rare forms will be manifested among the children. A follow up study should be conducted every few years or a surveillance system set up in the affected villages to track the extent and nature of the problem, and to assess the effectiveness or gaps in preventive and mitigation measures instituted.

There is also a need of comparative research on severity, and disability across districts, specific locations within districts identified as affected and socio-economic sections to further understand the determinants and pathways by which chronic arsenicosis manifests itself. While the relationship with caste has been observed in the data, further examination of the links between caste and class and their relative influence on manifestation of arsenicosis needs to be studied.

[40] Sample size earlier study was 1556 however total 956 individual has been included in my survey in 130 households.

Preventive measures are needed to reduce the severity of affected children. For example at one point of time one child has skin pigmentation (arsenicosis), if arsenic contaminated water will be continued in his/her consumption or will exposed through different sources, he/she may develop cancer or keratosis or pigmentation in severer form.

5.2 Manifestation and Social Determinants:

The caste question in conceptual framework of this study has been analysed in this study as 5.44% (11) arsenicosis affected individuals belong to SC, 3.89% (9) to EBC, 2.57% (6) to BC and 3% (7) cases are from the 'others' category. Earlier studies have not discussed the caste angle in arsenicosis. Another important finding came into light through geographical angle linked to caste as well. Three clusters of arsenicosis were found at separate locations in the village. One first location where SCs are residing, second is concentrated with EBC (mostly *Mahato, Sao*) whereas *Rajput* and *Yadav* are living at third location. Caste factor is coming in both ways either through number of individuals affected or through geographical location. Socio-economic condition of four categories of caste has been mentioned in the third cluster where *Yadav* was found as most economically unequal caste group (with wide range of income groups within the caste) whereas SC and EBC has lower social and economic places in the hierarchy.

The manifestation of arsenicosis has also links with depth of hand pumps as finding is showing 78.79% of arsenicosis affected individuals are fetching water from hand pumps whose depth is below 125 ft and no case was found who are drinking water from the hand pump more than 125 ft of depth. The earlier study has found depth of hand pump between 85 ft to 150 ft in Haldi Chhapra village however recently, socio-economically better off households, in response to the arsenicosis problem have started installing bore well more than 250 ft of depth.

In the opinion of villagers, government should install few bore wells at different locations in deeper aquifer as it is not yet contaminated. However this was already recommended earlier by scholars even though the authorities and political leaders have not been able to provide for it. The policy process is in progress on paper but not on ground. There are 6 functional dug wells in the village and the households that

fetch water from dug wells have no arsenicosis. The study therefore also suggests that dug well water contains less toxic arsenic than ground water. There is need to study this further and reuse of dug wells may emerge as one mitigation measures.

The water filters that were installed by a civil society organisation were found to be located at one extreme end of the village and under the charge of one household of the upper caste. It was found that these were not accessible to any other household. Two others that had been installed in other locations in the village were out of order and not being maintained.

Health status of the villagers is also making it susceptible to arsenicosis as around 28% of individual in my survey have reported different kind of health issues. To curtail the arsenicosis manifestation other health issues should also be addressed means arsenic should not be addressed in isolation.

5.3 Social Implications:

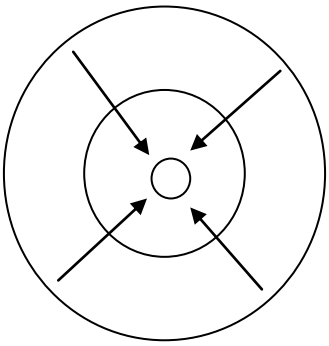
Arsenicosis affected individuals are facing social discrimination, isolation, problem in getting marriage proposal and they feel bad and embarrassed. However other people in the village maintain distance from affected individuals whereas it depends on severity of arsenicosis. One important aspect emerged in the village is the misunderstanding about arsenicosis as people mistakenly considered it as leprosy.

Gender and caste based implications has also been discovered. Male gender along with upper caste arsenicosis affected individuals are more vulnerable because upper caste is attached with the concept of purity however arsenicosis manifestation are understood as cosmic issue and disfigured individual. This becomes reason for upper caste male member finding it most difficult to getting marriage alliances. Lower caste people are also encountering with the marriage problem if someone has arsenicosis, although upper caste people has perception that this does not matter for them as lower caste are impure or lack humanness anyway.

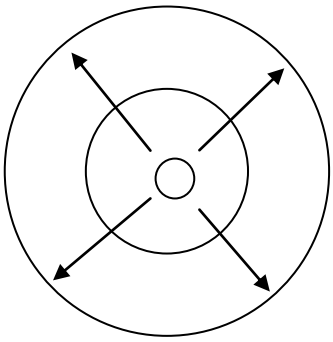
The social perception of the problem as an environmental problem leads to it being viewed primarily at the macro level as a village issue, then moves to family and finally to the affected individual. On the other hand, if it is viewed as a bio-medical

problem, it starts as an individual problem and then moves to meso level as a family issue and finally is seen as a macro issue at village level (see the figure).

Figure: 1 Representing the differences in perception from primacy to of a biomedical and an environmental perspective.



Representing the situation where the problem is viewed as an environmental problem, arsenicosis manifestation, they see first village (outer circle), then family (second circle) and then individual (inner circle).



Representing the situation where a bio-medical perspective is taken. They see first individual (inner circle), then family (second circle) and then village (outer circle),

While the number of affected households was small, analysing the social implications by the four types of households discussed in the conceptual framework it was found that all were facing some and or other kind of social implications. Despite there being no arsenicosis cases in the household, people faced problems as the contamination of ground water is a collective issue and stigmatized as arsenicosis affected village from viewpoint of those who are outsiders to the village. The children who did not have anyone with manifestations in the village also noted the problem of impure water and ill health due to it when they described their village in an essay competition used as participatory methodology in the study. A late number of households attempted to get water for domestic purposes from distant sources according to their perception of what were safe sources where the water was not contaminated.

In households where only adults have manifestation, though no significant impact was found on the children, in one case the father needed assistance to do agricultural work due to palmar keratosis and so one of his five children had to accompany him and this caused minor disruptions in their education.

In households where only children were affected, the influence was seen mainly on their social interaction with other children. The other children tended to shun their company and isolate them.

In households with both adults and children having manifestations, there was greater isolation of the children due to coming together of disruptions in daily routine and the social stigma.

5.4 Measures for Mitigation of the Problem

Periodic examination of water sources to identify the safe and contaminated ones, followed up with closing down the contaminated ones is an imperative. Further, as discussed above, either digging deeper bore wells or returning to use of dug wells could be other methods of limiting the exposure to arsenic contaminated water. Filters that eliminate soluble arsenic salt is a fourth measure. But probably the most primary will be to create systems for use of surface water and avoid use of ground water at all.

When any such measures are being installed it is important to ensure that all caste groups and households get access to the safe water in equal measure.

Finally, the affected persons will need medical and psychosocial support to mitigate the effects of the manifestations. But equally important seems to be the need to initiate activities in the village and in society at large that will decrease the stigma and reintegrate the affected children and adults as normal human beings in society. Wide mass media coverage is required to inform people about the water contamination and signs of manifestations, emphasizing that it is a non-infectious condition and does not spread from the affected to others. Schools must allow flexibility to the children with affected persons in their family because of which they may have to miss some attendance in school. The State government must work out a comprehensive program for control of arsenicosis with incorporation of all these elements of surveillance and mitigation of physical, economic, psychological and social effects.

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Appendix -1

Table: 1/A - Thematic Analysis of Essays, written by the children with code and important quotes from the essays

THEME →	**The Village**	**Occupation**	**Social Resources**	**Problem in Village**	**Ground Learning**	**Complacent**
CODE →	Bank of Ganga, Chaupal Culture, Cleaning Culture, Dhelwa Baba, Electricity, Farmer, Festival, Festival Prosperity,Festivity, Flood, Ganga, Green Field, Old Tree, Panchayat, Prosperity, Relatio n with Ganga, Religious Importance of Village, River Confluence, Social Coherence, Togetherness, Tree worship, Trees in village, Vehicle Culture, Village Attachment, Village Justice System, Village Prosperity, Village Role of the children	Agriculture Work, Boat Business, Cattle Raring, Farming, Irrigation, Medical Hall, Vegetable Production, Work on Boat	Panchayat Bhawan, Medical Hall, Play Ground, School, Sangam, Dharamshala, Temple	Alcoholism, Barriers, Broken Road, Children Lost, Water contamination, Death in Winter, Death due to Disease, Death due to Water Problem, Devastation of Tolas, Disease, Financial Burden, Flood Menace, Bank Erosion, Ganga Pollution, Garbage, Illegal Activities, Migration, Open Defecation, Small Drainage, Soil Pollution, Stagnant Water, Superstitions, Throw garbage in River, Violence on Women, Water Become Yellow	Hygiene Awareness, Medicine Doesn't' Work, Pollution Sources, Problem Prediction, Social Leaning, Social Prediction, Understanding of Development, Flood Response	Good House, Good Road, Good Water Arrangement, Honest People, No Scarcity of Water, No Shortage of Electricity, Pure Water, Trust on Leader, Village Happiness
Participant C-01	There is such a tree in my village where people worship.			The flood also comes here. That's why the water of hand pumps is polluted here and water are also yellow. Most of the houses of my village have no toilets. Most of the people goes to field for toilets.	We clean our village very well	
Participants C-02	There is a dhelwa baba in my village.			The road of my village is not good.		

Participants C-03	There is building in my village where panchayat happens. All innocent gets justice here.	In my village people do work on boat to run the family.	There is one playground in my village			We are happy with this village because everything and arrangements are good here. The water arrangement is good here in my village. The water is pure here. Water is drinkable.
Participants C-04	The people of my village sit on chaupal to talk to each other about happy and sorrow and other matters of their life.	Many people of my village rare the cattle.		...drainage water come out on road, work stop at many places. The people in my village do superstition.	This dirty water people uses in their houses. From which many kind of diseases happens. It should be stopped otherwise in future this problem will become bigger	
Participants C-05	The every house of my village has vehicle. The name of panchayat of my village is Kitta Chauhattar west.		There are five schools in my village. There are five medical halls in my village	People come here from far away in the kumbh mela. The children lost their way in the crowd.	We clean our village	
Participants					After few months when medicine doesn't work, they again go to the doctor and tell him that doctor sahib the medicine which you have prescribed is not working. And doctor says them that I am prescribing another medicine	
Participants C-08	We talk good and live together in my village.					
Participants C-12		Farming is the main work of my village		the soil pollution is high in my village and the people are creating pollution by throwing garbage here and there ...to run the family they go outside to work.		
Participants C-13				One bad addiction got into my village. That is to drink and sell alcohol.	Alcohol should be banned as soon as possible then only development will	

					happen.	
Participants C-14						
Participants B-01					If the water of my village would not be purified then many diseases can spread further.	
Participants B-02						
Participants B-03						
Participants B-04	Ganga river has met Son and Saryu		There are government and private school in my village	Seven tola of my village has devastated. Our village peoples goes outside of the village to earn money ex. Punjab, Hydrabad, Delhi etc.		
Participants A-01	·				There for use of pure water is necessary, if we use pure water then we get rid of these all diseases.	
Participants A-02				These days this river has polluted. The people who mostly bath in the Ganga, they also become prey of the disease.		

Table: 1/B - Thematic Analysis of Essay Writing with Code and Important Quotes

THEME →	**Arsenic in Village**	**Social Implications**	**Community Response**	**Water Caused Health Issue**	**Opinions**	**Government Apathy**
CODE →	Arsenic Consumption, Arsenic Contamination, Arsenic in Body, Manifestation of Arsenicosis, Arsenic Poisoning, Arsenic Menace, Chemical Reaction	Bully, Cloth Become Yellow, , Financial Burden, Glass Become Yellow, Social Discrimination, Social Distance, Utensil Become Yellow, Death Due to Water Problem, Financial Burden	Alternative Option, Ancient Water Source, Boil the Water, Community Response, Dug Well, Dug Well Importance, Dug well is better than Hand pump, Village Response, Water Purchase, Treatment, Treatment facility,	Gastric Issue, Health Effect of Ganga Bath, Health Issue, Physical Manifestation of Arsenicosis, Hair Fall, Itching, Physical Manifestation, Boils on Body, Skin Lesion, spot on Body, Spot on Face, Stomach Pain, Water Caused Disease, Yellow Teeth,	An Appeal, Doctors Confirmation, Opinion, Physician Response, Recommendations, Urgent Action Needed, Water Test,	Government Apathy, Lack of Health Services, No Mitigation Program, Pathetic Leaders Attitude, Political Trap, Politics on Arsenic, Politics on Water, Vote Strategy,
Participants C-01						
Participants C-02				Many disease spreads through water in my village.		
Participants C-03						
Participants C-04						
Participants C-05				The women of my village suffer a lot. The reason of this is disease.		
Participants		The poor villagers can't do anything and in financial crisis they devastate their life.				Often people from city come and tell the villagers that government is doing work on it, you give them vote, I will eradicate the water problem of the village
Participants						

C-08						
Participants C-12			When flood comes here, head of the village helps in the problem.			
Participants C-13	The Arsenic is high in the water of my village		That is why most of the people boils or filter the water to drink.	From which people are facing lots of problem. For example, itching, spots on body.	I believe this that the government should distribute a water filter machine or whatever in every house or in every ward	There is no facility to purify the water from the government side in my village.
Participants C- 14						
Participants B-01	The Arsenic is very high in the water of my village Haldi Chhapra, from which we drink then spread many diseases in our mouth.	If we wash vegetable, water become black, washing cloth, white cloth become yellow in few days.		The water is a big problem in my village Haldi Chhpara. Many diseases are spreading from this in my village. If we wash hair from this water, hair starts falling	We appeal to the government that treat the water of my village as soon as possible.	
Participants B-02						
Participants B-03						
Participants B-04				Most of the diseases spread from water in my village ex. Ring worm, itching, yellow teeth, and cloth become yellow etc.		
Participants A-01	We are seeing that the water available here has high quantity of Arsenic.			Due to contaminated water, the spot on face like disease spread and wound, boils happens.	When we go to the doctor to get treatment of these diseases, doctor says all these diseases are spreading due to contaminated water, use pure water. The arrangement of tap should be in every house hold and the water of that tap should be tested	

Participants A-02		Today's many people from our society are facing such disease that dies because of no treatment because they don't have money for the treatment.		The problem of dirty water effect on human health, some people die also.	To deal with this problem all people to should use water from well rather from hand pump.	

Appendix- 2

Household Survey Questionnaire

Questionnaire No.: ..... Date of Survey: .....

House Code: ..... Place (Tola/Village): .....

A. General Information about the Family

1. Name of the Informant(s): .....
2. Age: ..... 3. Sex: .....
4. Relation with Head of the Family: .....

5. Head of the family: .... 6. Age: .....…...
7. Sex: ..... 8. Religion: .....
9. Caste: ..... 10. Sub-caste/Sect (if applied): .....
11. No. of the family members: ..... 12. No. of Male members in the family: ……
13. No. of Female member in the family: ..... 14. Family Type: .....
15. How many children in the family (below the age of 15 years): .....
16. Monthly Income of the Family (from all sources).....
17. What are the sources of income: .....
18. How many members of the family are working: .....
19. Land holding of the family: .....

Family Profile (Table No. 1):

S.N.	Name	Age	Sex	Marital status	Education	Occupation	Health Issues (if any)	Relation with informant
1.								
2.								
3.								
4.								
5.								
6.								

B. Water Related Information

Tick ☑ mark the option wherever it applied. [Questionnaire related to water]

1. What is the source of water? (Tick more than one option if family uses more than one source).
   - A. Water tap ( )
   - B. Hand pump ( )
   - C. Rain water ( )
   - D. River ( )
   - D. Pond ( )
   - E. Water well ( )
   - F. ..... (mention if any other)

2. Do you find that water is fit for drinking? Yes ( ) No ( )

3. If no then what is the other source of drinking water?
   - A. Water Tap ( )
   - B. Hand Pump ( )
   - C. River ( )
   - D. Water well ( )
   - E. Pond ( )
   - F. ..... (mention if other than above option)

4. Is it owned by the family Yes ( ) No ( )

5. If yes (refer to question no. 4) what is the level of hand pump/tube well in the ground?
   - A. Less than 100 ft ( )
   - B. Between 100ft to 125 ft ( )
   - C. Between 125 ft to 150 ft ( )
   - D. More than 150 ft ( )

6. If no (refer to question no.4) who own the source of water?
   - A. Relative ( )
   - B. Government ( )
   - C. Neighbour ( )
   - D. Community ( )

7. If no (refer to question no. 4) then how far is the source of water?
   - A. Less than 100 meter ( )
   - B. Less than 1 km. ( )
   - C. Less than 500 meter ( )
   - D. More than 1 km ( )

8. Who usually fetch the water in the family

A. Male member ( ) B. Female member ( ) C. Both ( )

9. Do you purify the water before drinking?
   Yes ( ) No ( )

10. If yes then how you purify the water?
    A. Use personal water filter ( ) C. Boil the water before use ( )
    B. Use traditional method to purify the water ( ) D. . . . . .
    (Mention if any other).

11. Do you know about the water filter installed in the village? Yes ( ) No ( )

12. What is your opinion about it and how it has worked?
    ……
    ……

13. Do you use water filter that has been installed in the village? Yes ( ) No ( )

14. If yes then how frequent they use the water filter?
    A. Daily as per the need ( ) C. Usually ( )
    B. Daily as per the convenience to fetch the water ( ) D. Sometimes ( )

15. If no (refer to question no. 13) then what is the reason behind not using the water filter?
    A. Far away from the house ( )
    B. Due to lack of human resource to fetch the water ( )
    C. Restriction due to caste ( )
    D. Restriction due to the landowner where the water filter is installed ( )
    E. Do not think of any value ( )
    F. .....(mention if any other)

16. Do you know Arsenic contamination of water in the village? Yes ( )No ( )

17. Do you know the harmful effect of contaminated water? Yes ( ) No ( )

18. Do you know the arsenic content in the water that you consume? Yes ( )No ( )

C. Information Regarding Arsenic Related Health Issues

[Questionnaire for Arsenic related health issues]

1. What kind of health issue is the family facing due to arsenic content in the drinking water? (by the perspective of informants if they can list down)
   A. .....
   B. .....
   C. .....
   D. ……

2. If there are any health issue has been informed (other than above in the Table No.1) related to arsenic then what could be reason?
   A. Arsenic content in the water ( )
   B. Don't know about the arsenic but contaminated water ( )
   C. Don't know the reason ( )
   D. May be water ( )
   E. .....

3. Are these health issues creating any other (social, family level, economical, educational) problem in the family?
   ……
   …….....

Arsenicosis Profile of the Family (Table No. 2):

S.N.	Name	Age	Sex	Mode of identification (diagnosed by physician with or without prescription, patient compliant, physical symptoms seen by researcher)	Symptoms with affected body parts	Treated or untreated
1.						
2.						
3.						
4.						
5.						
6.						

If Adult member then (refer to Table No. 2)

4. Is the affected adult family member able to work? Yes ( ) No ( ) Partial ( ) any other ( )

5. Is that body part functioning properly? Yes ( ) No ( ) Partial ( ) Any other ( )

6. Is that affecting any child in your family? Yes ( ) No ( )

7. How is affecting child due to adult member's manifestation?
   .....
   .....
   .....

If child member (below the age of 15) of family (refer to question no. 3)

8. Is/are that child/children going to school? Yes ( ) No ( )

9. If no then why not?

   .....

   .....

10. Is that body part functioning properly? Yes ( ) No ( ) Partial ( ) Any other ( )

11. How is affecting the child due to his own manifestation?

    .....

    .....

Sign and symptoms of Chronic Arsenic (Manifestation) (Table No. 3)

Common Manifestation	**Total No. individuals affected**	**Male adult member**	**Female adult member**	**Male child (below the age of 15 years)**	**Female child (below the age of 15years)**
Skin lesion					
Skin pigmentation					
Hard patches on palm					
Hard patches on sole					
Rare Manifestation					
Any one got cancer					
Any one has obstetric disorder					
Any pregnancy loss in the family					

Appendix- 3

Interview Schedule

Name of the informant: …….. Age: …… Sex: ……

Marital status: …….Relation with the children: ……

A. General Profile of the children

Name: …… Age: ……...

Sex: ……. Class: …… Currently regular to school or not: …….

Name of Institution with address: ……..…….....

……
…

Residential address: ……

……
….

Religion: …… Cast: …… Sub-caste: ……...

B. Family Profile:

No. of Family Members: …… Type of family: ……

Income of the family through all sources: …….

No. of sisters: …… No. of brothers: ……..

Position of the children in the family: …….…….....

Father Name: …….. Occupation: …….

Qualification: ……

Mother Name: ……. Occupation: ……

Qualification: ……....

C. Health Profile

Any health issue (other than arsenic related): ……..……

What are the common manifestation of arsenic complaints by the child: ……..

Is the child diagnosed by the physicians? Yes ( ) No ( )

What was the diagnosis? ……

When was diagnosed? ……

Who has diagnosed? ……

What was the affect of the treatment? ……..

Any health issue in the past: ……

Treatment history: ……

……..

…….

INTERVIEW SCHEDULE (Semi-structured interview)

For Parents/family member

1. When did you come to know that child has arsenic health issue?
2. What were the initial symptoms?
3. How did you deal with the problem?

4. Before and after the Arsenicosis, did you find any changes in the social life of the child?
5. How does their peer group interact with him/her? Did you find any changes?
6. Did he/she any complaint about any discriminatory actions in the schools or in his/her daily life?
7. Gap in educational career and reasons behind it?
8. About the school life (how is school infrastructure, how much distance, mode travelling)
9. What is child's daily routine?
10. Tell me about your neighbor whom you interact in daily life? (their class, cast and gender).
11. How is your social interaction with your neighbors (social process: co-operation, conflict, competition etc), is there any changes in interaction due to arsenic manifestation in your child or you or your family member?

12. Who are the close friends of child in the village and in the school (their socio-economic profile)?
13. How is family treated in the village?
14. How families treat the child?
15. If the adult family member has dermal manifestation on palm or on sole, how their life is influenced?
16. Disability (personal care, loco motor, gripping) and labour issues?
17. How is this affecting the family?
18. How is your being affected because of Arsenicosis in the village?
19. How is affecting the child due to his own manifestation?
20. How does it influence your daily life?

Interaction with the child

1. Tell me about your favorite game?
2. Who are your best friends?
3. How they treat you before and after the dermal manifestation?

4. How is school teacher interact and friends interact you, did you find any changes?
5. How is school life and class environment?
6. Does anyone hate you or discriminate you and what could be the reason behind this?
7. How is your neighbor interacting with you?
8. Personal perception

Interview Schedule for the key informants

Name of the informants: ……..

Age: ……. Sex: …… Marital Status: ……..……

Designation: ……..…… Education Qualification: ……..

Occupation: ……..

Residential address: ……...……..

1. How he/she knows about the village?
2. What he or she knows about the Arsenicosis
3. What is quality of water that villagers consume?
4. What are the problems villagers facing due to contaminated water?
5. What are the health services available for the treatment of the general health issue and Arsenic related health issues?
6. What are the community reactions/actions for the problem?
7. How the communities treat the individual who has arsenic related health issues?
8. Is there any other social problem related arsenicosis?

Appendix- 4

Photo Story

Photograph 2

Photograph 1

These two photographs (1 and 2) are showing signboard of clinic of skin diseases. This kind of advertisement can be seen in the village on wall and electric pole. Even local doctor also mention skin diseases treatment facility in signboard.

Photograph 3

Photograph 4

Photographs 3 is a bottle water I took from a hand pump just to check for its turbidity and time period of changing colour as villagers were saying water become yellow. Within five minutes water changed to this colour. Second photograph (4) is utensil which becomes dirty and it feels bad to use this pot for cooking food.

Photograph 6

Photograph 5

Photographs 5 and 6 are options applied to purify the water. First photographs is to reduce particles in water whereas second photograph is made to purify water through using three layer of sand, charcoal and stone in the container.

Photograph 7

Photograph 8

These two photographs 7 is showing non-functional water filter near a temple in Nayka Tola whereas a water filter (entangled in bushes) and *hathikaul* attached to restructured dug well. This kind of restructuring has happened in village after realizing that dug well can better option however only 6 dug well are functioning.

Appendix -5

List of Castes in Bihar

पत्र संख्या-11/आ॰ 2-आ॰ नि॰-08/2006का॰ 225 /

बिहार सरकार,
कार्मिक एवं प्रशासनिक सुधार विभाग

प्रेषक,

तरुण प्रसाद,
सरकार के उप सचिव ।

सेवा में,

सभी आयुक्त एवं सचिव/सचिव
अध्यक्ष, लोक उद्यम ब्यूरो,
सभी प्रमण्डलीय आयुक्त
सभी विश्वविद्यालयों के कुलपति
सभी जिला पदाधिकारी
सचिव, बिहार लोक सेवा आयोग, पटना
परीक्षा नियंत्रक,
बिहार संयुक्त प्रवेश प्रतियोगिता परीक्षा पर्षद
सचिव, कर्मचारी चयन आयोग, पटना ।
सदस्य सचिव, पिछड़े वर्गों के लिए राज्य आयोग, पटना ।
निबंधक, सहकारिता, बिहार का कार्यालय
उच्च न्यायालय, पटना ।

पटना-15, दिनांक 16 जनवरी, 2007.

विषय:- उत्तरवर्त्ती बिहार हेतु अनुसूचित जाति एवं अनुसूचित जनजाति की समेकित सूची का सम्प्रेषण ।

महोदय,

निदेशानुसार उपर्युक्त विषय के संबंध में कहना है कि भारत का राजपत्र, अनुसूचित जाति एवं अनुसूचित जनजाति आदेश (संशोधन) अधिनियम-1976 (सं0-108/1976) दिनांक 18.9.1976 द्वारा बिहार हेतु अनुसूचित जाति एवं अनुसूचित जनजाति की सूची प्रकाशित की गई । भारत का राजपत्र, बिहार पुनर्गठन अधिनियम-2000 (सं0-30/2000) दिनांक 25.8.2000 द्वारा उत्तरवर्त्ती बिहार हेतु उक्त सूची को संशोधित किया गया । पुनः भारत का राजपत्र, अनुसूचित जाति एवं अनुसूचित जनजाति आदेश (संशोधन) अधिनियम-2002 (सं0-10/2003), दिनांक 7.1.2003 द्वारा उक्त सूची को संशोधित किया गया । उपर्युक्त तीनों अधिनियमों के आलोक में उत्तरवर्त्ती बिहार हेतु अनुसूचित जाति एवं अनुसूचित जनजाति की समेकित सूची प्रचारित की जा रही है ।

2. अनुरोध है कि इसे अधीनस्थ कार्यालयों/पदाधिकारियों के बीच परिचारित कर दिया जाय ताकि संबंधित व्यक्तियों को जाति प्रमाण पत्र प्राप्त करने में कोई असुविधा न हो । परन्तु किसी जाति विशेष के संबंध में संदेह होने पर मूल अधिनियम की प्रविष्टि को संदर्भ किया जाय ।

अनु0-यथोक्त ।

विश्वासभाजन,
15/1/07
सरकार के उप सचिव ।

List of Scheduled Castes for Bihar.

Serial No.	Name of Caste	Notified vide the scheduled castes and scheduled tribes orders(Amendment)Act---
(1)	Bantar	Act-1976 (No. 108/1976)
(2)	Bauri	Act-1976 (No. 108/1976)
(3)	Bhogta	Act-1976 (No. 108/1976)
(4)	Bhuiya	Act-1976 (No. 108/1976)
(5)	Deleted [Bhumij(excluding North Chotanagpur and South Chotanagpur divisions and Santal Parganas district)]	The Bihar Re-organisation Act-2000 (No. 30/2000)
(6)	Chamar, Mochi	Act-1976 (No. 108/1976)
(7)	Chaupal	Act-1976 (No. 108/1976)
(8)	Dabgar	Act-1976 (No. 108/1976)
(9)	Dhobi	Act-1976 (No. 108/1976)
(10)	Dom, Dhangad	Act-1976 (No. 108/1976)
(11)	Dusadh, Dhari, Dharhi	Act-1976 (No. 108/1976)
(12)	Ghasi	Act-1976 (No. 108/1976)
(13)	Halalkhor	Act-1976 (No. 108/1976)
(14)	Hari, Mehtar, Bhangi	Act-1976 (No. 108/1976)
(15)	Kanjar	Act-1976 (No. 108/1976)
(16)	Kurariar	Act-1976 (No. 108/1976)
(17)	Lalbegi	Act-1976 (No. 108/1976)
(18)	Musahar	Act-1976 (No. 108/1976)
(19)	Nat	Act-1976 (No. 108/1976)
(20)	Pan, Sawasi	Act-1976 (No. 108/1976)
(21)	Pasi	Act-1976 (No. 108/1976)
(22)	Rajwar	Act-1976 (No. 108/1976)
(23)	Turi	Act-1976 (No. 108/1976)

List of Scheduled Tribes for Bihar

Serial No.	Name of Caste	Notified vide the scheduled castes and scheduled tribes orders(Amendment)Act--
(1)	Asur, Agaria	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003)
(2)	Baiga	Act-1976 (No. 108/1976)
(3)	Banjara	Act-1976 (No. 108/1976)
(4)	Bathudi	Act-1976 (No. 108/1976)
(5)	Bedia	Act-1976 (No. 108/1976)
(6)	Deleted [Bhumij(In North Chotanagpur and South Chotanagpur divisions and Santal Parganas districts)]	The Bihar Re-organisation Act-2000 (No. 30/2000)
(7)	Binjhia	Act-1976 (No. 108/1976)
(8)	Birhor	Act-1976 (No. 108/1976)
(9)	Birjia	Act-1976 (No. 108/1976)
(10)	Chero	Act-1976 (No. 108/1976)
(11)	Chik Baraik	Act-1976 (No. 108/1976)
(12)	Gond	Act-1976 (No. 108/1976)
(13)	Gorait	Act-1976 (No. 108/1976)
(14)	Ho	Act-1976 (No. 108/1976)
(15)	Karmali	Act-1976 (No. 108/1976)
(16)	Kharia, Dhelki Kharia, Dudh Kharia, Hill Kharia	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003) Act-2002 (No. 10/2003) Act-2002 (No. 10/2003)
(17)	Kharwar	Act-1976 (No. 108/1976)
(18)	Khond	Act-1976 (No. 108/1976)
(19)	Kisan, Nagesia	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003)
(20)	Kora, Mudi-kora	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003)
(21)	Korwa	Act-1976 (No. 108/1976)
(22)	Lohara, Lohra	Act-1976 (No. 108/1976)
(23)	Mahli	Act-1976 (No. 108/1976)
(24)	Mal Paharia, Kumarbhag Paharia	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003)
(25)	Munda,	Act-1976 (No. 108/1976)

	Patar	Act-2002 (No. 10/2003)
(26)	Oraon, Dhangar (Oraon)	Act-1976 (No. 108/1976) Act-2002 (No. 10/2003)
(27)	Parhaiya	Act-1976 (No. 108/1976)
(28)	Santal	Act-1976 (No. 108/1976)
(29)	Sauria Paharia	Act-1976 (No. 108/1976)
(30)	Savar	Act-1976 (No. 108/1976)
(31)	Kawar	Act-2002 (No. 10/2003)
(32)	Kol	Act-2002 (No. 10/2003)
(33)	Tharu	Act-2002 (No. 10/2003)

पत्र संख्या–11/वि0–2–पि0व0आ0–6/2005 सा0प्र0 13623

बिहार सरकार

सामान्य प्रशासन विभाग

प्रेषक,

राजेन्द्र राम,
सरकार के अपर सचिव।

सेवा में,

सभी प्रधान सचिव/सचिव।
सभी प्रमण्डलीय आयुक्त।
सभी जिला पदाधिकारी।
सचिव, बिहार लोक सेवा आयोग, पटना।
सचिव, कर्मचारी चयन आयोग, पटना।
परीक्षा नियंत्रक, बिहार संयुक्त प्रवेश प्रतियोगिता परीक्षा पर्षद, पटना।
सचिव, केन्द्रीय चयन पर्षद (सिपाही भर्ती), पटना।
सदस्य सचिव, पिछड़े वर्गो के लिए राज्य आयोग, पटना।
सचिव, अति पिछड़े वर्गो के लिए राज्य आयोग, बिहार, पटना।

पटना–15, दिनांक 10-9-15

विषय :– **बिहार पदों एवं सेवाओं की रिक्तियों में आरक्षण (अनुसूचित जातियों/अनुसूचित जनजातियों एवं अन्य पिछड़े वर्गों के लिए) (अधिनियम–1991) बिहार अधिनियम–3/1992 की अत्यंत पिछड़े वर्गों की सूची (अनुसूची–1) एवं पिछड़े वर्गों की सूची (अनुसूची–2) का सम्प्रेषण।**

महोदय,

निदेशानुसार उपर्युक्त विषय के संबंध में कहना है कि सामान्य प्रशासन विभाग, बिहार, पटना के परिपत्र संख्या–10398 दिनांक–30.07.2015 द्वारा राज्य के अत्यन्त पिछड़े वर्गों एवं पिछड़े वर्गों की सूची परिचालित की गई है। कालक्रम से बिहार अधिनियम–3/1992 में अधिसूचित अत्यन्त पिछड़े वर्गों एवं पिछड़े वर्गों की सूची में संशोधन किया जाता रहा है, जिसे जन साधारण की जानकारी के लिए पुनः परिचालित किये जाने की आवश्यकता महसूस की गई है।

2. उक्त परिप्रेक्ष्य में बिहार अधिनियम–3, 1992 के अन्तर्गत अत्यंत पिछड़े वर्गों की सूची (अनुसूची–1) एवं पिछड़े वर्गों की सूची (अनुसूची–2) की अद्यतन सूची सुलभ प्रसंग हेतु प्रेषित की जा रही है।

3. अनुरोध है कि इसे अधीनस्थ कार्यालयों/पदाधिकारियों के बीच परिचालित कर दिया जाय, ताकि संबंधित व्यक्तियों को जाति प्रमाण पत्र प्राप्त करने में कोई असुविधा न हो। परन्तु किसी जाति विशेष के संबंध में संदेह होने पर मूल अधिनियम एवं संकल्प की प्रविष्टि का संदर्भ लिया जाए।

अनु0–यथोक्त।

विश्वासभाजन

(राजेन्द्र राम)
सरकार के अपर सचिव।

ज्ञापांक:–11/वि0–2–पि0व0आ0–6/2005 सा0प्र0 13623 / पटना–15, दिनांक 10-9-15

प्रतिलिपि–अनुलग्नक की प्रति सहित आई0टी0 मैनेजर, सामान्य प्रशासन विभाग, को विभागीय वेब साईट पर अपलोड करने हेतु प्रेषित।

(2) प्रभारी पदाधिकारी, बिहार प्रशासनिक सुधार मिशन सोसाईटी, बिहार, पटना को "अधिकार" सॉफ्टवेयर पर अपलोड करने हेतु प्रेषित।

सरकार के अपर सचिव।

FILE PATH :D/DHARMRAJ-BC/MBC LIST

ज्ञापांक–11 / वि0–2–पि0व0आ0–6 / 2005 सा0प्र0.13623.पटना–15, दिनांक– 10.09.15

प्रतिलिपि– अधीक्षक, राजकीय मुद्रणालय, गुलजारबाग, बिहार, पटना को बिहार गजट के आगामी असाधारण अंक में प्रकाशनार्थ प्रेषित। अनुरोध है कि इसकी 200 मुद्रित प्रतियाँ सामान्य प्रशासन विभाग को उपलब्ध करायी जाय।

10.9.2015

सरकार के अपर सचिव।

FILE PATH:-D/CHARMRAJ- BC/MBC LIST

अत्यन्त पिछड़े वर्गों की सूची
(अनुसूची–1)

1	कपरिया	1	Kapadia
2	कानू / (विलोपित)	2	Kanu / (Deleted)
3	(विलोपित)	3	(Deleted)
4	कलन्दर	4	Kalandar
5	कोछ	5	Kochh
6	कुर्मी (महतो) झारखंड स्वशासी क्षेत्र	6	Kurmi (Mahto) (Jharkhand autonomous area)
7	केवट (कउट)	7	Kewat (Kaut)
8	कादर	8	Kadar
9	कोरा	9	Kaura
10	कोरकू	10	Korku
11	केवर्त	11	Kaibart
12	(विलोपित)	12	(Deleted)
13	खटवा	13	Khatwa
14	(विलोपित)	14	(Deleted)
15	खतौरी	15	Khatouri
16	खंगर	16	Khangar
17	खटिक	17	Khatik
18	खेलटा	18	Khelta
19	(विलोपित)	19	(Deleted)
20	(विलोपित)	20	(Deleted)
21	गोड़ी (छावी)	21	Gorhi (Chhabi)
22	गंगई (गणेश)	22	Gangai (Ganesh)
23	गंगोता	23	Gangota
24	(विलोपित)	24	(Deleted)
25	गंधर्व	25	Gandharb
26	गुलगुलिया	26	Gulgulia
27	(विलोपित)	27	(Deleted)
28	चांय	28	Chain
29	चपोता	29	Chapota
30	चन्द्रवंशी (कहार, कमकर)	30	Chandrabansi (Kahar, Kamkar)
31	टिकुलहार	31	Tikulhar
32	ढेकारू	32	Dhekaru
33	(विलोपित)	33	(Deleted)
34	तमरिया	34	Tamaria
35	तुरहा	35	Turha
36	तियर	36	Tiar
37	(विलोपित)	37	(Deleted)
38	धानुक	38	Dhanuk
39	धामिन	39	Dhamin
40	धीमर	40	Dhimar
41	धनवार	41	Dhanwar

FILE PATH - D/DHARMRAJ/ BC/MBC LIST

42	नोनिया	42	Nonia
43	(विलोपित)	43	(Deleted)
44	नाई	44	Nai
45	नामशुद्र	45	Namsudar
46	पाण्डी	46	Pandi
47	पाल (भेड़िहार, गड़ेरी)	47	Pal (Bherihar, Gareri)
48	प्रधान	48	Pradhan
49	पिनगनिया	49	Pingania
50	पहिरा	50	Pahira
51	वारी	51	Bari
52	बेलदार	52	Beldar
53	बिन्द	53	Bind
54	(विलोपित)	54	(Deleted)
55	सेखड़ा	55	Shekhra
56	बागदी	56	Bagdi
57	भुईयार	57	Bhuiyar
58	भार	58	Bhar
59	(विलोपित)	59	(Deleted)
60	भास्कर	60	Bhaskar
61	माली (मालाकार)	61	Mali (Malakar)
62	मांगर	62	Mangar
63	मदार	63	Madar
64	मल्लाह	64	Mallah
65	मझवार	65	Majhwar
66	मारकन्डे	66	Markandey
67	मोरियारी	67	Moriyari
68	मलार (मालहोर)	68	Malar (Malhor)
69	मौलिक	69	Molik
70	राजधोबी	70	Rajdhobi
71	राजभर	71	Rajbhar
72	रंगवा	72	Rangwa
73	वनपर	73	Banpar
74	(विलोपित)	74	(Deleted)
75	सौटा (सोता)	75	Shota (Shota)
76	संतराश (केवल नवादा जिले के लिए)	76	Sang-Trash (for Nawada district only)
77	(विलोपित)	77	(Deleted)
78	अघोरी	78	Aghouri
79	अबदल	79	Abdal
80	कसाब (कसाई) (मुस्लिम)	80	Kasab (Kasai)(Muslim)
81	चीक (मुस्लिम)	81	Chik (Muslim)
82	डफाली (मुस्लिम)	82	Dafali (Muslim)
83	धुनिया (मुस्लिम)	83	Dhunia (Muslim)
84	धोबी (मुस्लिम)	84	Dhobi (Muslim)
85	नट (मुस्लिम)	85	Nut (Muslim)

FILE PATH:-D/DHARMRAJ-BC/MBC LIST

86	पमरिया (मुस्लिम)	86	Pamaria (Muslim)
87	भठियारा (मुस्लिम)	87	Bhathiara (Muslim)
88	भाट (मुस्लिम)	88	Bhat (Muslim)
89	मेहतर, लालबेगीया, हलालखोर, भंगी (मुस्लिम)	89	Mehtar, Lalbegia, Halalkhor, Bhangi (Muslim)
90	मिरियासीन (मुस्लिम)	90	Miriasin (Muslim)
91	मदारी (मुस्लिम)	91	Madari (Muslim)
92	मोरशिकार (मुस्लिम)	92	Meershikar (Muslim)
93	साई / फकीर / दिवान / मदार (मुस्लिम)	93	Saeen/Fakir/Diwan/Madar (Muslim)
94	मोमिन (मुस्लिम) (जुलाहा / अंसारी)	94	Momin (Muslim)(Julaha/Ansari)
95	अमात	95	Amat
96	चुड़ीहार (मुस्लिम)	96	Churihar (Muslim)
97	प्रजापति (कुम्हार)	97	Prajapati (Kumhar)
98	राईन या कुंजरा (मुस्लिम)	98	Raeen or Kunjara (Muslim)
99	सोयर	99	Soyar
100	ठकुराई (मुस्लिम)	100	Thakurai (Muslim)
101	नागर	101	Nagar
102	शेरशाहबादी	102	Shershahbadi
103	बक्खो (मुस्लिम)	103	Bakkho (Muslim)
104	अदरखी	104	Adrakhi
105	छीपी	105	Chhipi
106	तिली	106	Tili
107	इदरीसी या दर्जी (मुस्लिम)	107	Idrisi or Darji (Muslim)
108	सैकलगर (सिकलगर) (मुस्लिम)	108	Saikalgar (Sikalgar) (Muslim)
109	रंगरेज (मुस्लिम)	109	Rangrej (Muslim)
110	सिंदुरिया बनिया / कैथल वैश्य / कथबनिया	110	Sinduria Bania / Kaithal Vaishya / Kath Bania
111	मुकेरी (मुस्लिम)	111	Mukeri (Muslim)
112	ईटफरोश / ईटाफरोश / गदहेड़ी / ईटपज इब्राहिमी (मुस्लिम)	112	Itfarosh/Itafarosh/Gadheri/Itpaj Ibrahimi (Muslim)
113	बढ़ई	113	Barhi
114	पटवा	114	Patwa
115	कमार (लोहार और कर्मकार)	115	Kamar (Lohar & Karmkar)
116	देवहार	116	Dewhar
117	सामरी वैश्य	117	Samari Vaishya
118	हलुवाई	118	Haluwai
119	पैरघा / परिहार	119	Pairagha / Parihar
120	जागा	120	Jaga
121	लहेड़ी	121	Laheri
122	राजवंशी (रिसिया / देशिया या पोलिया)	122	Rajbanshi (Risia / Deshiya or Polia)
123	कुल्हैया	123	Kulhaiya
124	अवध बनिया	124	Awadh Bania
125	बरई, तमोली (चौरसिया)	125	Barai,Tamoli (Chaurasia)
126	तेली	126	Teli
127	दांगी	127	Dangi

नोटः–उन जातियों तथा वर्गों को जिन्हें मुस्लिम नहीं लिखा गया है, हिन्दु तथा मुस्लिम दोनों जातियों को समझना चाहिए, जैसे तेली में दोनों :–हिन्दु तथा मुसलमान तेली।

2. बिहार पदों एवं सेवाओं की रिक्तियों में आरक्षण (अनुसूचित जातियों/अनुसूचित जनजातियों एवं अन्य पिछड़े वर्गों के लिए) (अधिनियम–1991) बिहार अधिनियम–3/1992) के अत्यंत पिछड़े वर्गों की सूची (अनुसूची–1) में जिन जातियों/वर्गों का समावेशन/विलोपन किया गया है, उसका विवरण निम्नांकित हैः–

सूची क्रमांक	जाति का नाम	अधिनियम/संकल्प संख्या
2	'कानू' के साथ 'कानू/हलवाई' के रूप में शामिल किया गया।	संकल्प संख्या–1169, दिनांक–25.03.2010
6	कुर्मी (महतो) केवल छोटानागपुर डिविजन के लिए विलोपित कर कुर्मी (महतो) झारखंड स्वाशासी क्षेत्र अंकित किया गया।	संकल्प संख्या–110, दिनांक–24.07.1997
19	खतवे (विलोपित)	संकल्प संख्या–17891, दिनांक–28.12.2012
22	गंगाई (नगेश) के स्थान पर गंगई (गणेश)	संकल्प संख्या–2836, दिनांक–21.08.2007
24	विलोपित (गोड़/गोंड़) (Gour/Gonr)	संकल्प संख्या–695, दिनांक–28.02.2007
27	विलोपित (गौड़) (Gour)	संकल्प संख्या–695, दिनांक–28.02.2007
30	कमकर	संकल्प संख्या–8, दिनांक–08.01.2004
33	तांती (ततवा) (विलोपित)	संकल्प संख्या–9532, दिनांक–01.07.2015
43	नइया (विलोपित)	संकल्प संख्या–6135, दिनांक–22.04.2015
64	(सुरहिया) (विलोपित)	संकल्प संख्या–653, दिनांक–22.02.2007
93	फकीर, दिवान, मदार (मुस्लिम)	संकल्प संख्या–97, दिनांक–03.03.2003
94	जुलाहा/अंसारी	संकल्प संख्या–432, दिनांक–16.09.2002
95	अमात	बिहार अधिनियम–6/1996
96	चुड़ीहार (मुस्लिम)	बिहार अधिनियम–6/1996
97	प्रजापति (कुम्हार)	बिहार अधिनियम–6/1996
98	राईन या कुंजरा (मुस्लिम)	बिहार अधिनियम–6/1996
99	सोयर	बिहार अधिनियम–6/1996
100	ठकुराई (मुस्लिम)	संकल्प संख्या–178, दिनांक–18.12.1995
101	नागर	संकल्प संख्या–135, दिनांक–04.09.1996
102	शेरशाहबादी	संकल्प संख्या–135, दिनांक–04.09.1996
103	बक्खो (मुस्लिम)	संकल्प संख्या–183, दिनांक–27.11.1996
104	अदरखी	संकल्प संख्या–183, दिनांक–27.11.1996
105	छीपी	संकल्प संख्या–183, दिनांक–27.11.1996
106	तिली	संकल्प संख्या–109, दिनांक–24.07.1997
107	इदरीशी या दर्जी (मुस्लिम)	संकल्प संख्या–34, दिनांक–17.03.1998

FILE PATH:-D/DHARMRAJ-BC/MBC LIST

108	सैकलगर (सिकलगर) मुस्लिम	संकल्प संख्या–165, दिनांक–20.12.1997
109	रंगरेज (मुस्लिम)	संकल्प संख्या–211, दिनांक–10.04.2001
110	सिन्दुरिया बनिया	संकल्प संख्या–129, दिनांक–02.04.2002
110	कैथल वैश्य/कथबनिया	संकल्प संख्या–5617, दिनांक–05.04.2013
111	मुकेरी (मुस्लिम)	संकल्प संख्या–673, दिनांक–23.11.2001
112	ईटफरोश/ईटाफरोश/गदहेड़ी इटपज इब्राहिमी (मुस्लिम)	संकल्प संख्या–499, दिनांक–16.10.2003
113	बढ़ई	संकल्प संख्या–2844, दिनांक–12.06.2009
114	पटवा	संकल्प संख्या–2845, दिनांक–12.06.2009
115	कमार (लोहार और कर्मकार)	संकल्प संख्या–1170, दिनांक–25.03.2010
116	देवहार	संकल्प संख्या–2413, दिनांक–21.06.2010
117	सामरी वैश्य	संकल्प संख्या–3799, दिनांक–15.12.2011
118	हलुवाई	संकल्प संख्या–7920, दिनांक–20.05.2013
119	पैरघा/परिहार	संकल्प संख्या–19314, दिनांक–20.12.2013
120	जागा	संकल्प संख्या–19316, दिनांक–20.12.2013
121	लहेड़ी	संकल्प संख्या–19313, दिनांक–20.12.2013
122	राजवंशी (रिसिया/देशिया या पोलिया)	संकल्प संख्या–2655, दिनांक–24.02.2014
123	कुल्हैया	संकल्प संख्या–2654, दिनांक–24.02.2014
124	अवध बनिया	संकल्प संख्या–15308, दिनांक–10.11.2014
125	बरई, तमोली (चौरसिया)	संकल्प संख्या–6136, दिनांक–22.04.2015
126	तेली	संकल्प संख्या–6137, दिनांक–22.04.2015
127	दागी	संकल्प संख्या–9533, दिनांक–01.07.2015

नोटः– बिहार पदों एवं सेवाओं की रिक्तियों में आरक्षण (अनुसूचित जातियों/अनुसूचित जनजातियों एवं अन्य पिछड़े वर्गों के लिए) अधिनियम–1991 (बिहार अधिनियम–3/1992) के अत्यंत पिछड़े वर्गों की सूची (अनुसूची–1) के क्रमांक–3, 12, 14, 20, 37, 54, 59, 74, 77 पर अंकित जातियों को भारत सरकार द्वारा अनुसूचित जाति/अनुसूचित जनजाति की सूची में सम्मिलित किये जाने के फलस्वरूप स्वतः विलोपित समझे जायेंगे।

FILE PATH:-D/DHARMRAJ-BC/MBC LIST

पिछड़े वर्गो की सूची
(अनुसूची–2)

1	(विलोपित)	1	(Deleted)
2	कागजी	2	Kagji
3	(विलोपित)	3	(Deleted)
4	कुशवाहा (कोईरी)	4	Kushwaha (Koiri)
5	कोस्ता	5	Kosta
6	गद्दी	6	Gaddi
7	घटवार	7	Ghatwar
8	(विलोपित)	8	(Deleted)
9	चनउ	9	Chanau
10	जदुपतिया	10	Jadupatia
11	जोगी (जुगी)	11	Jogi (Jugi)
12	(विलोपित)	12	(Deleted)
13	(विलोपित)	13	(Deleted)
14	(विलोपित)	14	(Deleted)
15	नालबंद (मुस्लिम)	15	Nalband (Muslim)
16	(विलोपित)	16	(Deleted)
17	परथा	17	Partha
18	(विलोपित)	18	(Deleted)
19	(विलोपित)	19	(Deleted)
20	बनिया–(सूढ़ी, मोदक / मायरा, रोनियार, पनसारी, मोदी, कसेरा, केशरवानी, ठठेरा, कलवार (कलाल / एराकी), (वियाहुत कलवार), कमलापुरी वैश्य, माहुरीवैश्य, (विलोपित), बंगीवैश्य (बंगाली बनिया), बर्नवाल, अग्रहरीवैश्य, वैश्य पोद्दार, कसौधन, गंधबनिक, बाथम वैश्य, गोलदार(पूर्वी / पश्चिमी चम्पारण हेतु), (विलोपित)	20	Bania (Sundi, Modak/Maira, Roniar, Pansari, Modi, Kasera, Kesarwani, Thathera, Kalwar (Kalal/Eraki)(Biahut Kalwar), Kamalapuri Vaishya, Mahuri Vaishya, (Deleted), Bangi Vaishya (Bengali Bania), Barnwal, Agrahari Vaishya, Vaishya Poddar, Kasaudhan, Gandhbanik, Batham Vaishya, Goldar (For East/West Champaran), (Deleted)
21	(विलोपित)	21	(Deleted)
22	यादव–(ग्वाला, अहीर, गोरा, घासी, मेहर, सदगोप, लक्ष्मी नारायण गोला)	22	Yadav- (Gwala, Ahir, Gora, Ghasi, Mehar, Sadgop, Lakshmi Narain Gola)
23	(विलोपित)	23	(Deleted)
24	(विलोपित)	24	(Deleted)
25	रौतिया	25	Rautia
26	(विलोपित)	26	(Deleted)
27	(विलोपित)	27	(Deleted)
28	शिवहरी	28	Shivhari
29	सोनार	29	Sonar

FILE PATH - D:/DHARMRAJ BC/MBC LIST

30	सूत्रधार	30	Sutradhar
31	सुकियार	31	Sukiar
32	(विलोपित)	32	(Deleted)
33	ईसाई धर्मावलंबी (हरिजन)	33	Isai Dharmawalambi (Harijan)
34	ईसाई धर्मावलंबी (अन्य पिछड़ी जाति)	34	Ishai Dharmawalambi (Anya Pichari Jati)
35	कुर्मी	35	kurmi
36	भाट / भट / ब्रह्मभट्ट / राजभट (हिन्दू)	36	Bhaat/Bhat/Brahmbhat/Rajbhat (Hindu)
37	(विलोपित)	37	(Deleted)
38	(विलोपित)	38	(Deleted)
39	जट (हिन्दू) (सहरसा, सुपौल, मधेपुरा और अररिया जिलों के लिए)	39	Jat (Hindu) (for Saharsa, Supaul, Madhepura and Araria districts)
40	जट (मुस्लिम) (मधुबनी, दरभंगा, सीतामढ़ी, खगडिया एवं अररिया जिलों के लिए)	40	Jat (Muslim) (For Madhubani, Darbhanga, Sitamarhi, Khagaria and Araria disticts)
41	मडरिया (मुस्लिम) (मात्र भागलपुर जिला के सन्हौला प्रखंड एवं बांका जिला के धोरैया प्रखण्ड के लिए)	41	Madaria (Muslim) (only for sanhaula Block of Bhagalpur District and Dhoraia Block of Banka District)
42	दोनवार (केवल मधुबनी और सुपौल जिलों के लिए)	42	Donwar (only for Madhubani and Supaul Districts)
43	सुरजापुरी मुस्लिम (शेख, सैयद, मल्लिक, मोगल, पठान को छोड़कर) (केवल पूर्णिया, कटिहार, किशनगंज एवं अररिया जिलों के लिए)	43	Surjapuri Muslim (Excluding Shekh, Syed, Mallik, Mogal, Pathan)(only for Purnea, Katihar, Kishanganj and Araria districts)
44	मलिक (मुस्लिम)	44	Mallik (Muslim)
45	सैंथवार	45	Sainthwar
46	गोस्वामी, सन्यासी, अतिथ / अथीत, गोसाई, जति / यति	46	Goswami, Sanyasi, Atith / Athit, Gosai, Jati / Yati
47	किन्नर / कोथी / हिजड़ा / ट्रांसजेन्डर (थर्ड जेन्डर)		Kinnar/Kothi/Hijra/Transgender/ Third Gender

नोटः– उन जातियों तथा वर्गो को जिन्हें मुस्लिम नहीं लिखा गया है, हिन्दू तथा मुस्लिम दोनों जातियों को समझना चाहिए। जैसे तेली में दोनोंः– हिन्दु तथा मुसलमान तेली।

2. बिहार पदों एवं सेवाओं की रिक्तियों में आरक्षण (अनुसूचित जातियों / अनुसूचित जनजातियों एवं अन्य पिछड़े वर्गों के लिए) अधिनियम–1991 (बिहार अधिनियम–3 / 1992) के पिछड़े वर्गों की सूची (अनुसूची–2) में जिन जातियों का समावेशन / विलोपन किया गया है, उसका विवरण निम्नांकित हैः–

सूची क्रमांक	जाति का नाम	अधिनियम / संकल्प संख्या
03	कमार (लोहार और कर्मकार)	संकल्प संख्या–1170, दिनांक 25.03.2010
12	तमोली (विलोपित)	संकल्प संख्या–6136 दिनांक–22.04.2015
13	तेली (विलोपित)	संकल्प संख्या–6137 दिनांक–22.04.2015
14	देवहार	संकल्प संख्या–2413, दिनांक 21.06.2010
18	बढ़ई	संकल्प संख्या–2844, दिनांक 12.06.2009
19	बड़ई (विलोपित)	संकल्प संख्या–6136 दिनांक–22.04.2015
20	कसौधन	बिहार अधिनियम–6 / 1996
20	कलाल / एराकी	संकल्प संख्या–164, दिनांक 17.10.1996
20	गंधबनिक	संकल्प संख्या–110, दिनांक 24.07.1997
20	वियाहुत कलवार	संकल्प संख्या–79, दिनांक 28.05.1998
20	मोदक / मायरा	संकल्प संख्या–615, दिनांक 15.10.2001
20	बाथम वैश्य	संकल्प संख्या–102, दिनांक 21.03.2001
20	गोलदार (पूर्वी / पश्चिमी चम्पारण हेतु)	संकल्प संख्या–01, दिनांक 02.01.2002
20	कैथल वैश्य / कथ बनिया	संकल्प संख्या–248, दिनांक 24.06.2002
20	सामरी वैश्य	संकल्प संख्या–283, दिनांक 05.06.2003
20	सामरी वैश्य (विलोपित)	संकल्प संख्या–3799, दिनांक 15.12.2011
20	पोद्दार के स्थान पर वैश्य पोद्दार	संकल्प संख्या–2078, दिनांक 15.06.2007
20	पटवा	संकल्प संख्या–2845, दिनांक 12.06.2009
20	हलवाई (विलोपित)	संकल्प संख्या–1169, दिनांक 25.03.2010
20	अवध बनिया (विलोपित)	संकल्प संख्या–15308 दिनांक–10.11.2014
22	सदगोप	संकल्प संख्या–3, दिनांक 09.01.2001
22	लक्ष्मी नारायण गोला	संकल्प संख्या–328, दिनांक 22.12.2000
35	कुर्मी (महतो) से (महतो) विलोपित	संकल्प संख्या–1292, दिनांक 13.04.2007
36	भाट / भट / ब्रह्मभट / राजभट (हिन्दू)	संकल्प संख्या–40, दिनांक 03.01.2007
37	दांगी	बिहार अधिनियम–6 / 1996
37	दांगी (विलोपित)	संकल्प संख्या–9533 दिनांक 01.07.2015
38	कुल्हैया	संकल्प संख्या–135, दिनांक 04.09.1996
38	कुल्हैया (विलोपित)	संकल्प संख्या–2654, दिनांक 24.02.2014
39	जट (हिन्दू) (सहरसा, सुपौल, मधेपुरा और अररिया जिलों के लिए)	संकल्प संख्या–277, दिनांक 06.11.2000
40	जट (मुस्लिम) (मधुबनी, दरभंगा, सीतामढ़ी, खगड़िया एवं अररिया जिलों के लिए)	संकल्प संख्या–277, दिनांक 06.11.2000
41	मडरिया (मुस्लिम) (भागलपुर जिला के सन्हौला प्रखंड एवं बांका जिला के धोरैया प्रखण्ड के लिए)	संकल्प संख्या–177, दिनांक 13.05.2002
42	दोनवार (केवल मधुबनी और सुपौल जिलों के लिए)	संकल्प संख्या–530, दिनांक 26.11.2002
43	सुरजापुरी मुस्लिम (शेख, सैयद, मल्लिक, मोगल, पठान को छोड़कर) (केवल पूर्णिया, कटिहार, किशनगंज एवं अररिया जिलों के लिए)	संकल्प संख्या–500, दिनांक 16.10.2003
44	मलिक (मुस्लिम)	संकल्प संख्या–3176, दिनांक 29.05.2008

45	सैंथवार	संकल्प संख्या–1144 दिनांक 20.04.2011
46	गोस्वामी, सन्यासी, अतिथ / अथीत, गोसाई, जति / यति	संकल्प संख्या–12535, दिनांक 29.07.2013
47	किन्नर / कोथी / हिजड़ा / ट्रांसजेन्डर (थर्ड जेन्डर)	संकल्प संख्या–12722, दिनांक 12.09.2014

नोटः–पिछड़े वर्गों के अनुसूची–2 के क्रमांक–1, 3, 8, 14, 16, 18, 20 (सिन्दुरिया बनिया), 20 (हलवाई), 20 (पटवा), 21, 24, 26, 32, 20 (कैथल वैश्य / कथबनिया), 27, 23, 38, 12, 19, 13, 20 (अवध बनिया) एवं 37 में अंकित जातियों को विलोपित कर अत्यंत पिछड़े वर्गों की सूची (अनुसूची–1) के क्रमांक–क्रमशः 95, 115, 96, 116, 97, 113, 110, 02, 114, 111, 109, 98, 107, 110, 121, 122, 123, 125, 125, 126, 124 एवं 127 पर समावेशित किया गया।