Prevalence of Morbidity and Disease-Specific Morbidities in Assam

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Submitted by

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Declaration

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I hereby declare that the thesis title "**Prevalence of Morbidity and Disease-Specific Morbidities in Assam**" is the result of research work carried out by me in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, India, under the supervision of Dr. Rajshree Bedamatta, Professor Economics in the Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati, India.

In keeping with the general practice of reporting scientific observations, due acknowledgement has been made whenever the work described is based on findings of other investigations.

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Certificate

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This is to certify that the thesis titled "**Prevalence of Morbidity and Disease-Specific Morbidities in Assam**" submitted by Nayanakhee Sarma for the degree of Doctor of Philosophy in Development Studies in the Department of Humanities and Social Sciences at the Indian Institute of Technology Guwahati embodies bonafide record of research work carried out under my supervision and guidance.

The present thesis or any part thereof has not been submitted to any other University/Institute for award of any degree or diploma. All assistance received by the researcher has been duly acknowledged.

Rajshree Bedamatta

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Nayanakhee Sarma

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List of Abbreviations

AMCH	Assam Medical College and Hospital
ANM	Auxiliary Nurse and Midwife
ASHA	Accredited Social Health Activist
AWC	Anganwadi Centres
BMI	Body Mass Index
CBP	Central Brahmaputra Plains
CMNND	Communicable, maternal, neonatal, and nutritional diseases
COPD	Chronic obstructive pulmonary disease
CP	Cachar Plains
CSDH	Commission on Social Determinants of Health
CSO	Central Statistical Office
CVD	Cardiovascular Diseases
DALY	Disability Adjusted Life Years
EAG	Empowered Action Group states
EP	Eastern Plains
FAO	Food and Agricultural Organisation
FSU	First stage unit
GBD	Global Burden of Disease
GHE	Global Health Estimates
GNM	General Nursing and Midwifery
ICD	International Classification of Disease
IHDS	India Human Development Survey
IMR	Infant Mortality Rate
MMR	Maternal Mortality Rate
MMU	Mobile Medical Unit
MOHFW	Ministry of Health and Family Welfare
MOSPI	Ministry of Statistic and Programme Implementation

MPCE	Monthly Per Capita Consumption Expenditure
NCAER	National Council of Applied Economic Research
NCDs	Non-Communicable Diseases
NER	North Eastern Region
NFHS	National Family Health Survey
NHM	National Health Mission
NSS	National Sample Survey
NSSO	National Sample Survey Organisation
OBC	Other Backward Class
PDS	Public Distribution System
PPP	Public Private Partnership
QALY	Quality Adjusted Life Years
SAM	Severely Acute Malnourished
SE	Standard Error
SC	Schedule Caste
SDI	Socio-Demographic Index
SRM	Self-Reported Morbidity
ST	Schedule Tribe
TB	Tuberculosis
TE	Tea Estate
TG	Tea Garden
USU	Ultimate stage unit
WHO	World Health Organisation
WP	Western Plains
YLDs	Years lived with Disability

Abstract

The stock of human capital is a crucial determinant of economic growth and human development (Javed & Haq, 1981; Mincer, 1984; Sen, 1999; Galor & Tsiddon, 1997; Pelinescu, 2015). Furthermore, population health status significantly impacts the stock of human capital (Grossman, 1999; Goldin, 2016; Baldacci et al., 2008). It is thus essential to regularly assess the status of population health. In federal countries such as India, state governments shoulder the primary responsibility of health care delivery to the population. States like Assam rely heavily on the public health delivery system to achieve their desired health outcomes. Thus, public investments in health become a causal factor of health outcomes. Further, since public investments in health are primarily met out of the State exchequer, the status of population health becomes a critical identifier of progress made in development at the state level. This thesis studies the status of population health in India, focusing on Assam.

Global health estimates reflect a health transition underway in most countries (Reddy, 2016). The economic literature discusses population health status in the context of demographic and epidemiological transitions. The consensus is that developed countries have moved towards higher burdens of non-communicable diseases, whereas developing countries face dual burdens of communicable and non-communicable diseases. Some other literature also points to multiple disease burdens due to weather and climate-related adverse impacts on health (Watts et al., 2018). While these transitions are occurring, the rate in developing countries is not uniform. Similarly, health and disease burden transitions within countries' sub-national levels are also different. Various methods exist to study health transitions at the national and sub-national levels. Estimating levels of morbidity among population and disease burdens are regularly used in country-level and state-level assessments.

This thesis has three essays. First, we provide a long-term view of methodological issues surrounding morbidity and disease surveys of the National Sample Survey Organisation (NSSO)[1], India. The second essay provides population-level estimates of morbidity and disease specific morbidities for India and states based on NSSO unit-level records of the 71st and 75th rounds (2014-15 & 2017-18). We further examine socio-economic determinants of chronic and acute morbidity and disease-specific morbidity in Assam. The third essay is based on a primary study on the prevalence of morbidity and disease-specific morbidity among tea plantation workers of Assam.

At the Assam state level, we find the dual prevalence of diseases - communicable and non-communicable. However, morbidity reporting is much lower than in developed states such as Kerala. This should draw attention to the population-level awareness regarding an individual's well-being (Sen, 2002). For example, a person's well-being may be much below the desired levels. However, the self-perception regarding one's morbidity status may not be adequate. Similarly, undiagnosed, and unsought treatments may also bring down the reporting of morbidity at the population level. The NSSO unit-level records show a sufficiently high reporting of "other diseases". Urban Assam reports morbidity levels more than rural. There are NSS region-level differences in morbidity reporting in Assam. E.g., the Western Plains region has the highest reporting of acute and chronic morbidity. The lowest reporting is from the Central Brahmaputra Plains.

NSSO provides data on morbidity by chronic ailments (which has a reference period of more than 30 days), by acute ailments (which has a reference period of 15 days), and by hospitalization cases (which has a reference period of 365 days). Another critical categorization of morbidity is a spell of ailment which refers to a continuous period of sickness due to any particular type of disease within a reference of 15 days. We must consider all of the above morbidity cases

[1] Since 2019, the NSSO and Central Statistical Organisation has merged to be known as the National Statistical Office.

to assess morbidity status at the population level. Reporting of chronic and acute ailments are mutually exclusive categories. However, a spell of ailment contains all diseases reported in all categories. Therefore, the proportion of the population reporting spell of ailments by different disease categories provides robust information on disease burdens. In Assam, cases of hospitalization are higher for non-communicable diseases in the 71st and 75th rounds. Acute ailments reported at the population level are 25 per 1000 population and 19 per 1000 population, respectively. Chronic ailments reporting is 8 per 1000 population and 6 per 1000 population, respectively. Between the 71st and 75th rounds, reporting of chronic and acute ailments has decreased. For disease specific morbidity for hospitalisation cases, overall, in India the prevalence is higher for NCDs and Other diseases, except for North Eastern states where prevalence is higher for infectious diseases apart from other diseases. However, regarding disease prevalence for spell of ailments due to infectious diseases, cardiovascular diseases, and non-communicable diseases has increased in Assam. The proportion of the population in Assam suffering from spell of infectious group of diseases is highest among all other disease burdens in 75th rounds.

The third essay is on the health status of tea plantation workers of Assam based on a primary survey among 723 households and 3525 household members. The worker sample drawn was 1269. The tea plantation workers of Assam are highlighted as one of the most vulnerable groups in terms of health and nutrition outcomes (Biwas et al., 2002; Medhi, Barua & Mahanta, 2006). However, their contribution to the state's economic growth due to revenues earned by the tea sector is unparalleled (Mech, 2017). Compared to our findings on morbidity at the population level (6 per 1000 for chronic morbidity and 19 per 1000 for acute morbidity) from NSSO 75th round (2017-18) unit level records, the worker level reporting of morbidity (25.9 percent for chronic and 21.7 percent for acute) based on our primary survey conducted in 2021-22 is higher. The morbidity status of our sample worker is directly related to wage loss. In terms of disease prevalence, we find multiple prevalence of diseases - communicable, non-communicable, and occupation hazards related.

At the worker level, among communicable diseases, prevalence of tuberculosis (19 cases reported in chronic category) was widespread apart from common cold and fever (104 incidents in the category acute ailments). Undiagnosed diseases (22 incidents of chronic ailments) were also frequently reported. The most common NCD prevalent among the workers is hypertension (59 chronic cases). Anaemia (21 chronic cases) and gastritis (38 chronic and 14 acute cases) were also widely reported. Occupational health hazards, such as body and backache (26 acute and 54 chronic cases), headache (17 acute and 15 chronic cases) joint or bone diseases (17 chronic cases), and accidental injuries (11 acute cases) were also commonly cited.

Based on anthropometric measurements, we observed a high incidence (34.7 percent) of low BMI among the worker population. Female workers reflecting low BMI status is 37.7 percent and male workers are 30.2 percent. However, observed low BMI of workers do not show causality with their reporting about morbidity status. There is a lack of dietary diversity among the workers population, with their diet mostly comprising carbohydrates. However, the type of diseases reported and from in-depth interviews with health facilitators clearly points morbidity linkage of tea plantation workers with nutritional status, dietary intake, workplace hazards and low socioeconomic conditions.

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Chapter 1 Introduction and Review of Literature

1.1 Background

World over mortality rates is declining, and life expectancy is increasing; however, public health continues to be a matter of great concern in both the developing and developed world. The public health implications of communicable and non-communicable disease burdens and their impact on the extent and incidence of morbidity and mortality are huge. Globally there is an epidemiological transition - from communicable to non-communicable diseases.

The epidemiological transition of India, however, has a few paradoxes. While the incomes of roughly one-third of the population and medical technology have made rapid advances, nutrition deficiency continues to be the major public health hurdle and challenge. India is home to one-third of all stunted children and one-half of all wasted children across the globe. India's performance in maternal and child health indicators is also challenging. India has improved in terms of increased life expectancy and declining mortality rates and is currently undergoing a rapid epidemiological transition. However, the transition is towards the dual burden of diseases, both communicable and non-communicable (see, e.g., Yadav & Arokiasamy, 2014). Apart from the dual burden, there is also a shift in the burden towards non-communicable diseases (NCDs) and injuries with massive rural-urban and inter-state variations.

The Indian Council of Medical Research, Public Health Foundation of India, and Institute for Health Metrics and Evaluation (2017) study on *India: Health of the Nation's States* shows that the burden of NCDs is high in India, but along with it there is a widespread prevalence of infectious diseases. The report put forward that, malnutrition is one of the leading risk factors contributing to the disease burden at the all-India level as well as at the state level.

Child and maternal malnutrition contribute about 15 percent of the total disease burden in India in 2016, as per the report. The report concludes that, the risk of burden of child and maternal malnutrition is potentially highest in the Empowered Action Group (EAG) states[2]and Assam (Indian Council of Medical Research, Public Health Foundation of India, and Institute of Human Metrics and Evaluation, 2017). Unsafe drinking water, air pollution, lack of sanitation, and access to adequate nutrition are some of the leading causes of diseases like neonatal disorders, nutritional deficiencies, diarrhoeal diseases, lower respiratory infections, and other common infections which contribute significantly to the burden of child and maternal malnutrition in many of the Indian states till today (The Lancet, 2017).

Locating the disease-specific morbidities and their linkages with nutrition can provide us an outlook at the policy level of dealing with adverse nutrition outcomes through appropriate government and non-government interventions. Policy interventions require disease-specific morbidity studies at sub-national levels as morbidity and nutrition in India have enormous regional imbalances. We choose to study Assam because studies on self-reported morbidity and their linkages with socio-economic determinants are far and few. Moreover, Assam's child and maternal nutrition outcomes continue to ail.

This thesis inquiries into the state of population health in India with special focus on Assam. The study investigates the morbidity status of the overall population in India, and Assam's position when compared with other states. It also examines the association of reporting of morbidity and disease-specific morbidity with various socio-economic variables. We have used the National Sample Survey Organization's (NSSO) 71st round (2014) and 75th round (2017-18) unit-level data on *Social Consumption for Health*. The thesis further narrows down and focuses on tea plantation workers of Assam. The tea tribes in Assam are one of the

[2] A group of eight states – Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand, and Uttar Pradesh – that receive special attention and funds for health and development.

most vulnerable groups in terms of health and nutrition outcomes. The tea workers are significant contributors to the revenue earning of the state of Assam. The objective of this part of the research is to profile the disease prevalence of tea workers in Assam and to examine the risk factors contributing to their morbidity status.

This thesis has three essays: First, we provide a long-term view of the emergence and evolution of National Sample Survey Organization (NSSO) self-reported morbidity surveys in India. The second essay provides population-level estimates of morbidity and disease prevalence for India and states based on NSSO unit-level records of the 71st and 75th rounds (2014-15 & 2017-18). We further examine socio-economic determinants of morbidity and disease-specific morbidity in Assam. The third essay is based on a primary study on the prevalence of morbidity and disease-specific morbidity among tea plantation workers[3] of Assam.

1.2 Health and Healthcare

Scholars have regarded health as a form of human capital (Mushkin, 1962; Becker, 1994). The stock of human capital is a crucial determinant of *economic growth* and *human development* (Javed & Haq, 1981; Mincer, 1984; Sen, 1999; Galor & Tsiddon, 1997; Pelinescu, 2015). Population health status significantly impacts the stock of human capital (Grossman, 1999; Goldin, 2016; Baldacci et al., 2008). In federal countries such as India, state governments shoulder the primary responsibility of health care delivery to the population. Since public investments in health are primarily met out of the state exchequer, the status of population health becomes a critical identifier of progress made in development at the state level. States like Assam rely heavily on the public health delivery system to achieve their desired health

[3] Tea Plantation Workers are workers, working in the large tea estates and residing in line quarters as permanent workers or temporary workers. Assam's tea plantation workers have a colonial history as they were brought in from different parts of the country, particularly tribes, from the Bihar and Odisha provinces for tea cultivation in Assam (see for example, Sharma, 2011; Behal, 2014; Varma, 2016).

outcomes. Assessing health status requires valid statistics. Self-reported morbidity estimates and disease burdens are widely studied for health status assessments.

Health can be defined as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" adopted by WHO in 1948 (WHO, 2020). Healthcare represents the services, products, institutions, regulations, and people used for the maintenance and improvement of physical and mental health, especially through the provision of medical services (Phelps, 2017). Grossman (1972) has successfully discussed about health as a durable capital stock, that an individual inherits as an initial stock and which depreciates with age. The stock of health can be increased with an increase in investment, especially in medical care. In Grossman's model, a production function of health is an outcome of various inputs such as own time of the consumer, other market goods such as medical care, diet, exercise, recreation, and housing (Grossman, 1972). Besides medical care, there are also other factors that affect health in the form of socioeconomic determinants of health (Wagstaff, 1986).

1.2.1 Social determinants of health – a conceptual framework

To understand disease, it is important to understand the risk factors that lead to the prevalence of disease. Epidemiologists have contributed significantly in modern times to understanding the risk factors that cause diseases. Risk factors are defined as "an attribute or exposure that is significantly associated with the development of a disease" (Porta & Last, 2008) or "a determinant that can be modified by intervention, thereby reducing the possibility of occurrence of disease or other specified outcomes" (Porta & Last, 2008). During the 1960 – 1980s, the concept of risk factors emerged as determinates of chronic diseases (WHO, 1985). It further evolved as a concept during 1981-2000, after the Alma Ata Declaration of *Health for All*. Post 2000, the Sustainable Development Goals of 2015 emphasized, risk factors as one of the main domains of Global Reference List Core Health Indicators (2015) (WHO, 2015). The Social Determinants of Health framework of WHO gave primacy to macro, meso, local, and

household-level factors that contribute to health well-being (Solar and Irvin, 2010; WHO 2010).

In this thesis, we have used the World Health Organisation's (WHO) *conceptual framework for action on the social determinants of health*. At the behest of WHO's Commission on Social Determinants of Health (CSDH) established in May 2005, Solar and Irwin (2010) conceptualized a framework to understand the complexities that define health. The framework summarises how social, economic, and political factors such as income, education, occupation, gender, race/ethnicity, and other factors determine the socioeconomic position of an individual. The socioeconomic position of an individual in turn becomes the determinants of health status of an individual. Based on one's social status, there are differences in exposure and vulnerability to various health conditions (Solar and Irwin, 2010). This framework also draws attention to social determinants as the cause of poor health and inequalities between and within countries.

The CSDH framework mainly has two components that interact with one another and determines an individual's health status and well-being. Socioeconomic position (income, education, occupation, gender, race/ethnicity), political context, macroeconomic & social policies, and public policies are the structural determinants of health inequalities. There are also a set of intermediary determinants comprising material circumstances (living and working conditions, food availability, and physical work environment); psychosocial, behavioral, and biological factors comprising nutrition, physical activity, tobacco & alcohol consumption along with genetic factors. The health system within which individuals live and grow also plays a crucial role (Solar & Irwin, 2010; WHO, 2010)

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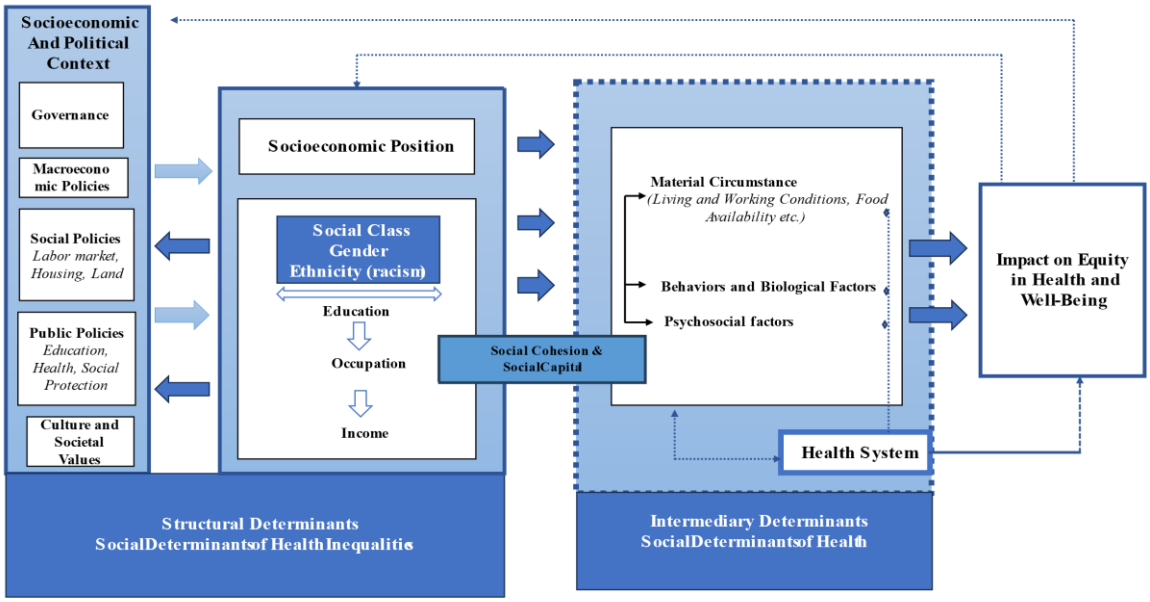
Figure 1-1: Commission on Social Determinants of Health Conceptual Framework



Source: Solar and Irwin (2010); WHO (2010)

1.3 Measuring health

1.3.1 Disease burden versus disease prevalence

Assessing health status requires valid statistics. Profiling disease burdens, and estimating morbidity are widely studied for assessing the health status of a population. In most national and international studies, estimations about health status are represented by disease burden. In countries such as India, nationally represented sample surveys on levels of morbidity and type of ailments are regularly carried out. They are referred to as self-reported morbidity based on the measure of prevalence of morbidity. There is a difference in the way we understand prevalence of morbidity and disease burden, which needs to be made clear. Diseases burden estimates consider both mortality and morbidity conditions. Whereas, morbidity prevalence is only based upon number of cases with sickness prevalent in a population.

Disease burden is calculated based on Disability-Adjusted Life-Years (DALY). It is an internationally standardized form of the Quality Adjusted Life Year (QALY). DALY is the most widely used measure at the global level to measure diseases burden. DALY measures *one lost*

year of healthy life due to premature mortality and the years of life lost (YLL) due to disability of a specified severity and duration (Murray & Lopez, 1996). The sum of DALYs across a given population measures the gap between current health status and an ideal health situation, where everyone lives to an advanced age, free of disease and disability (WHO, 2020[a]). The YLL component of disease burden is a measure of morbidity. On the contrary, *disease prevalence* measures the proportion of individuals in a defined population that are suffering or ailing from a disease at a specified point of time. Prevalence is measured by dividing existing cases of a specific disease at a given point in time divided by estimated population at the same point of time (Bonita et.al, 2006).

1.3.2 Global burden of disease studies

History and timeline of GBD study series

The Global Burden of Disease (GBD) study of the World Health Organization (WHO) is the oldest and continuing study on burden of diseases at the global level and is widely used in literature (WHO, 2020[a]). The first study was published in a ten-volume part in 1996 through a landmark publication titled The Global Burden of Disease and Injury Series (Murray & Lopez, 1996). Over the years they have published reports on numbers of diseases and risk factors at the global and regional levels. GBD 2016, under The Lancet special issue, covered a wide range of data from 133 countries which focused on 333 diseases and injuries and 84 risk factors, spread across 23 different age groups (Institute for Health Metrics and Evaluation, 2014).

A study titled *Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016* which is a part of the 2017 The Lancet series gave an overall picture of the global disease burden. The study found that, in 2016 the five-leading cause of YLDs at global level were low back pain, migraine, age-related and other hearing loss, iron-deficiency anaemia, and major depressive disorders. The study reported that, overall, there

is an increase in NCDs across all Socio-Demographic Index (SDI)[4] quintiles. The study also reported gender difference in terms of YLDs. Among women, the leading diseases are iron-deficiency anaemia, migraine, alzheimer disease and other dementias, major depressive disorder, anxiety, and all musculoskeletal disorders. Whereas, for men the major diseases affecting are substance use disorders, diabetes, cardiovascular diseases, cancers, and injuries.

The above study interpreted and argued that the decrease in death rates has declined post 1990, and YLDs rates have increased for diseases such as diabetes. Therefore, the study suggested that, there is a need for tracking morbidity data at country level to understand various trends and patterns of the diseases (Vos et al., 2017).

Another study in the same series "Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016" measured DALYs and healthy life expectancy (HALE)[5] across different locations, and compared how the epidemiological patterns are changing across the globe. It focused on how the health system is performing to this change and what are the needs in terms of policy development and resource allocation required in research. It suggested for country-specific incentives for disease burden in those aspects where the DALY is higher than expected. The main findings of the study showed that globally there is improvement in DALY and HALE. The study also found that with the increase in SDI, there is increases in life lived with disability, whereas, increase in SDI is associated with decreases in communicable, maternal, neonatal, and nutritional diseases (CMNND) (Hay et al, 2017).

[4] GBD, 2015, introduced the Socio-demographic Index (SDI). It is a summary measure that identifies where countries or other geographies sit on the spectrum of development. Expressed on a scale of 0 to 1, SDI is a composite average of the rankings of the incomes per capita, average educational attainment, and fertility rates of all areas in the GBD study. *Source*: Institute for Health Metrics and Evaluation (2014, April 18). *GBD history*. https://www.healthdata.org/gbd/about/history, browsed on 3rd December, 2019 and 4th July 2023

[5] Healthy life expectancy (HALE): The number of years that a person at a given age can expect to live in good health, taking into account mortality and disability

Study based on GBD 2017 data shows that, the working age population mainly suffers from disability related diseases. The study also pointed out the difference in diseases pattern contributing to early death and disability in high SDI and low SDI countries. The study reported that, the leading diseases in low SDI countries were neonatal disorder, lower respiratory infection, diarrheal disease, malaria and congenital defects; whereas the top five causes of early death and disability in high SDI countries are ischemic heart disease, low back pain, stroke, lung cancer and chronic obstructive pulmonary diseases (COPD) (Institute for Health Metrics and Evaluation, 2018).

Table 1.1: Timeline of the Global Burden of Disease Study Series

GBD 1990	• The GBD enterprise dates to the early 1990s. • The World Bank commissioned the original GBD study and featured it in the landmark World Development Report 1993: Investing in Health. • In 1998, the WHO created a Disease Burden Unit, which generated GBD estimates for 2000, 2001, and 2002, publishing the estimates in WHO's annual World Health Reports • In 2008, WHO updated the GBD estimates for 2004.
GBD 2010	• The Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) published new estimates for the complete time series from 1990 to 2010 • In 2013, the collaboration of World Bank and GBD came up with six regional reports (sub-Saharan Africa, East Asia, and Pacific, Eastern Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa and South Asia) based on findings from GBD 2010. • The Institute of Health Metrics and Evaluation (IHME) was founded in 2007 through funding from the Bill & Melinda Gates Foundation and the State of Washington
GBD 2013	• IHME maintains the Global Burden of Disease study (GBD) and is the coordinating center for international network of GBD contributors. • GBD in coordination with IHME, in 2013 expanded the methodology, datasets, and tools used in GBD 2010 and presented estimates for more than 300 diseases and injuries, 79 risk factors, and over 2,300 sequelae for 188 countries.
GBD 2015	• From GBD 2015 onwards, it started production of annual updates of the entire time series of GBD estimates. • In 2015, GBD updated and expanded the methodology, datasets, and tools used in GBD 2013. • It introduced the Socio-demographic Index (SDI), a summary measure that identifies where countries or other geographies sit on the spectrum of development. Expressed on a scale of 0 to 1, SDI is a composite average of the rankings of the incomes per capita, average educational attainment, and fertility rates of all areas in the GBD study.
GBD 2016	• GBD 2016, was published in a special issue of *The Lancet* in September 2017 and included the second annual report on the Sustainable Development Goal (SDG) indicators.
GBD 2017	• GBD 2017 was published in November 2018. • It provided for the first time an independent estimation of the population for each of 195 countries and territories and the globe, using a standardized, replicable approach, as well as a comprehensive update on fertility.
GDB 2019	• GBD 2019 was published in 2020 • The GBD 2019 carried out methodological improvements in the way DALYs are calculated.

Source: Institute for Health Metrics and Evaluation (2014, April 18). *GBD history*. https://www.healthdata.org/gbd/about/history, browsed on 3rd December, 2019 and 4th July 2023

Disease burden in India

India has experienced a change in disease profile at the national level with large differences among states. In 2016, the disease burden due to communicable, maternal, neonatal, and nutritional diseases (CMNND) dropped from 61 percent in 1990 to 33 percent. Disease burden due to NCDs increased from 30 percent in 1990 to 55 percent in 2016, and that of injuries increased from 9 percent in 1990 to 12 percent in 2016. Diarrheal diseases, lower respiratory infections, anemia, preterm birth complications, and tuberculosis were five out of ten individual leading causes of disease burden in India in 2016. Kerala, Goa, and Tamil Nadu reflected highest incidence of NCDs and injuries over infectious diseases. The incidence of NCDs and injuries was relatively lower in Bihar, Jharkhand, Uttar Pradesh, and Rajasthan. The burden of infectious diseases is higher in the EAG states and Assam. The burden of infectious diseases also differs by gender - with diarrheal disease, anemia, and lower respiratory infections higher among females, and tuberculosis higher among males. Similarly, infectious disease burden is also high among children under-5 years. Child and maternal malnutrition contributed 15 percent to the total disease burden in India. (Indian Council of Medical Research, Public Health Foundation of India, and Institute of Human Metrics and Evaluation, 2017).

Such changes in disease profiles pushed the discussion on epidemiological transition in fast-developing economies like India to the center stage. We seemed to have transitioned in terms of our morbidity status – from communicable to non-communicable diseases, mostly lifestyle-induced. In terms of the economy, as far as the population's health status is any indicator, we seemed to have made a dent in absolute poverty and found ourselves in the throngs of relative poverty. In many ways, a movement from communicable towards non-communicable diseases signaled a positive change in the living conditions of a large majority of the country's population. While there seemed to be a transition towards NCDs, the burden

of communicable diseases continued to be as high as the NCDs in many states. Moreover, these disease burdens differed by caste, class, and gender.

The study further reports that, there is inequality among Indian states when it comes to risk of child and maternal malnutrition. As discussed above, the burden is highest in the major EAG states and Assam and among female than male children. Another risk factor that contributes to infectious diseases in India is unsafe water and sanitation. Risk of unsafe water and sanitation is highest in several EAG states and Assam and higher in females than in males (Indian Council of Medical Research, Public Health Foundation of India, and Institute of Human Metricts and Evaluation, 2017).

The study also provided state-wise analysis, where in Assam, the top five causes of total disease burden for females are: diarrhoeal diseases, lower respiratory infection, stroke, preterm birth complications and ischaemic heart disease. Among the male counterparts, highest risk factors are stroke, diarrhoeal diseases, lower respiratory infection, ischaemic heart disease, and tuberculosis. The risk factors which contribute to the total DALYs in Assam are malnutrition (especially among children and mothers), air pollution, high blood pressure, dietary risk, and tobacco use. Noteworthy is that malnutrition is the leading risk factor for both male and females in Assam (Indian Council of Medical Research, Public Health Foundation of India, and Institute of Human Metrics and Evaluation, 2017).

Thus, economic growth-induced lifestyle changes seemed to have escaped large sections of the population, creating regional imbalances for morbidity, mortality, and thus the general level of production of health in the society. There is a need to investigate the problem of malnutrition as a risk factor and try to explore its interlinkage with both communicable diseases and non-communicable diseases which ultimately leads to morbid conditions in childhood, adulthood and old age with the increase in life expectancy. It is seen within India there are different patterns of disease burden among the states therefore it requires specific

attention in terms of health policy and intervention at the state level apart from a larger understanding of disease burden at the national level.

1.4 International Classification of diseases

At the International Health Conference held in New York City in June and July, 1948 entrusted the interim Commission of the World Health Organization with the responsibility of reviewing the existing machinery and prepare:

(i) The International Lists of Causes of Death

(ii) The establishment of International Lists of Causes of Morbidity

The interim commission formed the WHO Expert Committee on Health Statistics to prepare the list. The committee came up with the list *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death*[6] in 1948, at the First World Health summit (WHO, 1949).

At the global level, there was a need for uniform classification of illnesses in order to systematically collect data on mortality and morbidity. Various classifications were followed prior to 1948. But they were not uniformly followed across countries. Therefore, the International Classification of Diseases (ICD) was developed by the WHO to classify different causes of mortality and diseases. The modern version of the ICD was adopted by WHO at the World Health Assembly in 1948; following which most countries followed the ICD to carry out mortality and morbidity studies. The ICD version adopted in 1948 was ICD-6 which played a crucial role at the international level for health statistics. It was classified under the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* in 1948.

[6] The 1948 manual was published on 4th January 1948, and is available at https://www.who.int/publications/m/item/manual-of-the-international-statistical-classification-of-diseases--injuries--and-causes-of-death-(1948), browsed on 4th July, 2023.

Post 1948, the ICD was revised several times based on various discussions and international conferences. Some of the widely followed ICD classifications are ICD-7 (1955), ICD-8 (1965); ICD-9 (1977). Post ICD-9 and following recommendations from national and international bodies, the ICD-10 was initiated by the WHO in 1992 and was followed till 2021.[7] The ICD-10 has three volumes. The first volume describes the list, the second volume gives an overview of ICD-10 and the third volume gives an alphabetic index (Jiang et.al, 2009). WHO keeps revising this list at regular intervals, which is currently updated to ICD-11 version. The ICD-11 version is currently in public domain and is being used since 2022 (Albarbi et.al, 2021; WHO 2004; WHO, 2023).

The tenth disease list revision titled *International Statistical Classification of Disease and Related Health Problems*, *Volume 2*[8] highlights the main purpose of ICD. It is a systematic procedure of taking down, explaining, and comparing morbidity and mortality data collected across countries in different times. It is used as a standard classification for various health management as well as in epidemiological studies. It is used for studying the general health status of the population in addition to keeping track of the prevalence and incidence of diseases. The ICD was initially introduced to mainly classify mortality causes but later extended to include morbidity data too. Many health and vital data records use ICD to classify diseases and health problems. ICD provides the scope to include a wide range of complaints, symptoms, abnormal findings, signs, social circumstances, and complaints apart from formal diagnosis of diseases and injuries (WHO, 2004).

[7] The NSSO ailments list followed for morbidity estimates in this thesis, follows the broad classification of WHO's ICD-10. This is elaborated in Chapter 3.

[8] The 10th revision list 2nd edition, volume 2 elaborates on the guidelines for using the ICD and is available at https://apps.who.int/iris/bitstream/handle/10665/42980/9241546530_eng.pdf, browsed on 4th July 2023.

1.5 Health Transition- Epidemiological Transition, Demographic Transition, and Nutrition Transition

Disease burdens and prevalence of morbidity are part of the larger concept of epidemiological transition. But epidemiological transition does not occur in isolation. Adogu et. al (2015) linked epidemiological transition to improvements in nutrition, hygiene and sanitation, and medical knowledge and technology. The concept of epidemiological transition is also related to demographic transition (see Lee, 2003) as well as nutritional transition (Adogu et al. 2015). All of these concepts are broadly part of the term health transition. Health transition in developing countries is mainly related to three factors social, cultural and behavioiral (Caldwell, 1993)

Demographic transition highlights movements of countries from high fertility and mortality to low fertility and low mortality rates (Bloom & Williamson,1998). It is widely documented that increasing life expectancies and reduced mortality rates lead to increased life choices, giving rise to a situation of lifestyle diseases, broadly termed as non-communicable diseases (NCDs). Also, the ageing population are the ones that are most afflicted by NCDs (McNamara, 1982; Teitelbaum, 1975). On the other hand, nutritional transition which is described as a shift from lack of food, to a rising problem of overabundance and obesity will lead to shift in disease pattern towards diet- or nutrition-related non-communicable diseases (Adogu et.al, 2015).

We have seen that the GBD series have established that globally we have experienced an epidemiological transition. Large parts of the world have also experienced demographic and nutrition transitions. However, the effect of these simultaneous transitions is different for developing countries (Adogu et.al, 2015). In the developing countries, there is lack of socioeconomic development, nutrition, sanitation, and hygiene along with low human development index (HDI), as well as diseases related to poverty and food insecurity (Yach &

Beaglehole, 2003). Many countries also experience co-existence of under-nutrition and over-nutrition (Amuna & Zotoro, 2008). Pokin (2001), pointed out in the developing countries, there is nutrition transition mainly due to rapid change in socioeconomic conditions and demographic changes. The study based on household survey in China pointed out that to changes in diet and activity patterns. The study also pointed towards coexistence of both malnourished and overweight members within the families. Moreover, the study also pointed out on differences in diet patterns in rural areas. Similar studies in other developing countries also points towards changing nutrition pattern increase in degenerative diseases with economic development (Drewnowski & Popkin, 1997; Popkin, 2004). Shetty (2002), points out that in India too there is rapid and simulations nutrition, demographic and epidemiological transition along with rapid urbanization. The study reports that, due to these simultaneous changes, and changing dietary pattern there is increase in chronic disease especially in the urban areas. Shetty (2013), further points that in developing countries along with the burden of undernutrition and malnutrition, there is simulations occurrence of over nutrition. This 'double burden' affects different demographic groups as well as different population groups in the developing countries simultaneously.

Diseases related to poverty and food insecurity contribute to mortality and morbidity rates and at the same time, with rising incomes, the overall burden of NDCs are also increasing (Beaglehole & Yach, 2003). Thus, the developing countries are engulfed under a 'double burden' of communicable and NCDs. Similarly, the epidemiological transition in India has also been paradoxical. There is an increasing burden of NCDs in the old age without replacing the burden of communicable diseases. There is a rise in chronic disease burden without a substantial reduction in acute diseases such as diarrheas (Yadav & Arokiasamy, 2014).

1.5.1 The link between epidemiology and socioeconomic determinants

Epidemiologist Abdel R. Omran put forward the epidemiological transition theory in 1971. Omran posited that mortality patterns characterize three successive stages of transition: (1) the age of pestilence and famine, (2) the age of receding pandemics, (3) the age of degenerative and man-made diseases. The three stages show how the disease pattern changes from infectious to chronic diseases such as cardiovascular diseases, cancer, and diabetes (Omran, 1971). Many scholars have further extended Omran's epidemiological transition theory. The previous theory did not include death due to violence and accident and behavioural causes which was added by Rogers & Hackenberg in 1987. A fifth stage in the epidemiological transition came up in the later part of 20th century with the re-emergence of infectious and parasitic diseases, like HIV/AIDS, dengue, Ebola etc. (Olshansky et.al, 1998). Scholars have argued that with time, the original epidemiological transition theory needs to be revised. Mercer (2018) proposed that in order to understand the changing pattern of diseases, epidemiological transition theory needs to consider role of different conditions and at the same time track chronic diseases and infections contracted in the life course, which affects disability, mortality and morbidity. Similarly, there is a need to understand the critical role played by social determinants of health in epidemiological transition (Santosa et.al, 2014).

Over the years, epidemiological studies have shifted attention towards the social determinants of health and disease, most of which lie outside the health sector. Determinants include factors that influence health: biological, chemical, physical, social, cultural, economic, genetic, and behavioural (Lee 2005; Irwin et.al, 2006; Marmot, 2005).

Morbidity data and cross-sectional study

With time there has been change in age structure of the population. The death rates and case-fatality have also changed due to rapid advancements in healthcare. Data on morbidity plays an important role in assessing the changing scenarios. Under epidemiological study

design, cross-sectional study design is widely used. Cross-sectional studies are also called prevalence studies. They measure the prevalence of diseases. Health care needs of the population can be assessed through data from cross-sectional studies (Bonita et.al, 2006). It is seen that repeated cross-sectional surveys using independent random samples with standardized definitions and survey methods provide useful indications of trends, like the survey carried out under NSS Health Rounds in India. These surveys collect data on representative samples of the populations focusing on personal and demographic characteristics, illnesses, and health-related habits. It also considers various factors like age, gender, and ethnicity which affect health.

Nutrition and population health

The effect of nutrition on overall demographic and health indicators is well known (Mc Keown 1950-1980). Studies (for e.g., Amuna & Zotoro, 2008; Tomkins & Watson, 1989) have highlighted the role of epidemiological and nutritional transition in overall health transition which is characterized by the change in both disease burden and morbidity patterns. The simultaneous nutritional and epidemiological transition in the developing countries is characterized by double burden of diseases (Yadav & Arokiasamy, 2014; Amuna & Zotoro, 2008). Childhood conditions affect morbidity conditions in adulthood. Morbidity in adulthood due to cardiovascular diseases, lung diseases, arthritis are associated with poor childhood health (Blackwel et.al, 2001). Experience of developing countries has shown that poverty and food insecurity result in morbidity and mortality (Yache & Baglehole, 2003). Wide spread malnutrition, especially child and maternal malnutrition prevail in the developing countries. Family's preference, practices and background are closely linked to food and feeding behaviour of children (Ministry of Health and Family Welfare, 2019).

Malnutrition and infectious diseases

There is a linkage between malnutrition and infectious diseases that goes in a vicious cycle (Tomkins & Watson, 1989; Katona & Katon-Apte, 2007; Bailey et.al, 2015). The vicious cycle is that of poor nutrition, compromised immune function, increased exposure to infectious diseases, which in turn leads to decreased dietary intake. A person is more exposed to infection when he/she is malnourished; exposure to infections also contribute to malnutrition (Katona & Katon-Apte, 2007; Tomkins & Watson, 1989; Chandra, 1997; Brown, 2003; Fotso & Defo, 2005).

Within malnutrition, an important contributor is micronutrient deficiency. Micronutrient deficiency of iron, zinc, vitamin A, iodine etc. largely contributes to health outcomes. It leads to poor growth, impaired intellect, prenatal condition, and increased risk of mortality and morbidity (Katona & Katon-Apte, 2007; Bailey et.al, 2015). Therefore, the overall health outcome depends on food supply, health conditions and healthcare facilities.

Malnutrition is one of the major risk factors for infectious diseases in India. Poverty and lack of access to safe drinking water and sanitation aggravates morbidity. Some of the infectious diseases like respiratory infections, prenatal conditions, diarrheal disease, tuberculosis, and malaria have relation to malnutrition. Schaible & Kaufmann (2007), points out how protein energy malnutrition is mainly related to three main infectious diseases of HIV/AIDS, malaria, and tuberculosis. It is seen that kwashiorkor in children often leads to skin infection (Schaible & Kaufmann, 2007). Lack of protein in the diet mainly affects children in low-income countries (Scrimshaw & SanGiovanni, 1997). Scholar like Cegielski & McMurray (2004), Villamor et. al, (2006) has established the link between tuberculosis and malnutrition. It is often seen that malnutrition is one of the leading causes on onset of tuberculosis (Cegielski & McMurray, 2004). Studies based in India have also shown that malnutrition as one of the major risk factors for tuberculosis. Shetty et.al (2006), in their study evaluated the risk factors

for tuberculosis in South India and the results showed that, the main risk factors are low level of education, low BMI and not having separate kitchen apart from pre-existence of chronic disease like diabetes. Studies focusing on tea plantation workers in Assam have also reported high risk of tuberculosis among plantation workers. In a clinical study by Chelleng et. al (2014) found that the significant risk factors which contributes to tuberculosis among plantation workers are illiteracy, alcohol consumption, irregular incomes, low BMI and usage of firewood for cooking. Studies (Kuh and Ben-Shlomo, 1997; Kuh & Wadsworth, 1993) also show that early life health situation have effects on health in adult life.

Nutrition and population health indicators

Thomas McKeown in a series of research published from 1950s to 1980s argued that the growth in population in the industrialized world from the late 1700s to the present was not due to life-saving advancements in the field of medicine or public health, but due to improvements in overall standards of living, especially diet and nutritional status resulting from better economic conditions (Mc Keown 1950-1980). His thesis was criticized on several grounds for completely neglecting the role of advancement in medicine, role of vaccinations and the larger discourse of public health in terms of sanitation and hygiene (Colgrove, 2002). Although McKeown's thesis has been criticized but in recent times scholars and researchers have argued and suggested that there is a need for widening the scope of social conditions which will have a long-term improvement in the health of the population (Link and Phelan, 1995). Bozzoli et.al (2009) have established causal relationship between adult height and childhood diseases. Their study also showed that early-life burden of undernutrition and disease not only is responsible for mortality in childhood but also leaves a residue of long-term health risks for survivors which is expressed as adult height and in late-life disease. Study based on Indian population shows, mother's height has an effect on the latter health status of the children, especially for anaemic mothers (Kumar and Nahlen, 2023). Scholars have also associated, the

improved height for age in childhood are associated with increased height during adulthood and numbers of years of schooling completed (Alderman et.al, 2006).

Almond et.al, 2018 based on review of several studies linking childhood circumstances and adult outcomes post-2011, showed that even mild shocks during childhood can have a considerable negative impact on health during adulthood. They have identified six factors that contribute to such shocks: nutritional shock, prenatal maternal stress, infectious diseases, pollution exposure, weather and climate change, effect of alcohol and tobacco on fetal development. Along with the shocks, parental investment on children and policy interventions like promotion of maternity leave, child & medical care and maternal education interact in a complex way which ultimately affects the health status.

Evidence from India shows intergenerational effects of anaemia. Children having anaemic mothers are more likely to be anaemic. The factor which affects mother and child anaemic status is wealth quintile (Kumar and Nahlen, 2023). Another, factor which affects anaemia and cognitive development of children is mainly due to dearth of information about health risk emerging from lack of nutrition, especially diet diversity and healthy behaviour (Krämer, et.al, 2021).

Nutrition and non-communicable diseases

Maternal nutrition also plays an important role in morbidity status of specific groups of population, such as children. Scholars have widely studied the linkage between chronic diseases in adults and "early malnutrition war" (Amuna & Zotor, 2008) or nutritional stress in pregnancy (Barker, 1990; Barker et.al, 1993; Goldberg & Prentice 1994; Robinson,2001; Moore, 1998). James Neel put forward his original hypothesis [9] in 1962 (Neel, 1962). It is seen

[9]James Neel, a professor of Human Genetics at the University of Michigan Medical School, proposed the "thrifty genotype" hypothesis in 1962 in his paper "Diabetes Mellitus: A 'Thrifty' Genotype Rendered Detrimental by 'Progress'?" The thrifty phenotype hypothesis arose from challenges posed to the thrifty gene hypothesis. The thrifty phenotype hypothesis theorizes that instead of arising genetically, the "thrifty factors" developed as a direct result of the environment within the womb during development. The development of insulin resistance is theorized to be directly related to the body "predicting" a life of

in the context of mothers in the developing countries thrifty phenotype[10] plays a curtail role. Due to thrifty phenotype along with maternal hunger and malnutrition, the fetus suffers from early nutrition restriction affecting their metabolism in later life (Hales & Barker, 1992; Amuna & Zotor, 2008; Wells and Cole, 2002). Later during adulthood, due to improvement in socioeconomic conditions and access to food, those who were thrifty phenotypes may be vulnerable to chronic diseases like type 2 diabetes mellitus and CVD (Moore, 1998). The quantity and quality of nutrients intake during pregnancy affects the development of the fetus which affects during adulthood in the form of coronary heart disease along with stroke, diabetes, and hypertension (Barker, 1997). Epidemiological studies show risk of diabetes and cardiovascular mortality is more for those who have gone through nutritional deficiency during pregnancy (Langley-Evans and McMullen, 2010).

India and Assam – nutrition deficiency

A recent study by titled *Comprehensive National Nutrition Survey*, by Ministry of Health and Family Welfare in 2019, found that anaemia continues to be a major public health problem in India. While iron deficiency is an important cause of anaemia and of concern at certain points in the life cycle (pregnancy, infancy and adolescence), several other factors also contribute to anaemia including deficiencies of vitamin A, folate, vitamin B12 and zinc, illnesses, and parasitic infections. Micronutrient deficiencies are also an important cause of morbidity and mortality, especially in infants and pre-school children. The age groups surveyed for the purpose of the study were 0-4 years (pre-school children), 5-14 years (school-age children) and 15-19 years (adolescents). At the state level of Assam, high prevalence of micronutrient deficiency among population age group is 0- 19 years. The age group with

starvation for the developing fetus. Hence, one of the main causes of type 2 diabetes has been attributed to poor fetal and infant growth and the subsequent development of the metabolic syndrome.

[10] The thrifty phenotype hypothesis says that reduced fetal growth is strongly associated with a number of chronic conditions later in life. This increased susceptibility results from adaptations made by the fetus in an environment limited in its supply of nutrients

highest prevalence of anaemia, zinc, and vitamin B12 deficiency is 10- 19 years. Whereas vitamin A deficiency is highest in the age group pf 1-4 years.

Swaminathan et.al, 2019 in the study under Global Burden of Disease Study reported that, the main risk factor for death of children younger than 5 years (68.2%) in all the states of India in 2017 was malnutrition. About 17.3 percent of health loss of all-age groups in India is also due to malnutrition and it is highest among the low SDI states. This rate is highest in the states of Uttar Pradesh, Bihar, Assam, and Rajasthan. Overall, in India, the prevalence of low birthweight is 21.4 percent, child stunting is 39.3 percent, child wasting is 15.7 percent, child underweight is 32.7 percent, anaemia in children is 59.7 percent, and anaemia in women (15-49 years) is 54.4 percent. Besides, a recent study based on systematic review of literature of 270 original studies between 2015 and 2020 in India focusing on deficiency of micronutrients in India showed, that vitamin D deficiency is highest among the Indian population, followed by iron, vitamin B12, folic acid and iodine deficiency respectively (Venkatesh et. al, 2021).

1.6 Measuring morbidity

Morbidity is defined as "Illness, disability, handicap, and other compromised states of well-being - physical, social, and mental-all constitute critical dimensions of health and these attributes of sickness are termed as morbidity" (Murray and Chen, 1992). Simultaneous change in morbidity and mortality along with socioeconomic determinants have notable effect on the pattern of health transition. Several scholars have pointed out different effects. First, there is increase in morbidity and decline in mortality. As mortality declines, the risk of chronic diseases increases (Alter and Riley, 1989). Secondly, as mortality declines, and people's life expectancy increase, the stock of health of an individual decrease as the persons age. This leads to increased morbidity and higher risk of mortality in older age groups (Grossman, 1972). With improved nutrition, there is decline of infectious diseases but at the same time it increases chances of autoimmune diseases (Murray et. al, 1990). With delay in death, there is increase in

proportion of population who are suffering from chronic diseases, and in turn there is an increase in disability (Gruenberg, 1977; Kramer, 1980). Over time, with improvement in health care services and access to these services, the use of these services makes the people aware about the diseases. This may eventually lead to increase in self-reported morbidity about diseases, especially chronic diseases like hypertension, which need diagnosis before being self-reported (Murray and Chen, 1993).

1.6.1 Self-reported versus observed morbidity

There are two fundamental types of morbidity measures: self-perceived morbidity and observed morbidity. Self-perceived morbidity or self-reported morbidity is defined as "Measures that are perceived and reported by an individual, usually in response to inquiries regarding illness. Self-perceived morbidity depends upon an individual's perception of illness" (Murray and Chen, 1992). Whereas, observed morbidity is assessed through an independent observer "employing specific methods that can be repeated with some degree of consistency" (Murray and Chen, 1992). Scholars like Belcher et.al (1976) have argued that self-perceived morbidity and observed morbidity measures fundamentally different aspects of illness and disease. At the same time both self-perceived morbidity and observed morbidity has its own limitation, yet both the methods are widely used in different contexts to understand the health status of population.

For self-perceived morbidity, symptom reporting is the most common measure used. It has its own limitations in terms of survey methodology like language and wording, length of the recall period, the timing of the inquiry, and reporting by proxy respondents (Murray and Chen, 1992). Despite its limitations, it is seen that self-perceived morbidity reporting is widely used in both developed as well as developing countries (Rogers and Crimmins, 2011; Prinaja et.al, 2012 b). India's NSSO uses self-perceived morbidity measure in its health rounds, since data on observed morbidity based on institutional and hospital-based statistics do not reflect

the actual picture of the incidence of disease and disability (Shariff, 1995). Self-perceived morbidity is often used as a measure of morbidity of the population in epidemiological surveys as well as in public health for accessing the health status of the population (Barber et.al, 2009). Since self-reported morbidity is based on individual's own perceptions it is often used to access health perceptions (Perruccio et.al, 2010). Scholar have accessed that self-reported morbidity is often related to an individual's experiences about their health (Perruccio et.al, 2010). As indicated, self-reported morbidity mainly covers reporting of individuals physical symptoms and incident of pain (Mantyselka et. al, 2003; Perruccio et. al, 2005). People also report about their disability and not able to function (Hoeymans et. al, 1999) apart from reporting of fatigue and weakness (Stewart et. al, 2008).

Self-perceived or self-reported morbidity is the most common measure used in socio-economic studies. As pointed out by Murray and Chen (1992), in the social context, self-reported morbidity or perceived illness is itself an important social indicator as it reflects the importance of wellbeing to the people of the society. Secondly, it provides information on the importance of the disease to an individual. Lastly, it is an important indicator for monitoring changes in disease burden. Long term changes in self-reported morbidity reflects socio-cultural changes which affect the perception of illness for an individual (Murray and Chen, 1993).

1.6.2 Self-reported morbidity in socio-economic studies – validity and debate

Although self- reported morbidity is widely used, there are debates on their validity. On one hand we have self-reported morbidity as stable, consistent a as well as reliable tool for studying population health when there is absence of individual level data (Idler and Benyamini, 1997). On the other hand, Sen (2002) highlights the limitation of self-reported morbidity through the concept of 'positional objectivity' (Sen, 1993). Sen explains this by taking examples from Indian states of Kerala and Bihar. Kerala usually reports high self-perceived morbidity compared to Bihar, although Kerala has better life expectancy and literacy compared

to Bihar. Sen, argues that this is because individual's perception about own health depends upon the individual's social experiences. Perceiving and reporting about the presence of illness is often missed by a socially disadvantaged individual (Sen, 2002).

The other side of the debate is that self-reported morbidity has validity when its relationship is associated with socio-economic status (Subramanian et.al, 2009). Prinaja et.al, (2012 b) further explain that, the states of Kerala and Bihar are at different stage of development which means they may be at different stages of epidemiological transition. Kerala being on higher side of epidemiological transition have higher prevalence of chronic NCDs whereas Bihar is still engulfed with communicable diseases. Since NCDs are chronic in nature there is more reporting of morbidity in Kerala (Prinaja et.al, 2012 b). Thus, despite the prevailing debate that surround self-reported morbidity, it has been extensively used as a method to study population health in the disciplines of public health, social, economic, and clinical research (Idler and Benyamini, 1997; DeSalvo et.al, 2005).

Idler and Benyamini (1997) came up with viable explanations for self-reported morbidity (SRM) as a measure of health status. They pointed out that SRM has the ability to capture a full range of illness that the person reports, in some cases they report the symptoms of the diseases. It highlights the severity of the disease to an individual along with perception about his/her own health. This in turn affects one's outlook towards health. SRM also indicate the presence or absence of resources that affects decline in health status. Self-reported morbidity is best studied when using both quantitative as well as qualitative data (Idler and Benyamini, 1997; Balaj, 2022). It becomes more insightful by looking at health outcomes other than mortality, focusing on special population and studying the association of cultural processes with health (Balaj, 2022).

1.6.3 Self-reported morbidity and healthcare-seeking behaviour

Self-reported morbidity is affected by various factors like demographic characteristics, socio-economic factors, geographic location, social security, or any other pre-existing health conditions. The difference in self-reported morbidity reflects various dimensions. The basic dimension is that it reflects demand for healthcare or the health seeking behaviour (Akthar et.al, 2020). Sen, 1993 points out that in the absence of health care accessibility and social awareness, individual's conception of reporting normal and potential pathological morbidity is often blurred. Difference in self-reported morbidity has been used by various studies to understand for demand for health care (Van and Koolman; 2004). The economic theory of demand for health revolves around the concept of social determinants of health which indicates how it can be used to put forward various policy issues such as socioeconomic inequalities in health (Wagstaff A., 1986). According to Michale Grossman's model (1972) of demand for good health; health can be viewed as a durable capital stock, that produces an output of healthy time. It assumes that an individual inherits an initial stock of health that depreciates with age and can be increased by investment. In the model gross investment in health capital are produced by household production function and the various inputs are own time of the consumer; other market goods such as medical care, diet, exercise, recreation and housing. The production function also depends on other variables like environmental variables; but the most important variable is education of the consumer who is a producer of good health as education influences the efficiency of the production process. Along with this, the use and access to health care services also increase self-reported morbidity. At the community and individual level, increase knowledge of healthcare and health will in turn increase the health standards to higher levels. Similarly, diagnosis of chronic diseases due to availability of health care services will also increase its self-reporting as most of these diseases needs proper diagnosis, before being self-reported (e.g., hypertension, diabetes etc.) (Murray and Chen, 1992; Murray and Chen, 1993).

1.7 Self-reported morbidity in India

In India self-reported morbidity data from secondary source is mainly available from National Sample Survey (NSS), National Family health Survey (NFHS) and India Human Development Survey (IHDS). All the three surveys collect sample data that can be nationally represented. The NSSO is the oldest data source among the three sources that has provided morbidity data since the 1950s. It provides morbidity data of India post- independence in different rounds of survey till date. We have elaborated on the NSSO health surveys on self-reported morbidity in *Chapter 2*. This section reviews the findings of various studies carried out based on NSSO health surveys.

1.7.1 Inter-state differences in morbidity levels

There have been various studies assessing trends and patterns of morbidity in India based on NSSO data both at the national and sub-national level. Srinivasan et al. (2017) categorized the different rounds of NSSO focusing on morbidity into three sets for analysis. The first set covered data from rounds 7th, 11th, 12thand 13th (1953 – 1958). The second set covers large and small sample surveys between 17th and 28th rounds (1961-62; 1968-69; 1973, 1974; 1980). The third set covered thick and thin surveys of the 42nd, 52nd, 60th, and 71st rounds (1986–1987; 1995–1996, 2004; 2006; and 2014-15).

Based on the above rounds of morbidity surveys, Srinivasan et al. (2017) show that the incidence and prevalence rates of the first two sets do not have comparison categories with the third set of morbidity rounds. The findings of the study showed in the 52nd round, there was no significant difference between the percentage of ailing persons per 1000 by gender and rural-urban. Whereas in the 60th and 71st round there was a significant increase in percentage of ailing persons. The increase in reporting over time has been interpreted mainly due to increasing health consciousness over time and increase in reporting among the urban population (NSSO, 2015). Based on 71st round, Srinivasan et al. (2017) has found a positive association between

self-reported health status (SRH) and socio-economic status (SES) as well as the society in which she/he lives in India. It points out that lower the SES lower will be the health status (which means that reporting of morbidity is higher). The interstate comparison of morbidity reporting in the 28th round showed, the top five states in rural areas reporting higher self-morbidity were Kerala, Andhra Pradesh, Tamil Nadu, Punjab and Maharashtra. On the other hand, bottom five states in rural areas were Gujarat, Bihar, Uttar Pradesh, Karnataka and Assam. Similarly in the urban areas, the top five states were Kerala, Tamil Nadu, Maharashtra, Andhra Pradesh and West Bengal. The bottom-five in urban areas were Gujarat, Assam, Bihar, Uttar Pradesh and Karnataka. The analysis of the 71st round also showed similar results, with top five in rural areas were, Kerala, West Bengal, Punjab, Tamil Nadu and Andhra Pradesh. Whereas the bottom five were Assam, Madhya Pradesh, Rajasthan, Bihar and Haryana.

Another study, focusing on interstate variation in morbidity patterns in the recent round of NSSO 52nd and 60th round, showed that, for gender, morbidity prevalence for both sexes were higher in the states of Kerala, West Bengal, Punjab, Uttar Pradesh, Maharashtra, and Andhra Pradesh. Among both the sex, female reporting of morbidity is higher in Punjab, Himachal Pradesh, Tamil Nadu, and Haryana. The states where rates of reporting of morbidity prevalence are relatively lower are Bihar, Rajasthan, Madhya Pradesh, and Karnataka (Ghosh & Arokiasamy, 2009).

Sundararaman & Muraleedharan (2015) based on a summary report on health from the 71st round showed that there has been a steady increase in the gap between the proportions of ailing persons in urban and rural areas. They argued that this widening of the gap is due to changing cultural contexts, health awareness and access to care. Therefore, states with better maternal and child mortality rates like Kerala, Tamil Nadu, West Bengal and Punjab have Proportion of Ailing Persons (PAPs) far higher than those with the highest maternal and child mortalities, like Assam, Chhattisgarh, Jharkhand and Madhya Pradesh. Even the hospitalization

rate shows that the very high hospitalization rate in Kerala. Although it is discussed in the literature that Kerala's high hospitalization rate is an outlier, and could mean an excess of utilization.

1.7.2 Incidence of morbidity by socioeconomic indicators

Socioeconomic factors like education, area of residence (rural/urban), income along with demographic variables like age, gender have significant impact on the morbidity status of the population and self-reporting of morbidity. Ghosh & Arokiasamy (2009) showed that level of education and morbidity prevalence are found to be inversely related. The monthly per capita consumption expenditure (MPCE) quintile however showed a positive relationship with prevalence of morbidity. Reporting of chronic disease were higher among the better-off population. Age was a significant predictor of morbidity. Acute ailment reporting was higher among children, whereas chronic ailment reporting was higher among the elder population. The study also showed significant difference between morbidity prevalence between male and female. Female reported more compared to males. Seasonal variations in morbidity prevalence were also found to be significant.

Males are less likely to report sickness than their female counterparts (Srinivasan, et al. 2017). Similarly, children (0–6 years) based on proxy[11] reporting were more likely to report sickness than people in the age of 6–61 years. Individuals with higher educational attainment levels reported lower levels of morbidity. Social group and religion significantly impact the prevalence of an ailment, especially in the case of Schedule Tribes (STs), Other Backward Caste (OBCs) and Muslims. Some of the variables which show significant impact are age and urban residents. Age positively and significantly impacted the duration of sickness, while the income of an individual does not seem to be affecting the duration of sickness. On average,

[11] The NSSO survey is also based on proxy reporting of morbidity, i.e., other household members may also report about the morbidity status of an individual in the latter's absence.

urban residents report being sick for a significantly higher number of days compared to their rural counterparts.

Paul & Singh (2017), based on NSS rounds of 52nd, 60th and 71st round; showed factors like gender, place of residence (rural/urban), education, age, monthly per capita consumption expenditure, caste, marital status and household size have significant impact on reporting of morbidity at all India level. The study also highlighted the importance of health ideals, accessibility of health care services along with various socioeconomic factors affecting reporting of morbidity and disease profile. The study highlights the low reporting of morbidity in North-eastern states of India, even though these states have comparatively higher level of literacy rates. Therefore, the scholar argue that higher education level may not increase prevalence of morbidity in the absence of healthcare services. Prasad, (2012) studied the ailing and hospitalization cases based on 52nd and 60th round. The findings show, at all India level, Hindus and never married group of population had higher chance of reporting of ailment and hospitalization. The study also reported that younger males in urban areas reported less ailing and hospitalization. Among the states in India, the reporting was higher in the Southern and Western states. Subramanian et. al (2009), assessed the association between self-reported morbidity and socioeconomic status. The findings show that individuals with no education reported higher level of self-reported morbidity.

Singh (2017) used NSSO 60th round morbidity estimates to understand how different socio-economic determinants are associated with the level of morbidity in Northeast India and to assess the inequality and patterns of morbidity among the Northeastern states. Women were found to report more illness rates than males in all the Northeastern states except Sikkim. By social group, morbidity reporting was highest among SCs. Enabling factors like education and income also have a significant impact on illness rate.

Devi & Bedamatta (2017) based on a case study of Nagaon district of Assam have showed that cases of untreated morbidity among women are higher than that of males. Age is a positive and significant predictor of morbidity in rural areas. Based on morbidity estimates from the National Council of Applied Economic Research and NSSO, the study also highlighted the low levels of reporting of morbidity in low growth states such as Assam.

1.7.3 Disease-specific morbidity

Paul & Singh (2017) shed light on the epidemiological transition in India by studying changes in the disease profile by states. They used self-reported morbidity estimates using three NSSO rounds (52nd, 60th and 71st). The results showed an increasing trend of infectious disease, cardio vascular diseases (CVDs) and non-communicable diseases (NCDs) during the period 1995-2014. Self-reported morbidity was higher among female and older population in the urban areas. Assam reported higher prevalence of infectious diseases. Kerala showed an increasing trend in CVDs in all three rounds of NSS. Tamil Nadu, Andhra Pradesh, West Bengal, Gujarat, and Rajasthan also showed an increasing trend for CVDs. There was a growing incidence of CVDs and NCDs, especially among the elderly from Kerala, Tamil Nadu, Punjab, and West Bengal. For socioeconomic factors, reporting of CVDs and NCDs were higher among the urban population. For infectious diseases, although reporting was higher in rural areas, but reporting has increased in urban areas too. Overall, the study concludes that, dual burden of communicable and non-communicable diseases prevails in India and there is a need for better policy and public health system. Patra & Bhise (2016) focusing on mainly on NDCs, reported that, in India there is a gap between the NCD prevalence among women and men. Women are affected more by NCDs compered to men.

Yadav & Arokiasamy (2014) based on NSS round between 1986- 2004, explored the changes in disease pattern and how India is advancing in its epidemiological transition. The findings show, that the burden of NCDs in India is increasing and is affecting especially the

older age group as life expectancy has increased. The scholars argue that India is in a stage of dual burden of disease, as the prevalence of NCDs has increased without replacing the burden of communicable diseases.

Using NSS unit level data, various scholars tried to look at specific states and the prevailing self-reported morbidity status and the type of disease being reported. Most of the studies were based on NSS health rounds from 52nd, 60th and 71st. Prinja et.al (2015) studied the morbidity pattern for the states of Bihar and Kerala, based on 60th round. Similarly, Dilip 2002, studied the morbidity and hospitalization pattern in Kerala and the various socioeconomic and demographic factors affecting it. The study was based on NSS 52nd round. Paul et.al 2020, studied morbidity and hospitalization in Kerala, based on unit level data for 52nd, 60th and 71st round. The study further narrowed down and also captured the patterns at the district level in Kerala. Ghosh & Arokiasamy, 2010; studied the pattern of morbidity and hospitalization in West Bengal based on NSS 60th round. But no such published study was available for the state of Assam.

1.8 Health and morbidity status in tea plantations of Assam

Assam is one of the major states of India, in the North Eastern part of India. It covers a total area about 78438 square kilometers. The state capital is Dispur. Assam, is regarded as the gateway to the North Eastern part of India and Guwahati is the largest city in the state which comes under Kamrup Metro district. As per Statistical Handbook Assam, 2022, at present there are 33 districts in Assam. According to 2011, census the total population in Assam is around three crores. The density of population of Assam is 398 persons per square kilometer, which is above the all-India density of 382 persons per square kilometer. The sex ration per 1000 male is 958 and the child (0-6 years) sex ratio is 962. The total literacy rate stands at 72.19 percent (Directorate of Economics and Statistics government of Assam, 2023). As per Office of Registrar General of India (SRS Bulletin); the maternal mortality rate (MMR) for Assam 2017-

2018 is 205 whereas that of India is 103 (Sample Registration System[a], 2022). The infant mortality rate of Assam in 2020 is 36, on the other hand, all India figure stands at 28 (Sample Registration System [b], 2022). The total life expectancy at birth in Assam is 67.5, whereas for India it is 69.4 years. Female life expectancy stands at 68.3 years. At all India level life expectancy at birth stands at 69.4. The female and male life expectancy are 70.7 years and 68.2 years respectively. Basic health outcomes show that compared to all India, the health outcomes in Assam below national average (Directorate of Economics and Statistics, Government of Assam, 2023).

According to Assam Human Development Report**,** 2014; districts in Assam with life expectancy at birth below state average are Cachar, Karimganj, Hailakandi, Tinsukia, Sonitpur, Dibrugarh and Sibsagar. According to spatial diversity (Hills, Char/Riverine, General, Multiple Diversity, Border, Flood Affected, tea garden) category life expectancy is lowest in tea garden areas. The report finds that in Assam, in areas affected by flood and tea-garden areas there is a high prevalence of NCDs and communicable diseases. The reliance on government health facilities is higher in chars, flood-affected areas, and tea garden areas (OKD Institute of Social Change and Development and Institute for Human Development, 2016).

1.8.1 Recent studies (mainly clinical) on health and nutrition status of tea plantation workers in Assam

The health and nutrition outcomes of the tea plantation workers in Assam are far below state average. There is high prevalence of IMR and MMR in these areas apart from high prevalence of both communicable and non-communicable diseases (OKD Institute of Social Change and Development and Institute for Human Development, 2016). In the recent times there have been studies carried out at the tea plantation workers level in Assam to understand their health and nutrition status. Most of these are clinical studies especially led by Indian Council of Medical Research, Dibrugarh, Assam and a few other studies (Mahanta et al.,2016;

Mahanta et al., 2015; Mahanta et al., 2013; Rane et al., 2019; Biswas 2002). The study by Medhi et al. (2006) focus on health and nutrition status of the tea plantation workers in Dibrugarh district. The study found that there is high incidence of undernutrition and infectious diseases mainly due to low socioeconomic conditions and unhygienic living condition. The prevalence of underweight children and thinness among adults was high. For diseases the prevalence of deficiency disease like anaemia was widespread, along with infectious diseases like skin infection, tuberculosis, diarrhoea, and respiratory problems. NCDs like hypertension, senile cataract, epilepsy, and back pain were registered. High prevalence of hypertension among the tea plantation workers and the potential risk factors attributed to this phenomenon is mainly due to alcohol consumption (especially locally prepared alcohol), intake of extra salt in food as well as in tea and tobacco consumption both among men and women (Hazarika et al., 2002). Biswas et al. (2002), studied the nutritional status of the tea plantation workers mainly focusing on body mass index (BMI) of the workers. The findings showed that the high prevalence of undernutrition among the workers with females being affected more.

Rajbangshi and Nambiar (2020) based on qualitative studies among women plantation workers in in three tea gardens in Jorhat found that structural and intermediary determinants like poverty, poor labour condition, poor housing and sanitation and inadequate food affected the health of women workers. The literature has established a linkage between the practice of excessive slat consumption and hypertension among the tea plantation workers. Clinical studies, Borah et al. (2018) studied how high salt diet increased blood pressure among tea plantation workers. There is a practice of consuming salted tea both at home as well as at workplace during tea plucking by the tea plantation workers. Salted tea is even provided by garden management (Borah et al., 2018). In recent times, there have been interventions to reduce this practice. However, there is a gap in the literature, as there is no published work on

when and why the practice of excessive salt and salted tea consumption among the tea plantation workers came into being.

1.8.2 Environmental epidemiology and occupational epidemiology

Environmental factors play an important role in influencing and causing most of the diseases. Similarly, the type of occupation and place of work has influence over the health status of an individual. "Environmental epidemiology provides a scientific basis for studying and interpreting the relationships between the environment and population health." (Bonita et.al, 2006). On the other hand, occupational epidemiology is defined as "Occupational epidemiology deals specifically with environmental factors in the workplace. Physical injuries are strongly dependent on factors in the living or working environment but are also strongly determined by behavioural factors." (Bonita et.al, 2006). Park (2017); have also defined occupational environment as "sum of external conditions and influences which prevail at the place of work and which have a bearing on the health of the working population".

Park (2017) has identified three types of interaction in any working condition. Firstly, individuals with physical, chemical, and biological agent; second individuals and machine and lastly one individual with other individual. According to WHO, 1997, the major environmental factors which may affect health are: psychological (such as stress); biological (bacteria, viruses, parasites); physical (climate, noise, radiation); accidental (while using different machines); and chemical (exposure to different chemicals at workplace) (WHO Office of Global and Integrated Environmental Health, 1997). Therefore, any industrial worker depending on the nature of work is exposed to five types of hazards; physical, chemical, biological, mechanical, and psychological (Park, 2017). Tea industry is by far an agricultural industry. ILO & WHO (1962) identified the health problems of agricultural workers due to the nature of the work. These problems can be zoonotic diseases (such as TB); accidents (due to use of machinery in agriculture); physical (such as exposed to adverse climatic condition of high temperature in

sun, humidity, rain, excessive noise etc.) and respiratory diseases (due to exposer of dust from grains, rice husk, tea etc.). The document also points out that the agricultural workers are more prone to infectious diseases and nutritional deficiencies especially in the developing countries. There is a lack of consumption of milk and egg among the agricultural workers and they mainly depend on cereals for their nutrition and calorie requirement (ILO & WHO, 1962).

Occupational epidemiology is usually concerned with an adult population that is young or middle-aged, and often predominantly male. In occupational epidemiology it is often observed that epidemiology most exposed persons are relatively healthy, especially when they begin working (Bonita et.al, 2006). However, in our case among tea garden workers, females too are equally part of the workforce, therefore it applies to both male and female in the study area. General epidemiological studies focusing on general environmental factors include children and elderly as well as sick people. These people are more sensitive to the exposer factors as workplace hazards than the working adults. Therefore, when we interpret the data of occupational epidemiology, we basically focus on the workers (Bonita et.al, 2006).

However, in the case of tea garden workers it is slightly different. Firstly, all the workers family live within the tea estate and they are dependent on the tea garden management for their basic need like housing, drinking water, sanitation, supply of ration, health care facilities and other materials in kinds like (firewood, blanket, mosquito net) apart from their minimum wage. Secondly, they live either adjacent to the tea garden factory and the tea gardens. These gardens are regularly sprayed with insecticides and pesticides, which affects most of the people dwelling around it. Lastly, the tea garden labour workforce working in the tea gardens of Assam are intergenerational. The families in these estates have been working in these gardens over generations, since the time they have been bought as migrant workers from central and eastern India by the colonial British rulers. Therefore, the interpretation of occupational epidemiology for tea garden workers will have a few exceptions.

A few recent studies details about occupational health hazard of plantation workers of Assam. Banerji & Willoughby (2019) in their study based on 510 workers in 50 tea estates of Assam. The study, reported that, women tea workers especially take long hours of work which is labour intensive such as low-paid task of plucking tea. The study also reported of low wage rates in tea estates are below the minimum wage for Assam's unskilled agricultural workers. Apart from this the study reported lack of basic healthcare, education, housing, and sanitation in the tea garden areas.

Note on Plantation Labour Act, 1951

The tea plantation workers come under, the *Plantation Labour Act, 1951,* of India. The act makes it mandatory to provide welfare benefits like drinking water, housing, and health care, along with child crèche facilities. It also mandates a minimum daily wage as well as non-wage benefits in kind for the workers (such as dry ration) (Ministry of Labour and Employment, 1951). Under the act, the per week 48 hours of work for adult workers is eligible for the minimum daily wage. Working hours beyond the 48 hours of work per week counts under double wage. The welfare benefits under the act are only available for the permanent resident workers and their bonafide dependent. Whereas, these benefits are not available for temporary workers. Therefore, in order to cut cost, many plantation managements engage plantation workers as temporary workers, especially women during the peak tea plucking season (Sankrityayan, 2018). Studies have also shown that, the minimum wage for tea plantation workers are lowest in Assam and West Bengal, compared to their counterpart in Tamil Nadu, Karnataka, and Kerala. Studies have also pointed out that, the difficulty due to low wage is mainly faced by single or widowed women household working in tea plantations, as the wage earning are inadequate for them to support the household (Global Network for the Right to Food and Nutrition, 2016).

1.8.1 Historical background of tea industry and tea plantation workers of Assam

Assam is the largest producer of tea in India. The tea industry is one of the major industries in Assam which is about 172 years old. In the recent years, post-independence maximum growth of tea industry in Assam occurred during 1996- 2005 (Department of Industries & Commerce, June 2023). In the recent years there has been emergence of small tea growers in Assam. The present study only focuses on plantation workers and the small tea growers are out the preview on the present study. As per the Tea Board of India, Regional Office, Guwahati, 2022 the total area under tea cultivation as of 2021 is 347201 hectares. Out of this, the district with the highest area under tea cultivation is Tinsukia (57009 hectares) followed by Dibrugarh (53381 hectares). The total area covered by big tea growers is 232399.35 hectares. The coverage is highest for Tinsukia district (35499.79 hectares) followed by Dibrugarh district (33491.97 hectares) (Directorate of Economics and Statistics, Government of Assam, 2023).

With the discovery of tea in 1823 in the upper Brahmaputra plains by Robert Bruce and the establishment of the Assam Company in 1839 marked the beginning of the tea plantation and tea industry in Assam (Industries & Commerce, Government of Assam, June 2023). The boom in tea plantations took place during the nineteenth century (Sankrityayan, 2018). With the establishment of tea plantations in Assam by British colonial rulers there was a need for large number of permanent workers in the plantation (Sankrityayan, 2018). Rana P. Behal in his book *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam* discusses the history of the tea industry of Assam during the time period between 1840s to 1940s.The tea plantation workers of Assam have a colonial past. These workers migrated to Assam during colonial British rule during the nineteenth century. These workers were tribal people bought by the planters outside of Assam especially from Central India, and were subjected to low daily wage, physical coercion, and high mortality rates of labour (Kalita,

2022). The workers mainly recruited from central India, covering present day Madhya Pradesh, Andhra Pradesh, Orissa, and Jharkhand, through labour agents and *sardars* (Giffiths, 1967). The mechanism of the tea plantation labour system was such that, entire families were tied for several generations for plantation work. From the beginning of the plantation, women played a central role in terms of field workers in the tea garden, especially in tea plucking (Sankrityayan, 2018).

A few historical works show the health and nutrition status of the tea plantation workers. The historical works of Arnab Dey points out the, the tea plantation workers have a history of a range of infectious diseases cholera, kala-azar (or black fever), malaria, anaemia, dysentery, dropsy, diarrhoea, respiratory disease (Dey, 2018). Historical works also points out that, the tea plantation workers were more prone to malaria due to malnutrition. This was mainly because the plantation workers mainly survived rice and there was lack of other nitrogenous food items like lentils, cereals, and oil due to lack of accessibility and affordability other food items among the plantation workers (Saikia, 2014).

1.9 Justification of the present study

Having discussed the different themes under the review of literature, it is seen there is a gap in the literature to understand how the various social determinants affect health based on self-reported morbidity in the state of Assam. As indicated, Assam is one of the states with low health outcomes. Therefore, we choose to study self-reported morbidity reporting, disease-specific morbidity reporting, and its linkage with important socioeconomic determinants of health, with special focus on the state of Assam because:

a) Assam's health and nutrition outcome indicators reflect vulnerability when compared to most of the states of India and are below the national average.

b) There is a lack of evidence-based studies using both secondary and primary data to study self-reported morbidity and the disease pattern reported especially at the state level of Assam and comparing to other Indian states.

c) National Sample Survey Organization (NSSO) is the oldest data source that has provided self-reported morbidity data for India since the 1950s. At the state level of Assam there is no study which looks into the details of unit-level data of NSSO for Assam focusing on the health rounds. Therefore, the study will be a contribution to the literature and overall understanding of prevalence of morbidity and disease pattern in Assam in comparison with other Indian states based on recent NSSO health rounds (71st Round, 2014 and 75th Round, 2017-18).

d) Assam has a diverse spatial and demographic diversity, with some regions and particular communities being more vulnerable in terms of health and nutrition outcomes. NSSO does not provide data at the community level. Therefore, focusing on one of the nutritionally vulnerable communities of Assam will be a contribution to the literature based on primary survey.

e) Primary survey to understand self-reported morbidity and its linkage with various socioeconomic determinants of the tea garden community from a social science perspective is relevant, as there has not been much research done in this area apart from a few clinical studies. The study will be an addition to the literature. The socio-economic literature surrounding the tea garden workers community, highlight them as one of the most vulnerable and marginalized group in the state of Assam. Widespread hunger, malnutrition, and severe anaemia among children and women have been discussed in academic as well as policy circles. Tobacco and alcohol consumption is also reported to be very high among the tea garden workers community.

1.10 Research objectives and questions

Objective I:

To study self-reported morbidity patterns in India and Assam and examine the socio-economic determinants.

Research Question 1: Are there regional differences in morbidity prevalence in India and Assam?

Research Question 2: What are the disease-specific morbidities in India and Assam?

Research Question 3: What are the socio-economic determinants that show linkage with prevalence of morbidity and disease-specific morbidity in Assam?

Objective II:

To examine the morbidity status and profile disease prevalence of tea plantation workers of Assam

Research Question 4: What are the levels of self-reported morbidities among tea plantation workers of Assam?

Research Question 5: What are the socio-economic determinants of morbidity among tea plantation workers of Assam?

***Research Question 6*:** What is the disease profile and stage of health transition of the plantation workers?

1.11 Data sources used for the study

Secondary Data Source	
NSSO Social Consumption Health Rounds:	
NSSO unit level data of 71st Round (2014)	National Sample Survey Organization, Ministry of Statistics and Programme Implementation (NSSO, 2016)
NSSO unit level data of 75th Round (2017-18)	National Sample Survey Organization, Ministry of Statistics and Programme Implementation (NSSO, 2022)
Primary Data	
A detailed sample survey of Tea Plantation Worker's households in four tea garden-dominated districts of Assam	*Based on:* Structured and close-ended interview schedule for quantitative data collection. Semi-structured and open-ended in-depth interview guide for qualitative data collection.

Chapter 2 Morbidity Surveys in India

In India, self-reported morbidity surveys are undertaken on a regular basis. Official statistics on SRM are collected primarily by the National Statistical Office (NSO), previously known as the National Sample Survey Organisation. Other agencies such as India Human Development Survey (IHDS) and National Family Health Survey (NFHS) also collect morbidity data in India. This chapter studies the emergence and evolution of NSSO morbidity surveys since the 1950s. Morbidity data collected by other agencies are discussed in section 2. Section 3 tracks the definitions; reference period and survey schedules of the latest morbidity rounds of 71st and 75th of NSSO conducted in the years 2014 and 2017 respectively. The NSO has not conducted new rounds of morbidity surveys. This section also discusses the definitional changes that have taken place in NSSO morbidity surveys and the implication they may have on the comparison of results. Section 4 summarizes and concludes the chapter.

2.1 Importance of Morbidity Surveys

At the global level, morbidity data comprises estimates on Disability Adjusted Life Years (DALY) provided by the WHO's Global Health Estimates (GHE) under the aegis of Global Health Observatory. Data on DALYs are available for the time period 2000 to 2019, by WHO regions, country, age, sex and by income groups (WHO, 2023). The DALY estimates are based on various sources, such as, national vital registration data, WHO technical programmes, United Nations partners and inter-agency groups, the Global Burden of Disease (GBD) and other scientific studies. The data so gathered are scrutinized and reviewed by WHO member states and GHE before the data is available in the public domain (WHO, 2023).

Globally the GBD study has played a crucial role in generating morbidity data. It is a Lancet initiative which provides worldwide data on observational epidemiology. It is led by Institute for Health Metrics and Evaluation (IHME) at the University of Washington, Seattle

(USA). It has been providing data from 1990 regularly with the latest issue GBD 2019, published in October 2020. It provides data for 204 countries, 369 types of diseases and injuries and 87 risk factors (The Lancet, 2023).

Morbidity data is a part of overall health statistics data. WHO's Expert Committee on Health statistics defined morbidity as "any departure, subjective or objective, from a state of physiological well-being." The principal use of morbidity data is the description and investigation of the pattern of illnesses and the use of medical care. This will help to direct the available resources towards the maintenance and promotion of public health. The Expert committee recommended that all countries should study the extent of their health problems so that the available health and medical care can be effectively used for maximum benefit. Therefore, the objective of the health statistics collected, of which morbidity data is a component, contributes to assessment of health status of population, early detection of changes in health and future predictions (WHO, 1968).

Self-Reported Morbidity (SRM) is widely used to assess the health status of the population. Measurement of health also relies on clinical assessment as well as diagnostic investigation, but this method has logistic constraints when carrying out population-based surveys. SRM is useful especially when there is a lack of individual-level data (Prinja et.al, 2012). Therefore, it is widely used in social science research in India and across the world for population-based surveys, cross-sectional surveys as well as community-based surveys.

Over the years, social scientists have used SRM data to analyse various aspects of health status including risk factors impacting population health (Heistaro et.al, 2001; Prinja et.al, 2012 b; Bayliss et.al, 2012). SRM is also used to assess how various demographic, social, economic, and geographic factors such as income, gender, age, region, educational status, religion etc. affect reporting (Kondo et.al, 2009; Gunasekara et.al 2012). Health economists have used it

extensively to estimate demand for health care services and the cost of treatment for the type of morbidity reported (Prinja et.al, 2012; Van & Koolman, 2004; Dilip, 2002).

SRM has also been established as a crucial tool by various studies as a predictor of mortality in the population and the population at risk of death (Prinja et.al, 2012 a; Idler & Benyaminin, 1997). SRM is also a useful tool which captures an array of information on various aspects of ill health of an individual (Idler & Benyaminin, 1997). It covers a range of different illnesses a person has and at the same time various symptoms of undiagnosed diseases of an individual. It reflects the human judgement of the severity and family history regarding any current illness of an individual (Idler & Benyaminin, 1997). The role played by health interventions in impacting population health status is also captured by the SRM (Perruccio et.al, 2010). SRM is thus a useful tool in health status assessments.

2.2 NSSO's morbidity surveys (1950s to present)

2.2.1 NSSO and Ministry of Statistics and Programme Implementation

The NSO, or the erstwhile NSSO, functions under the Ministry of Statistics and Programme Implementation (MoSPI). The Department of Statistics and the Department of Programme Implementation were merged to form the Ministry of Statistics and Programme Implementation on 15th October 1999. Presently MoSPI has been divided into two broad wings: Statistics and Programme Implementation. National Statistical Office (NSO) is the Statistics wing of MoSPI. Under NSO there are three main divisions. (i) Central Statistical Office (CSO) (ii) Computer Centre and (iii) National Sample Survey Office (NSSO). Similarly, under the Programme Implementation wing, there are mainly three divisions. (i) Twenty Point Programme (ii) Infrastructure Monitoring and Project Monitoring and (iii) Member of Parliament Local Area Development Scheme. Apart from these core wings, National Statistical

Commission and Indian Statistical Institute are an integral part of MoSPI (Ministry of Statistics and Programme Implementation [a], 2023).

2.2.2 Tracking Statistical System in India

British administration during the colonial era started to establish the statistical system in India. Administration during that period was at the provincial level. The administration at the provincial level was required regularly to publish annual administration reports based on relevant statistics. The provincial reports were mainly dependent on information from the district offices. This led to the formation of the first Statistical Abstract of British India (1840-1865). Over the years the development of statistical information developed in the provinces in India and it collected a range of information in the field of agriculture, industries, civil supplies (during World War II), education, forestry, labour, cooperation, health, and vital statistics. The Statistical Committee was formed in 1862 and there was regular publication of Statistical Abstract of British India till 1923. Another significant milestone in 1881 was the first complete Population Census throughout the country, thereafter regular census was carried out every ten years. In 1945 an Inter-Departmental Committee was set up to study the already available statistical materials in India and to make further recommendations by identifying the gaps. The committee recommended the formation of a Central Statistical Office, statistical cadre, setting up of Statistical Bureaus at State Government Headquarters and overall statistics preparation for the entire country. Post India's independence a statistical unit was set up under the central government in the Cabinet Secretariat in 1949. The theoretical and professional statistics developed in India under the pioneering guidance of Professor P.C. Mahalanobis when he was appointed as the first statistical adviser to the Cabinet, Government of India in January 1949. After this, in 1950 the National Sample Survey (NSS) was established to carry out sample surveys on a variety of socio-economic aspects. The statistical unit in the Cabinet

Secretariate was later developed into Central Statistical Organisation in 1951(Ministry of Statistics and Programme Implementation [b], 2023).

Today NSS carries out multiple sample survey on diverse topics. It conducts large-scale sample surveys and collects primary data on various aspects required by various government agencies both at the central as well as state level. These data are also available in the public domain. NSS operated in both rural and urban areas of India across all states and union territories. At present NSS has four divisions under it: (i) Survey Design and Research Division (SDRD); (ii) Field Operations Division (FOD); (iii) Data Processing Division (DPD); and (iv) Survey Coordination Division (SCD). The four main broad categories under which NSS collects data regularly are (Ministry of Statistics and Programme Implementation [c], 2023; NSSO, 2001): Household surveys on socio-economic subjects; Surveys on land holding, livestock, and agriculture; Establishment surveys, and enterprise surveys; Village surveys.

2.2.3 Morbidity surveys under NSSO in India

The NSSO started functioning fully from the 1950s onwards and was entrusted with collecting primary data on various aspects nationally, which would help in policy making and socioeconomic planning. Information on morbidity status of the population was collected for the very first time by NSSO in its 7th round (October 1953 – March 1954). After the seventh round, there were three more rounds which collected data on morbidity at certain intervals. The three rounds were, the 11th round (August 1956–Jan 1957), 12th round (February 1957–July 1957), and 13th round during the time period from 1956 – 1958. All four rounds were exploratory in nature and their main objective was evolving an appropriate method of data collection for population-based morbidity surveys. A full-scale, pan-India morbidity survey, was carried out by NSSO in the 28th round (October 1973 – June 1974). This survey was based on the findings of the previous four exploratory rounds. In between the 13th and the 28th round,

there was a pilot study round to study morbidity in the 17th round (NSSO, 2006; NSSO 2016; NSSO 2020).

The second phase of the morbidity surveys by NSSO began from the 35th round (July 1980 - June 1981). **From the 35th round onwards, morbidity survey became part of all India Survey on Social Consumption**. Public distribution system, health services, mass immunisation & family welfare programmes, and educational services were the topics covered under the 35th round. But the results of this round of survey were not published. 42nd round (July 1986 - June 1987) and 52nd round (July 1995 – June 1996) were the second and the third survey on Social Consumption respectively. Morbidity data collection was an integral part of both these rounds with a few modifications. In the 42nd round, along with the usual morbidity data collection, problems of aged persons and expenses on medical services were included. (NSSO, 2006; NSSO 2016; NSSO 2020).

After the 52nd round, after a gap of nine years, the 60th round morbidity survey titled "Morbidity and Health Care" was carried out in January- June 2004. Post 60th round, two rounds of morbidity surveys were carried out, 71st round (January – June 2014) and 75th round (2017 – 2018). The 60th and 71st rounds were smaller samples for a period of six months each. The 75th round is a large sample survey. The title of both the reports of 71st and 75th rounds is "Health in India" (NSSO, 2006; NSSO 2016; NSSO 2020).

Srinivasan. et.al, 2017 have categorized the different rounds of NSSO morbidity surveys into three broad sets. The first set, 1953 – 1958, covered data from rounds 7th, 11th, 12th, and 13th. The report for all these rounds was published in Report Number 49 by NSSO in 1961. The second set covers 17th Round (September 1961–June 1962) and 28th Round (October 1973–June 1974). The first part of 17th round was a special study of morbidity in India and the second part was a pilot enquiry on morbidity providing comparisons on incidence and prevalence rates, responses of self vs proxy respondents, rural and urban areas, different recall

periods, categories of sickness, prevalence rate by type of disability, response to probing questions and their implications. The third set covered the quinquennial surveys of the 42nd (1986–1987) and 52nd (1995–1996). Apart from the above, the recent rounds of 60th (January–June 2004) and 71st (January–June 2014,) rounds are also included.

Srinivasan. et.al (2017) reported that the morbidity data in the first and second sets of NSSO morbidity survey represented data on prevalence and incidence rate. But the surveys under the third set presented morbidity data in terms of "estimated proportion of persons reporting ailment at any time during the 15-day reference period and are not strictly the prevalence rates as recommended by the Expert Committee on Health Statistics of the WHO" (NSSO 2015). The scholars further pointed out that, 71st round data included data on the nature of treatment, level of care in institutions with provision for admission of sick persons as in-patients for treatment, ailment. It also included data on medical expenditure for treatment, non-medical expenditure, total expenditure and on total expenses on medical care. They put forward that, the third set contains relevant information about morbidity, previous rounds did not include all such data (Srinivasan. et.al, 2017). After the 71st round, the recent large sample round on morbidity was carried out in 2017 – 2018 under the 75th survey of Social Consumption. The details of recent NSSO rounds of 71st and 75th with definitions, reference period, disease list etc. are discussed in the following section.

2.3 Other morbidity surveys in India

NSSO has been the oldest source of morbidity data focusing on large sample surveys for pan India. However, post-1990s there have been few other surveys which have been collecting morbidity data along with other data at the population level at regular intervals.

The National Family Health Survey (NFHS) has regularly collected specific disease-related morbidity data since its initiation in 1992. It collects data on specific diseases in the form of self-reported as well as observed morbidity (by using biomarkers). NFHS survey is

carried out under the Ministry of Health and Family Welfare (MoHFW), Government of India. It is the main funding agency for the study. MoHFW has entrusted International Institute for Population Sciences (IIPS), Mumbai, as the nodal agency for all the rounds of NFHS. Till date there have been five rounds of NFHS surveys, the latest being the NFHS-5 (2018-19). NFHS-1 was conducted in 1992-93. The second round of NFHS was conducted in 1998-99. NFHS-2 mainly focused on the reproductive and child health of women and specific diseases like anaemia among women in the age group of 15-49 years. NFHS-3 was conducted in the year 2005-06. For the first time, the survey also included men in the age group of 15- 54 years. Apart from other information, NFHS-3 for the first time introduced blood testing for HIV prevalence. Other components of the survey were clinical, anthropometric, and biomedical testing. NFHS-4 (2015-16) collected similar data as NFHS-3. For the first time, NFHS-4 provided data at the district level. Observed morbidity information was collected using biomarkers for blood pressure, blood glucose, haemoglobin measure and HIV testing for both women (15- 49 years) and men (15- 54 years). Self-reported current morbidity information was collected for women and men for specific diseases of diabetes, asthma, goitre, heart disease, and cancer. Information on the health status of children regarding diarrhoea, fever, illness with cough, fast or difficulty breathing due to problem in the chest or blocked or runny nose with a reference period of two weeks was collected from the mothers of children in the age group of 0- 5 years. The latest round of NFHS-5 (2019-21) provides the same information as the previous round at the district and state levels except for HIV testing. The sample size of the latest round is 636,699 households, 724,115 women, and 101,839 men (International Institute for Population Sciences and ICF, 2021; International Institute for Population Sciences and ICF, 2017).

The second large sample survey which collects data on morbidity pan India is India Human Development Survey (IHDS). National Council of Applied Economics Research, New

Delhi and the University of Maryland carries out the IHDS as a collaborative research project. Till date, there have been two rounds of the survey. The first is the IHDS-I (2005) and the latest is the IHDS-II (2011-12). The total sample size of IHDS-I is 41,554 households in rural and urban areas of India. The same sample households were followed during IHDS- II, but a total of 6,911 households were lost to recontact from IHDS-I to IHDS- II. The number of new households considered in IHDS- II which were not included in IHDS- I is 2,134. Some of the households from round one had split into two or more households during the second round. The split households residing in the same village or urban block were considered. The total sample households finally considered for IHDS- II were 42,152. Under the Health and Education questionnaire of IHDS, questions on short-term self-reported morbidity (reference period of 30 days) for all the members of the households were asked mainly for three specific illnesses of fever, cough, and diarrhoea. Questions on long-term morbidity (reference period 12 months) were asked for specific disease cataracts, tuberculosis, hypertension, heart disease, diabetes, leprosy, cancer, asthma, polio, paralysis, epilepsy, mental illness, STD or AIDS, meeting with accidents in last twelve months and other long-term diseases (Desai, Vanneman, and National Council of Applied Economic Research, 2018).

A one-time survey of the morbidity status of the population was carried out by the NCAER in 1993. The household survey on medical care was carried out by NCAER along with the fifth Market Information Survey of Households. The survey collected detailed data on morbidity, healthcare utilization and health expenditure. The total sample size of the survey was 18,693 households. Later, the survey was not repeated. The survey mainly focused on differentials and determinants of morbidity in India and health scenario and public policy in India (Shariff, 1995).

The reason for using NSSO surveys over the above surveys are the following. First, the sample size available from NSSO are bigger and more extensive than the others. Second, the

NSSO follows a robust methodology from the NSS region level and downwards making it representative at the state level. Third, the NSS estimates are available at the population level, covering entire population including children and elderly unlike the NFHS which includes only includes certain age groups for men and women. The size of population covered under each of the surveys are summarised as follows.

- NSSO morbidity surveys: available since 1950s at population level; sample size used in the latest 75th round (2017-18): 113,823 households and 555,115 persons.
- NFHS morbidity data: sample size used in 2018-19 is 600,100 households; age restricted; Women's age – 15- 49 and men's age – 15- 54; clinical morbidity reporting based on biomarkers
- IHDS morbidity data: available since 2005 and the latest is 2011-12. The 2011-12 round has 42,152 households (sample households repeated); questions on short-term (reference period of 30 days) and long-term (reference period 12 months) are asked.

2.4 Definitions, reference period and survey schedules: NSSO 71st and 75th round

2.4.1 Definitions

This section discusses the definition that has been considered by the latest NSS rounds of 71st and 75th to collect data on self-reporting of morbidity. Information on morbidity based on the survey respondents are collected at the household level for each member of the household. The reporting of morbidity is either self-reporting or proxy reporting. Self-reporting morbidity data is collected for most of the members of the household who are old enough to provide information about themselves. Whereas, proxy reporting is collected for some members (especially children) from other members of the household. NSSO considers specific definitions for certain terms to collect information on morbidity. The definitions considered have been discussed below:

Ailment (which includes both illness and injury) is "any deviation from the state of physical and mental well-being." NSSO considers ailment for both cases of treated or

untreated. It also considers ailments for which an individual may not be hospitalised or confined to bed. In both 71st and 75th rounds of the survey, aliments were inclusive of all types of injuries, such as cuts, wounds, haemorrhage, fractures, and burns caused by an accident, including bites to any part of the body; and cases of abortion (natural or accidental). Whereas ailments were exclusive of cases of sterilisation; normal pregnancy without complications; and cases of pre-existing visual, hearing, speech, locomotor, and mental disabilities (NSSO 2016; NSSO 2020).

Chronic ailment is defined by NSSO as "any member of the household was experiencing symptoms persisting for more than one month on the date of survey – indicating any problem caused by an ailment affecting any organ of the body. Or has been taking a course of treatment on medical advice for a period of one month or more and continuing as on the date of survey, aimed at alleviation of the symptoms of any ailment on the date of survey were considered as chronic ailment." It is to be noted that, chronic ailment excludes minor skin ailments, minor headaches and body aches, and minor gastric discomfort after meals under the definition of ailment, even if it is of long-standing nature, unless the respondent insists that they cause restriction to his/her activity and disabilities such as congenital blindness (NSSO 2016; NSSO 2020).

Ailment of short duration (any other ailment) is defined by NSSO as "aliments which are not chronic in nature" for a reference period of fifteen (15) days. It includes any problem relating to the skin, head, eyes, ears, nose, throat, arms, hands, chest, heart, stomach, liver, kidney, legs, feet, or any other organ of the body. Further, it includes, both treated as well as untreated ailments and injuries and persons under medication on medical advice for illness or injury within the reference period (NSSO 2016; NSSO 2020).

Spell of ailment is defined as "a continuous period of sickness due to a specific ailment." For the analysis of the nature of ailment and expenditure incurred for different types

of ailments reported by the respondents, NSSO considers a reference period of fifteen days for spell of ailment. It includes short-duration ailment; cases of hospitalization and chronic ailments suffered within the reference period of last 15 days. Different cases of spell of ailment suffered within the reference period of 15 days consider are: ailments of different persons are considered as two separate spells of ailments; the same person suffering from two different nature of ailment within the reference period are considered as two separate spells of ailment; and same person suffering from same nature of ailment but in two spells within the reference period are also considered as separate spells of ailments. It is to be noted that, NSSO distinguishes between acute ailments and spell of ailments although the reference period for both are 15 days. Acute ailment is only a yes/no reporting of sicknesses which had an onset within the reference period of 15 days. It is collected to distinguish proportions of population suffering from long-term ailments. Whereas, spell of ailments which also has a reference period of 15 days, however, includes long-term illnesses as well as hospitalization cases, provided they continue to suffer within the reference period (NSSO 2016; NSSO 2020).

NSSO defines **hospitalization** as "admission as in-patient to a medical institution for treatment of some ailment or injury, or for childbirth, is called hospitalization." The reference period for hospitalization cases is 365 days. Different cases of hospitalization considered, within the reference period of 365 days are: hospitalization of two different persons are two separate cases of hospitalization; same person hospitalized in two different hospitals, within the reference period, are considered as two separate cases of hospitalization; and same person hospitalized same the same hospital for two different ailments or spell of ailment are also considered as separate hospitalization cases (NSSO 2016; NSSO 2020).

The NSSO obtains information on morbidity based on the survey respondents' answers (yes or no) to the following questions:

- Have you been suffering from any chronic ailment for more than one month?

- Have you been suffering from any other ailment during the last 15 days?
- Have you been hospitalized any time during last 365 days?

The answers are based on *self-reporting* or *proxy-reporting* for the household members (NSSO 2016; NSSO 2020).

The latest rounds of NSSO Social Consumption Health collect data at the household level as well as individual level. The main heads under which data is collected are:

Basic Household Details: Household size, occupation, religion, social group, access to latrine, source of drinking water, source of cooking fuel and household level monthly consumption expenditure.

Demographic Details: Age, Gender, Education level, Marital status, coverage under health insurance, suffering from short ailment, chronic ailment, and cases of hospitalization.

Particulars of hospitalization as in-patient of medical institution in last 365 days (type of ailment reported and the expenditure on treatment of the individuals)

Particulars of spell of ailments of household members during last 15 days (type of ailment and expenditure on treatment)

Particulars of former household members who died during the last 365 days.

Particulars of economic independence and state of health of persons age 60 and above

Particulars of immunization of children (0-5 years) and pre and post natal care of women (15-49 years).

2.4.2 Disease-specific morbidity and disease list (nature of ailment)

Data on **disease-specific morbidity** or **the nature of ailment** reported is collected by NSS for both cases of in-patient of medical institutions during the last 365 days and spell of ailment of household members during the last 15 days. Both NSS 71st and 75th rounds have an

exhaustive list of sixty different types of disease. Apart from the sixty different types of ailments, there is also a dummy ailment category for child delivery cases which includes normal delivery, caesarean delivery, or any other delivery. Within the list of sixty different types of ailments there are two categories as: symptoms not fitting into any of the other fifty-eight types of ailments and another category is where the respondent could not even state the main symptom.

Within the exhaustive list of sixty different types of diseases, NSSO identifies some of the diseases as reported diagnosis. A few examples of diseases that are marked as reported diagnosis are fever due to diphtheria, whooping cough; tuberculosis; HIV/AIDS; cancer; diabetes; sickle cell etc. NSSO defines reported diagnosis as "it refers to a diagnosis that was communicated to the person with ailment or family member by an attending healthcare provider or diagnostician. It could be verbal or written. In some ailment codes, there are further clarifications or probing hints provided to enquire whether there is a reported diagnosis available." (NSSO 2016; NSSO,2019; NSSO, 2020; NSSO 2023)

2.4.3 Reference Period

"In survey research, requests can be asked about any present situation, past events or actions or even future events. Reference period is the time indicated in survey research where the request is about past items" (Zavala, 2014). NSSO surveys in the 71st and 75th round mainly collect self-reported morbidity data for hospitalization cases and ailments (illness or injury) for different reference periods. For 71st round, the reference period considered from the date of survey any time between January 2014 to June 2014. Whereas, for 75th round, the reference period considered from the date of survey any time between July 2017 to June 2018 (NSSO 2016; NSSO,2019; NSSO, 2020; NSSO 2023).

Reference periods considered under NSS 71st and 75th round

365 days or one year: For hospitalization cases, the reference period is taken as 365 days prior from the date of the survey.

More than one month: For chronic ailment the reference period taken is more than one month prior (or more than 30 days) from the date of the survey.

Fifteen days (15 days): For any other ailment other than chronic, the reference period is taken for 15 days prior from the date of the survey.

2.4.4 Survey Schedule

NSSO uses Schedule 25.0 for Household Social Consumption: Health for both 71st and 75th rounds. It collects data on quantitative information on the health sector. An important component of the schedule is to collect data on the prevalence of morbidity rates among different age-sex groups in different regions of the country. It also collects information on the extent of use of health care services especially provided by the government. Apart from this the survey also collects data on hospitalization, medical care received as in-patient of medical institutions and expenditure incurred on treatment received. Along with this, the nature of ailment data is collected for cases of in-patient of medical institutions and any spell of ailment during the last 15 days reference period. For in-patient of medical institutions, the reference period is taken for 365 days. Data on expenditure incurred and source of treatment for spell of ailment in the last 15 days is also collected in the schedule.

The survey schedule also collects data on immunization and expenditure on immunization of children in the age group of 0-5 years. It also collects data on prenatal and postnatal care for women of age 15-49 years who were pregnant during the last 365 days. For the population aged 60 years and above the survey schedule collects data on their health status, economic independence, and degree of isolation.

According to the NSSO report, one of the main objectives of the survey schedule is to primarily, collected data on indicators of morbidity, hospitalization rates, the utilization of both public and private healthcare institutions and proportion of institutional childbirth apart from information on demographic and socio-economic characteristics of the individuals.

For both 71st and 75th rounds the survey schedule is divided into eleven blocks having specific significance. Block 1 and 2 are related to the details on the identification of the sample households, while Block 3 records the information on essential household characteristics viz. religion, social group (caste), household size and household's usual monthly consumption expenditure etc. Block 4 comprise of information on demographic particulars of household members such as age, sex, education level, marital status, and usual activity status. This block collects information on self-reporting or proxy reporting (especially for children) of hospitalization, suffering from any chronic ailment and suffering from any other ailment besides chronic during the reference period of 15 days. It also collects data on whether covered under any scheme for health expenditure support. Block 5 collects data on particulars of former household members who died during the last 365 days along with the details of any medical treatment received before death. Block 6 collects information on particulars of medical treatment received as an in-patient of medical institutions during the last 365 days, which includes data on the nature of ailment and source of treatment for the individuals' reporting cases of hospitalization. Block 7 collects data on expenses incurred during the last 365 days for treatment of members as an in-patient of medical institutions. Block 8 collects similar information as block 6 on particulars of spell of ailment of household members during the last 15 days. Here too the nature ailment and source of treatment reported are collected. Block 9 collects data on expenses incurred for treatment of spell of ailment during the last 15 days by household members. Block 10 is divided into two parts "a" and "b" respectively. Block 10 (a) collects data on particulars of economic dependence and the state of health of persons aged 60

years and above. Block 10 (b) collects data on expenditure on immunization if any during the last 365 days and the status of immunization of children on the date of survey aged 0-5 years. Finally, Block 11, collects data on particulars of pre-natal and post-natal care of women of age 15-49 years who were pregnant during the last 365 days.

2.4.5 Definitional changes

Over the years NSSO morbidity surveys have changed in terms of definitions and disease list used for the primary survey. This section discusses some of the changes in the recent NSS 60th, 71st and 75th rounds as provided in the NSSO reports. The first difference between the 60th round and 71st & 75th rounds is based on pre-existing disabilities. In 60th round persons with disabilities were recorded as ailing persons, whereas in the 71st and 75th rounds pre-existing disabilities were recorded as chronic ailments only if treatment was sought during the reference period otherwise not recorded as ailments; however, disabilities acquired during the reference period recorded as ailment. The second difference is in terms of treatments for ailments. In 60th round treatments administered on medical advice only were considered as treatment; self-medication and medication on the advice of chemists at the chemist shop were not considered as treatment; on the other hand, in the 71st and 75th rounds, treatment administered on medical advice and self-medication and medication taken on the advice of chemists at the chemist shop was considered as treatment. Morbidity information for persons aged 60 years and above was collected for a reference period of 365 days, 15 days, and on the date of survey. However, in 71st and 75th rounds morbidity information on the date of survey was not collected for persons aged 60 years and above. The disease list was upgraded from 42 different types of disease in the 60th round to 60 different types of diseases in the 71st and 75th rounds. From 71st round onwards in the list of nature of treatment classification for ailments reported the 'Indian System of Medicine' (which includes ayurveda, unani and siddha),

Homeopathy and 'Yoga or Naturopathy' was included, which was earlier not included in the 60th round (NSSO 2016; NSSO 2020).

2.4.6 Why consider the latest rounds of NSSO 71st and 75th

For the analysis, we have chosen to study the latest Health rounds of NSSO Social Consumption – 71st and 75th Round. Both the rounds have data on self-reported morbidity with adequate sample size covering all age groups with an exhaustive list of diseases. Moreover, the study focuses to look at the recent trends of self-reported health status of the population. It also gives us an idea of the health status of the population as preceding the pandemic. In India, the 71st and 75th NSSO rounds were the best reliable sample data source to study the recent trends of self-reported morbidity. The 71st and 75th rounds are easily comparable as there have not been any definitional changes in between these two rounds. However, there have been some definitional changes from NSS 60th round to 71st round, therefore the 60th round is not comparable to some extent with the 71st round. Self-reported morbidity data is collected for *any other ailment at any time during the last 15 days* and *any chronic ailment* for the 71st and 75th rounds for all the states of India. But for the 60th round, data for only *whether ailing any time during the last 15 days* was collected.

2.5 Conclusion

NSSO is one of the oldest databases for Self-Reported morbidity in India and one of the largest socio-economic-based health surveys. Through NSSO health data we can look at the larger epidemiological transition of the population over a period of time. NSSO does projections of the current year of survey when we do the estimates, therefore in between the census rounds it is the most reliable data source to get the population level estimates. The guidelines, definitions and the survey schedule designs are great sources of standard reference for researchers and other organisations to carry out smaller studies.

The health rounds of NSS covers various broad aspects of health: self-reported morbidity, morbidity data for all age population, and a separate section for old age population (above 60 years) which other socio-economic health database do not provide. It also provides data on type of diseases reported, type of health services used and type of treatment sought by the population and out of pocket expenditure for medical treatment.

The importance of health surveys and morbidity as an indicator of the health status of a population has increased over the years. Age at death and cause provides an instant depiction of health status. In high mortality settings, information on trends of death (by causes) substantiates the progress of health programs as survival improves with modernization and populations age, mortality measures do not give an adequate picture of a population's health status. Morbidity rates reflect the health status of the population. Indicators of morbidity such as the prevalence of chronic diseases and disabilities become more important data on the frequency and distribution of an illness can aid in controlling its spread and, in some cases, may lead to the identification of its causes.

Chapter 3 Research Design- Concepts, Data Source and Methodology

Section 3.1 of this chapter discusses the overall research design for the study. Section 3.2 discusses, data and methods used for analysis of secondary data. Section 3.3 discusses the method of analysis of primary data.

3.1 Research Design for the Study

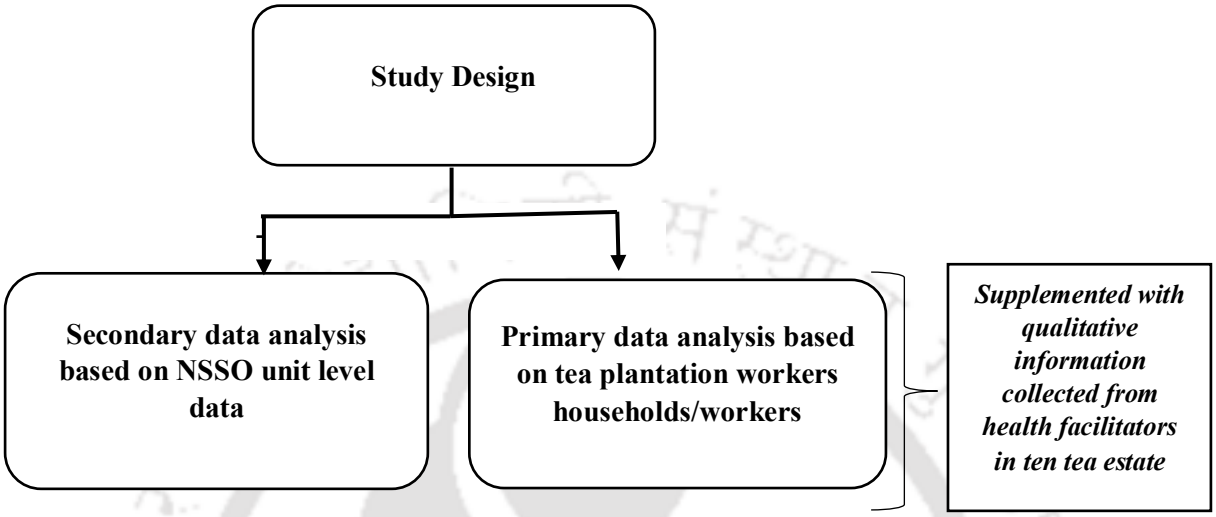
The study inquiries into the state of population health in all the Indian states with special focus on the state of Assam. The study investigates the morbidity patterns in the overall population and locates Assam's position when compared with other states of India. It examines the association of reporting of morbidity and reporting of disease-specific morbidity with various socio-economic variables at the state level of Assam. Using a quantitative descriptive methodology, the first objective has been studied based on secondary data of National Sample Survey Organization's (NSSO) unit-level data on *Social Consumption for Health* for 71st (2014) and 75th rounds (2017-18).

The second part of the thesis further narrows down and focuses on tea plantation workers of Assam. The objective of this part of the thesis is to assess self-reported morbidity and profile type of diseases reported by the plantation workers in Assam. It examines the various risk factors that affects the morbidity of the tea plantation workers. For the second objective too, quantitative descriptive methodology has been used. Primary survey at household level was carried out. Apart from primary quantitative data, qualitative data in the form of in-depth interview with health facilitators in the tea estates were collected.

For the quantitative data analysis, a structured close ended questionnaire was constructed to collect data from tea plantation workers and their households during September 2021 to May 2022. For the qualitative study, an open-ended semi structured interview guide

was used. For the primary study, four tea garden cultivation dominated districts of Dibrugarh, Tinsukia, Jorhat and Sibsagar district in upper Assam of Brahmaputra valley were selected.

Figure 3-1: Research Design



Source: Authors design

3.1.1 Measuring disease frequency from cross-sectional studies in epidemiology

In epidemiological studies, the first step is to measure the occurrence of disease or other health states of the population group under study and then compare it with different population groups. The concept of incidence and prevalence are generally used for measure of disease frequency. The number of people under study generally includes people from the population who are exposed to the risk of the diseases and can be exposed to the risk factors and measured by variables such as demographic, geographical, or environmental. **Incidence** is defined as the rate of occurrence of new cases arising in a given period in a specified population; **Prevalence** is defined as the frequency of existing cases in a defined population at a given point in time (Bonita et. al, 2006). Both incidence and prevalence mainly count the number of cases at risk in defined population. Prevalence as a measure of disease frequency has been used in this study to measure morbidity.

3.1.2 Qualitative content analysis (directed content analysis)

The qualitative data collected from in-depth interview with the health facilitators in the tea garden area has been based under qualitative content analysis approach. Qualitative content analysis has three distinct approaches. The three approaches are conventional content analysis, directed content analysis and summative content analysis (Hsieh & Shannon, 2005). The approach for all the three types of content analysis is different. The type of qualitative content analysis method chosen by a researcher depends on the theoretical and substantive interest and problem being studied (Weber, 1990). For the study of in-depth interview of health facilitators in the tea plantation areas, directed content analysis has been used. In directed content analysis approach, analysis starts with a theory or initial relevant research findings, which acts as a guide for initial codes (Hsieh & Shannon, 2005). Data for directed content analysis is collected through interview, open-ended questions, followed by targeted questions about the predetermined categories.

For the in-depth interview of the health facilitators, we had prior knowledge about the conditions of work based on the survey in tea estates. The qualitative survey was carried out in ten tea estates of Tinsukia district during February-March 2022.

3.2 Research Design for Secondary Quantitative data

3.2.1 Description of the NSSO survey design

Data

Self-reported morbidity data at all India level from secondary source is mainly available from National Sample Survey. The rounds which collect data on self-reported morbidity comes under India- Social Consumption Health Round. NSSO collects detailed information on morbidity patterns of the population from selected households covering all the states and union

territories of India. The study focuses on the latest two health rounds of NSS 71st (2014) and NSS 75th (2017-2018). The findings and analysis of the results of the quantitative data based on secondary data of NSSO has been discussed in chapter 4 and chapter 5 of the thesis.

Sampling Design

NSSO uses a multi-stage sampling design covering all the states and union territories with uniform sampling procedure and geographical coverage. A stratified multi-stage sampling design has been adopted both for 71st and 75th round of NSS health round survey. The first stage unit (FSU) are based on census villages in rural sectors and FSU blocks in the urban sector. The ultimate stage unit (USU) are households in both rural and urban sectors.

Sample size

We use NSSO unit-level data to study the morbidity pattern of Indian states and Assam. The all-India sample size at the individual level of the 71st and 75th rounds is 333104 and 555115 persons respectively; covering 65932 and 113823 households. At the state level of Assam, the individual sample sizes are 11411 and 18463 respectively; and corresponding household sample sizes are 2255 and 3744. All analysis is based on the central sample. The details of the NSS health round survey schedule have already been discussed in chapter 2 of the thesis.

Diseases Classification

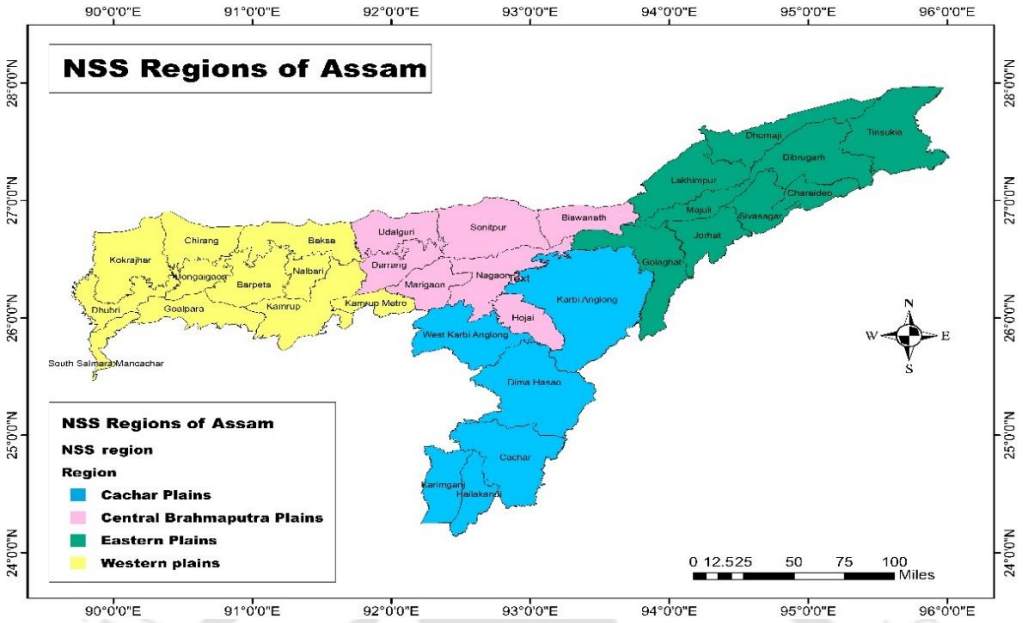
Data for the nature of ailment (types of diseases reported) are collected for 61 different types of diseases in NSS 71st round which consist of sixty main diseases and one category for childbirth (normal/caesarean and other type of deliver). Similarly, in the 75th round data on nature of ailment was collected for 63 different types of diseases, which consist of sixty main diseases and three categories separately for three types of childbirth (normal/caesarean and other type of deliver). For our analysis of diseases specific morbidity childbirth cases for both

the rounds have not considered. Paul and Singh (2017); has classified the exhaustive list of 60 different types of diseases listed by NSSO into five broad categories of infectious diseases, cardiovascular diseases (CVD), non-communicable diseases (NCDs), disability, and other diseases. The classification of disease has been done according to the International Classification of Disease (WHO). For the analysis of diseases specific morbidity, the study follows the same classification of diseases both for NSS 71st and 75th round (diseases list in appendix to chapter 3, table A 3.1).

NSS Regions of Assam

NSS state regions are formed below the category of state and union territories. NSS regions at state level are groups of districts 'having similar geographical features and population densities' within the state, and are treated as NSS Regions. These NSS regions keeps on revising during different round. The latest revision of NSS region was made during the NSS 68th round. The state of Assam has been divided into four NSS regions. The four NSS Regions of Assam are Eastern Plains (EP), Western Plains (WP), Cachar Plains (CP) and Central Brahmaputra Plains (CBP). District wise NSS regions of Assam has been presented in table A 3.2, appendix to chapter 3.

Figure 3-2: Map showing NSS Regions of Assam and the distribution of Districts



Map Source: ArcGIS Hub, Esri India, GIS online; Date of release 14th September, 2021; Prepared in ArcGIS 10.2

3.2.2 Methods for secondary data analysis

Grouping of Indian States

For our analysis at the Indian state level, we have categorized the Indian states and union territories into six broad groups: Northern Region, Southern Region, Eastern Region, Western Region, North Eastern Region, and Central Region. We have categorized the states into these six regions and compare the regional patterns for both 71st and 75th round. This comparison also gives a clear picture of Assam's position in terms of reporting of morbidity and reporting of diseases specific morbidity.

Table 3.1: Categorization of Indian States and Union Territories into Six Regions

Northern Region	*Southern Region*	*Eastern Region*	*Western Region*	*North Eastern Region*	*Central Region*
Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, and Rajasthan	Andaman & Nicobar Islands, Andhra Pradesh, Karnataka, Kerala, Puducherry, Tamil Nadu, and Telangana	Bihar, Jharkhand, Odisha, and West Bengal	Dadra & Nagar Haveli, Daman & Diu, Goa, Gujarat, Lakshadweep, and Maharashtra	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura	Chhattisgarh, Madhya Pradesh, Uttarakhand, and Uttar Pradesh

Prevalence of morbidity

Prevalence of morbidity has been calculated for reporting of acute and chronic ailments separately by individuals. Reporting is also calculated for reporting of both acute and chronic or either acute or chronic, to get the overall morbidity status. Prevalence rate is also calculated for reporting of disease-specific morbidity and clubbed into five broad categories in alignment with WHO International Classification of Diseases - 10. The five broad categories are Infectious Diseases, Cardiovascular Diseases (CVDs), Non-communicable Diseases (NCDs), Disabilities, and Other Diseases. At the state level of Assam, unit level data has also been used to calculate prevalence of morbidity by different social determinants which affects reporting of morbidity and reporting of diseases specific morbidity for hospitalization cases and for spell of ailment. The social determinants have been categorized into three broad categories: Demographic, Socio-Economic and Geographic factors.

Table 3.2: Social Determinants of Health

Broad Categories for Social Determinants	Social Determinants
Demographic Characteristics	Gender, Age, Marital Status, Social Group and Religion
Socio-Economic Factors	Wealth Quintile, Education, Household Size, Activity Status, Sanitation, Drinking water and Coverage under Health Insurance
Geographic Factors	Place of Residence (rural and urban) and NSS State Regions

Source: Authors classification

Prevalence of self-reported morbidity is calculated in terms of number of persons reporting morbidity per thousand population. Weights were assigned to the samples to estimate the prevalence of morbidity at the population level. The weights assigned to make the estimation at population level were the pre-assigned weights provided by NSSO for each round. All statistical and econometric analysis was carried out in STATA 17.

The prevalence of morbidity per thousand population is calculated by the following formula:

$$Pi = \frac{Mi}{Ti} \times 1000 \text{ ----------(I)}$$

Where,

Mi =Number of persons with a particular ailment

Ti=Total number of persons alive in the sample households

For the analysis of reporting of morbidity by socioeconomic determinants, we rely on binary logistic regression and for the reporting of disease-specific morbidity we rely on multivariate logistic regression. The details of the dependent and independent variable along with the model specification has been discussed in chapters 5.

Table 3.3: List of Estimations carried out to fulfil Research Objective I using Secondary Data

Research Question	Estimates Carried Out
Research Question 1	• Morbidity prevalence per 1000 population, Acute & Chronic Ailment, Indian States, NSSO 71st& 75th Rounds.
Research Question 2	• Prevalence of Disease-specific Morbidity per 1000 population, Hospitalization & Spell of Ailment, Indian States, NSSO 71st& 75th Rounds. • Specific diseases reported under each broad category of diseases for hospitalization and spell of ailment.
Research Question 3	• Prevalence of Morbidity per 1000 population, Acute & Chronic, by Socio-economic Variables, Assam, NSSO 71st& 75th Rounds. • Prevalence of Disease-specific Morbidity per 1000 population, for Hospitalization & Spell of Ailment, Assam, NSSO 71st& 75th Rounds. • Binary Logistic Regression, Prevalence of Morbidity by social determinants, Assam, NSSO 71st& 75th Rounds. • Multivariate Logistic Regression, Prevalence of Disease-specific Morbidities by social determinants, Hospitalization & Spell of Ailment, Assam, NSSO 71st& 75th Rounds.

3.3 Research Design for Quantitative and Qualitative Primary data

3.3.1 Quantitative research design for the primary data

The primary data collected for the study is basically on self-reported morbidity of the tea plantation workers and other household members of the tea plantation workers. Data on type of diseases being reported by the workers were also collected to understand the overall

disease profile. Further to understand the burden of various risk factors and social determinants affecting reporting of morbidity of the workers, information various social, demographic factors along with tobacco use, alcohol consumption and diet of the tea plantation workers were collected. Secondly, the study also collected data on height and weight of the respondent workers to calculate the BMI of the workers.

Survey Design

For the study, the districts of Dibrugarh, Tinsukia, Jorhat and Sibsagar (which is broadly comes under the Eastern Plains region by NSS region classification) were selected for the survey of morbidity of tea plantation workers of Assam. All the four districts are situated on the Southern bank of Brahmaputra River valley and are contagious districts in upper Assam. The districts were selected based on the dominance of tea cultivation by districts. Dibrugarh has the highest number of tea gardens in Assam (177) followed by Tinsukia (122). The results and the analysis of the quantitative survey of the primary data has been discussed in chapter 6 of the thesis.

General Note on Survey Districts

Table 3.4: General Profile of the Survey Districts

Districts	Area covered	Population (2011 census)	Literacy Rate (2011 census)	Area under Tea Cultivation (2021)
Dibrugarh	3381 sq km	1326335	76.05	53381 hect.
Tinsukia	3790 sq km	1327929	69.66	57009 hect.
Sibsagar	1581 sq km	692435	84.49	15140 hect.
Jorhat	1758 sq km	924952	82.78	26498 hect.

Source: Statistical Handbook of Assam 2022

Table 3.5: Medical & Paramedical Personnel Under Government Sector, 2021-22

Districts	Doctors		Pharmacist		Nurse (ANM)		Midwives (GNM)	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Dibrugarh	128	25	33	11	143	10	93	10
Tinsukia	122	28	28	20	169	21	178	22
Sibsagar	118	27	35	9	142	19	98	11
Jorhat	76	23	40	11	150	16	143	18

Source: Statistical Handbook of Assam 2022

Table 3.6: Healthcare Facilities in the Survey Districts, 2021-22

Districts	State Govt. Medical College Hospital	No. Civil Hospital	S.D.C.H.	F.R.U.	Sub-centers	Community Health Centres (Rural)	Primary Health Centres (Rural)	Poly Clinic/Nursing Home	Diagnostic Centres
Dibrugarh	1	1	0	0	166	8	19	22	10
Tinsukia	0	0	0	0	234	10	21	24	34
Sibsagar	0	1	1	0	173	2	27	9	11
Jorhat	1	0	2	1	105	6	25	22	23

S.D.C.H = Sub Divisional Civil Hospital; F.R.U. = First Referral Units

Source: Statistical Handbook Assam, 2022

The survey was carried at the household level in the tea estates line quarters having at least one member of the family working as tea plantation worker. Basic household level information was collected: demographic details of all the household members, sources of household income and consumption-expenditure (food and non-food), household level information on drinking water source and sanitation. Self-reported morbidity details were collected for: both short duration ailment (acute ailment) and chronic ailment and reporting of hospitalization for all the members of the household. At the tea plantation workers level, detailed information on reporting of morbidity (both short duration ailment and chronic ailment) and reporting of hospitalization along with the corresponding type of disease being reported by the workers were collected. It is to be noted, proxy reporting of morbidity of the sample population was considered as, NSSO too rely on proxy reporting of morbidity surveys.

Sample Frame

The sampling for the primary survey was done in three stages. The first stage unit (FSU) are the tea cultivation dominated districts (Dibrugarh, Tinsukia, Jorhat and Sibsagar). Second stage unit (SSU) are the sample tea estates for each of the districts. Sample estates were chosen by the method of systematic random sampling based on list provided by the Office of Assistant Labour Commissioner, Government of Assam for each district. The ultimate stage units (USU) are the households. Households in each sample tea estate were chosen by the method of simple

random sampling. At each stage, random sampling based on probability proportional to size of sample with replacement was followed.

Cochran's equation was used for determination of sample size for unknown population.

$\boldsymbol{n_0 = \frac{Z^2 pq}{e^2}}$;

Where $\boldsymbol{n_0}$ is the sample size,

$\boldsymbol{Z^2}$ is the abscissa of the normal curve that cuts off an area $\propto$ at the tails,

$(\boldsymbol{1-\propto})$ equals the desired confidence level e.g., 95%

$\boldsymbol{e}$ is the desired level of precision,

$\boldsymbol{p}$ is the estimated proportion of an attribute that is present in the population and $\boldsymbol{q}$ is $\boldsymbol{1-p}$. The value for $\boldsymbol{Z}$ is found in statistical tables which contain the area under the normal curve e.g., *Z = 1.96 for 95 % confidence level*.

Allotment of sample tea estates in the districts: The sample tea gardens from the sample districts are not highly skewed as tea community workers follow a typical lifestyle in the garden areas. Therefore, it is assumed a response distribution of about 95 %. Following Cochran's formula at a 5 % margin of error and 95 % confidence interval the minimum sample size of the number of tea gardens that can be surveyed was calculated. Accordingly, the number of tea gardens at the district level was decided.

Allotment of sample households in the tea estates: For the allotment of households in the sample tea gardens similar procedure of selection has been followed. However, the margin of error was fixed at 3 % at 95 % confidence interval. Because of the spatial differences among the survey districts, it is expected some skewness of information collected at the household level. Therefore, the response distribution was fixed at a benchmark minimum of 50 %.

Accordingly minimum sample size of the number of households that can be surveyed was calculated.

Highlights of the Survey Schedule

The survey schedule has been prepared according to the objective to the study. The survey schedule is basically divided into two parts: first part focuses on information collected at household level. The second part focuses on specifically on the information collected at tea plantation worker's level.

Reference Period considered for Morbidity data collection for the survey

For morbidity data collection, the reference period was taken as 30 days for short duration ailments (acute ailment), more than 30 days for chronic ailment and 365 days for hospitalization cases.

Disease list followed for collection of data on type of disease reported for the survey

The study followed the same list of 63 different types of disease or ailment as provided by latest NSSO 75th round for the survey along with four new additions. Additions made are: Infectious – Covid 19; CVDs – Hypotension (low blood pressure); NCDs – Piles; Others – Post Covid Vaccination Fever.

Household Level information collected

At the household level, basic household level information was collected for

Demographic Details: Age, Gender, Marital Status, Education level, Occupation Status, Activity Status, Household Size and Religion for all the members of the household were collected.

Source of Household Consumption-Expenditure (on monthly basis) was collected for: Food items: Grocery, Fruits & Vegetables, Egg/Fish/Meat and Dairy; and Non-Food items: Medical

expenditure, Education, Electricity, Cooking Fuel, House Rent, Mobile/TV/News Paper recharge, Transportation, Repayment of loan and Miscellaneous

Household level information on: Source of drinking water and sanitation

Self-Reported morbidity details for all the members of the household: Self-reported morbidity details were collected for short duration ailment (acute ailment), chronic ailment and reporting of hospitalization for all the individuals of the household according to the reference period respectively.

Information collected at Tea Plantation Worker's level

Self-Reported morbidity details of the workers: Self-reported morbidity details were collected for short duration ailment (acute ailment), chronic ailment and reporting of hospitalization for all the tea garden workers surveyed along with the corresponding type of disease reported for acute, chronic ailment and hospitalization.

Healthcare details of the workers: For the type of ailment reported by the workers the corresponding details of weather seeking medical advice and source of treatment for the respective ailment reported were collected for the tea garden workers. Apart from this, data on nearest health care facility outside the tea estate of the sampled tea plantation workers household was collected.

Occupational Details: Data on type of worker (Permanent or Temporary tea plantation worker), type of work done (tea plucking, factory worker etc) and type of occupational hazard faced by the workers were also collected as it has direct implication on health for all the tea garden workers surveyed.

Anthropometric Measures: Data on anthropometric measures of the plantation workers were collected. Height of the workers (in cm.) and weight of the workers (in kg) were collected to calculate the body mass index (BMI) of the workers to see the nutritional linkage with health.

Dietary Intake: Data on dietary intake of the workers along with consumption of smocking, tobacco and alcohol was collected to understand the nutrition linkage. Data on frequency (number of meals) taken by the worker per day was collected. Apart from this, frequency of consumption (Daily, Weekly, Occasionally, Never) of different food groups by the workers (viz. Staples, Pulses and beans, Potatoes & Onions, Non-leafy vegetables, green leafy vegetables, fruits, milk/dairy products, egg, fish, meat, packaged food, edible oil, and beverages) along with smoking, tobacco and alcohol consumption by the worker was collected. Information on 24-hour recall of food items consumed by the workers just before the day of survey was also collected.

3.3.2 Methods used for analysis of quantitative primary data

Primary data of morbidity reporting was collected at household level for all the individuals of the household. Simple "yes" and "no" questions were asked for acute ailment reported by the individuals for a reference period of one month (or thirty days) on the date of survey. Similarly simple "yes" and "no" questions were asked for chronic ailment reported by the individuals for a reference period of more than one month and a year on the date of survey. Hospitalization cases were also recorded with simple "yes" and "no" questions for a reference period of one year (or 365 days).

Reporting of morbidity was calculated by hundred persons of the population. Prevalence of morbidity was calculated for the sample population at per 100 persons. For the analysis of reporting of morbidity (both reporting of acute ailment and reporting of chronic ailment) *ten social determinants were considered*. Under ***demographic characteristics*** gender, age (age groups considered), marital status (which includes never married, widowed, and divorced/separated) and religion (Hindus and others group, which includes Christians, Muslims, and Buddhist) was considered. Under ***socioeconomic factors*** education, occupation status, activity status, household size, source of drinking water and sanitation was considered.

For the analysis of reporting of morbidity by social determinants, we have considered binary logistic regression both for reporting of morbidity at sample population level and reporting of morbidity at tea plantation worker's level. The dependent and independent variables considered for the model have been discussed in details in chapter 6

Self-Reported morbidity by Social Determinates by Tea Plantation Workers

For the analysis of reporting of morbidity (both reporting of acute ailment and reporting of chronic ailment) at tea plantation workers level, *nineteen social determinates have been considered*. Under ***demographic characteristics*** gender, age, marital status, and religion. Under ***socioeconomic factors*** education, occupation status, household size and sanitation have been considered. For ***nutritional*** linkage we have considered BMI category (low, normal, overweight, obese) and BMI category (low and normal & above). For food intake number of food groups consumed daily; secondly, daily consumption of at least four food groups have been considered, next we have considered consumption of pulses, egg/fish/meat, beverage and intoxicant daily. For ***workplace hazard*** we have considered number of workplace hazard reported and secondly at least one workplace hazard reported. Reporting was calculated for per hundred population.

Table 3.7: List of Estimations carried out to fulfil Research Objective II using Primary Data

Research Question	***Estimates Carried Out***
Descriptive Statistics of the Sample Population	• Gender, Age, Education, Occupation Status and Activity Status of sample population
Research Question 4 and Research Question 6	• Reporting of Morbidity (Acute, Chronic and Hospitalization) by all Household members of Tea plantation workers; • Prevalence of Morbidity per 100 by demographic and socio-economic characteristics by household members; • Binary Logistic Regression for Prevalence of Morbidity by Demographic and Socio-economic Variables by Household members; • Reporting of Morbidity (Acute, Chronic and Hospitalization) by Tea plantation workers; • Diseases Reported (Acute, Chronic & Hospitalization) by Tea plantation workers.
Research Question 5	• Anthropometric Profile of the Tea plantation workers (BMI calculation); • Dietary Intake of the Workers (Frequency or number of meals; Frequency of Different Types of Food Groups Consumed by the Workers; Dietary Diversity Score; 24-hour recall); • Workplace Hazards (Nature of Work, Number of Workplace Hazard, Type of hazard); • Prevalence of Morbidity per 100 by demographic, socio-economic characteristics, BMI category, food intake and workplace hazard by Tea plantation workers; • Binary Logistic Regression for Prevalence of Morbidity by demographic, socio-economic characteristics, BMI category, food intake and Workplace hazard by Tea plantation workers

3.3.3 Qualitative research design for primary data

The qualitative survey for in-depth interview basically had three main schedules, which were semi structured and open ended. Health facilitators from 10 tea estates were interviewed through semi-structured open-ended questionnaires. The health facilitators included ASHA workers, ANMs, GNMs, doctors, pharmacists and health assistants working in the tea estate hospitals/dispensaries.

Basic information regarding the tea estate

This schedule mainly comprised of basic details of the respondent who was interviewed for the in-depth interview. The second part consists of basic details about the tea estate in terms of total families residing in the tea estate, number of line quarters, number of AWC within the tea estate, availability of crèche facility for children of the tea plantation workers, primary schools within the tea estate and main source of water. Third part of the schedule, comprised of open-ended question based on healthcare facilities available within the tea estates. This included information on health care facilities available in the tea estate provided by tea garden management, any government health care facility within the tea garden (like government dispensary/sub center), availability of health workforce at the tea garden health care facility, medical facilities provided by tea garden management (both for permanent and temporary workers). Health care facilities in terms of types of medical facilities (both for outpatient and inpatient available within the tea estate). Types of disease reported, cases frequently reported at the health care facility within the tea estates were collected from the health facilitators in the tea estate. Lastly, overall general observation about the tea estate was also noted during the field study.

Interview guide for health personal (trained) in the health facilities of tea garden areas

The main aim of this open-ended schedule (interview guide) was to understand the overall health and nutrition status of the tea plantation workers and as a whole of the community. The broad themes for the interview guide are: Reporting of morbidity by tea plantation workers; Reporting of disease specific morbidity among tea plantation workers; Morbidity- Nutrition linkage (nutrition-disease linkage and nutrition security &disease linkage); Reporting of disease-specific morbidity affected by various socio-economic variables; Reporting of disease-specific morbidity affected by various socio-cultural variables; Role of public health in the tea garden areas; constraints and challenges in health care facilities

in tea garden areas; and provision of health care facilities for permanent and temporary tea plantation workers.

Interview guide for MMU service in tea estates

Initial findings from the above mentioned two interview guides for the qualitative study, one point came to light. The importance of Mobile Medical Unit (MMU) in providing health care facilities in the remote tea garden area. Therefore, based on this, telephonic interview with the same health personals of the sample tea gardens in Tinsukia district was carries out to understand the role, importance, and availability of MMU service in the tea garden areas. The broad themes under the interview guide are: Regularity, availability, and timing of the service; Nature of services provided; Coordination of MMU staff with health workers in tea garden area; Benefit and people's opinion about the MMU service.

Chapter 4 Morbidity Prevalence and Diseases-Specific Morbidity in India

This chapter discusses the status of morbidity in Indian states based on the 71st and 75th rounds (2014 to 2017-18) of NSSO. It discusses the levels and pattern of acute, chronic, and overall morbidity in different Indian states. Morbidity by different diseases and disease groups is also discussed in this chapter. Section 4.1 discusses overall morbidity in India and by six different state regions. Section 4.2 classified the state regions by disease prevalence. Section 4.3 compares the morbidity and disease prevalence patterns emerging from the analysis. The chapter also discusses the limitations of using NSSO unit level data.

4.1 Prevalence of Morbidity and Disease-Specific Morbidity by Geographical Regions in India

4.1.1 Overall morbidity status

As already discussed in the previous chapters, NSSO collects data on SRM for two reference periods: (a) A period of 15 days for any ailment, other than chronic and (b) A period of more than one month or 30 days for chronic ailment. From now on in the chapter, any ailment, in the reference *period of 15 days* will be termed as *acute ailment*. We have estimated overall morbidity in the population by combining the reporting of acute and chronic ailments.

At the all-India level, overall morbidity reporting in terms of prevalence per 1000 persons stands at 100 (10 percent) and 76 (7.6 percent) respectively in 71st and 75th rounds (table 4.1). Between the 71st and 75th rounds, reporting of morbidity has declined in all Indian States.

In Chapter 2 we have discussed important definitional change that occurred between the 60th and 71st rounds with respect to persons counted under the disease group *disability*. Prior to the 71st round, all persons ailing from disabilities, even if not acquired during the reference period of 365 days, were counted as suffering from disability ailment. However, from

the 71st round, only those persons who acquired disabilities *during the reference period* were counted. The above definitional change may impact comparability of morbidity status in 71st and 75th rounds with the earlier rounds.

At the state-level, few states and union territories have shown a slight rise in morbidity status from the 71st to 75th round. States that have shown a rise in morbidity levels are Delhi, Himachal Pradesh and Jammu & Kashmir in the Northern region; Jharkhand in the Eastern region; Maharashtra in the Western region; Chhattisgarh and Uttar Pradesh in the Central region and Mizoram in the North Eastern region. Rest of the states and union territories (UTs) have registered decline in prevalence of morbidity. Kerala (326 and 256 per 1000 persons, 71st and 75th round respectively) remains the highest reporting state in both the rounds and Assam one of the lowest (33 and 25 per 1000 persons for 71st and 75th rounds respectively).

Table 4.1: Reporting of Morbidity (Acute or Chronic), Indian states, NSS 71st and 75th Round

States	71st Round		75th Round	
	Per 1000 Person	Percent	Per 1000 Person	Percent
Northern States				
Chandigarh	134	13.4	94	9.4
Delhi	40	4.0	60	6.0
Haryana	63	6.3	59	5.9
Himachal Pradesh	80	8.0	103	10.3
Jammu & Kashmir	59	5.9	72	7.2
Punjab	169	16.9	113	11.3
Rajasthan	62	6.2	49	4.9
Southern States				
Andaman & Nicobar	184	18.4	86	8.6
Andhra Pradesh	174	17.4	144	14.4
Karnataka	99	9.9	43	4.3
Kerala	326	32.6	256	25.6
Puducherry	222	22.2	22	2.2
Tamil Nadu	170	17.0	61	6.1
Telangana	98	9.8	56	5.6
Eastern States				
Bihar	59	5.9	25	2.5
Jharkhand	62	6.2	67	6.7
Odisha	104	10.4	93	9.3
West Bengal	172	17.2	139	13.9
Western States				
D & N Haveli	106	10.6	63	6.3

Daman & Diu	175	17.5	33	3.3
Goa	181	18.1	59	5.9
Gujarat	100	10.0	68	6.8
Lakshadweep	235	23.5	106	10.6
Maharashtra	77	7.7	88	8.8
North Eastern States				
Arunachal Pradesh	88	8.8	29	2.9
Assam	33	3.3	25	2.5
Manipur	19	1.9	19	1.9
Meghalaya	31	3.1	4	0.4
Mizoram	28	2.8	34	3.4
Nagaland	28	2.8	8	0.8
Sikkim	41	4.1	34	3.4
Tripura	39	3.9	31	3.1
Central States				
Chhattisgarh	41	4.1	49	4.9
Madhya Pradesh	59	5.9	40	4.0
Uttarakhand	86	8.6	35	3.5
Uttar Pradesh	73	7.3	75	7.5
India	**100**	**10.0**	**76**	**7.6**

Source: Estimated from unit level data of NSS 71st and 75th rounds.

4.1.2 Prevalence of Acute and Chronic morbidity

Estimates of prevalence of acute and chronic ailment separately show, while overall there has been a decline in both acute and chronic ailments, there are a few exceptions.[12] Acute ailment reporting has increased in Delhi, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Jharkhand, Mizoram, Chhattisgarh, and Uttar Pradesh. Chronic ailment reporting has increased in Chandigarh, Delhi, Himachal Pradesh, Odisha, Maharashtra, Mizoram, and Chhattisgarh. Prevalence of acute morbidity stands at 52 persons and chronic morbidity 48 persons per 1000 population at the all-India level in the 71st round (Table A 4.2 and figures 4-1 and 4-3). Among major states, highest acute ailment reporting is in Kerala (118 persons per 1000 population), followed by Punjab, Goa, and West Bengal. Assam is on the lower side of reporting ailment (25 persons per 1000 population). Other major states reporting low morbidity prevalence are

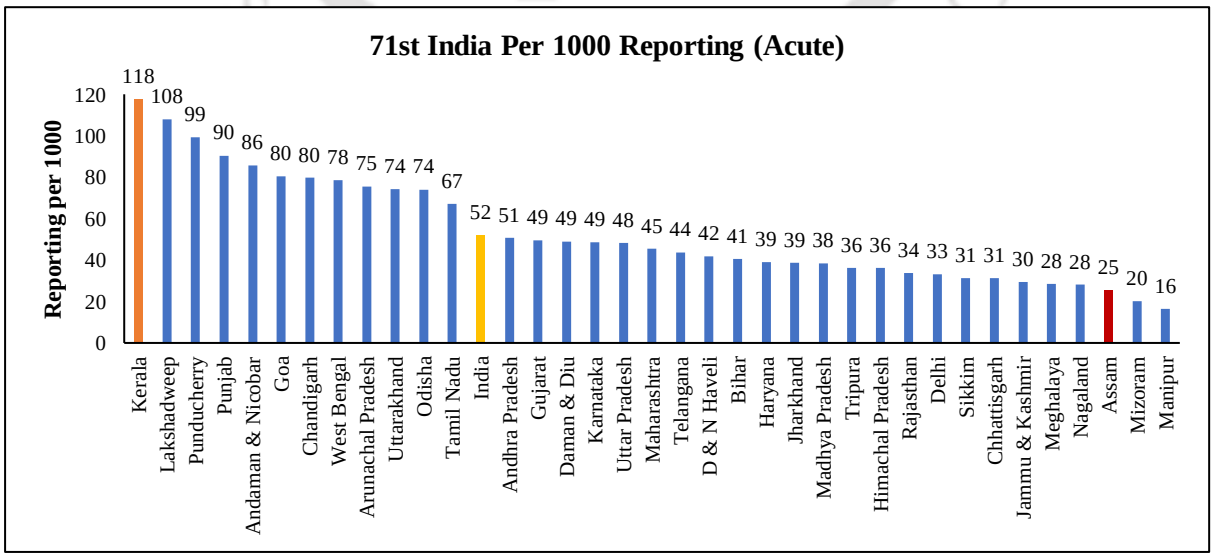
[12] Estimates in Table A 4.2, Appendix to chapter 4.

Jammu & Kashmir, Rajasthan, Chhattisgarh, and the North Eastern states of Nagaland, Manipur, and Meghalaya.

Chronic ailment reporting is also highest in Kerala (208 persons per 1000 population) followed by Andhra Pradesh and Tamil Nadu. Even for chronic ailments, Assam has very low reporting rate (8 persons per 1000 population). Other major states which have low reporting of chronic ailments are Bihar, Uttarakhand, Chhattisgarh, and all the other North Eastern states.

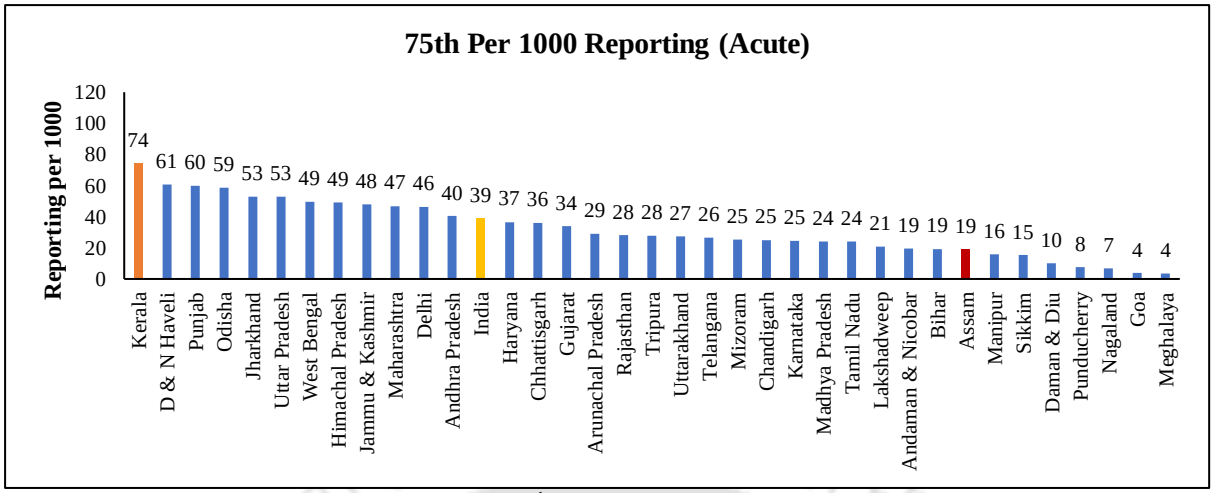
In the 75th round, prevalence of acute morbidity is 39 persons and chronic morbidity 37 persons per 1000 population at the all-India level (Table A 4.2 and Figure 4-2 and 4-4). Kerala (74 persons per 1000 population), followed by Punjab, Odisha, Jharkhand, and Uttar Pradesh have highest reporting of acute ailment. Assam is again on the lower side of reporting ailment (19 persons per 1000 population). Other major states reporting low morbidity prevalence are Bihar, Goa, Nagaland, Manipur, and Meghalaya. Chronic ailment reporting is highest in Kerala (181 persons per 1000 population) followed by Andhra Pradesh and West Bengal. Here too, Assam has very low reporting rate (6 persons per 1000 population) as well as Bihar, Uttarakhand and other North Eastern states.

Figure 4-1: Reporting of Acute Morbidity per 1000 population, Indian states, NSS 71st Round



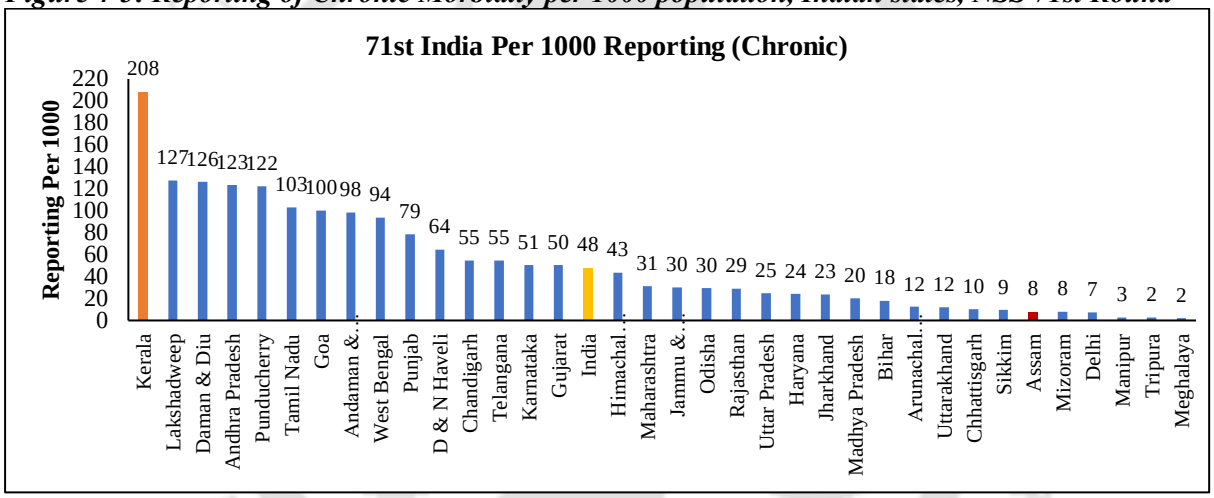
Source: Estimated from unit level data of NSS 71st round

Figure 4-2: Reporting of Acute Morbidity per 1000 population, Indian states, NSS 75th Round



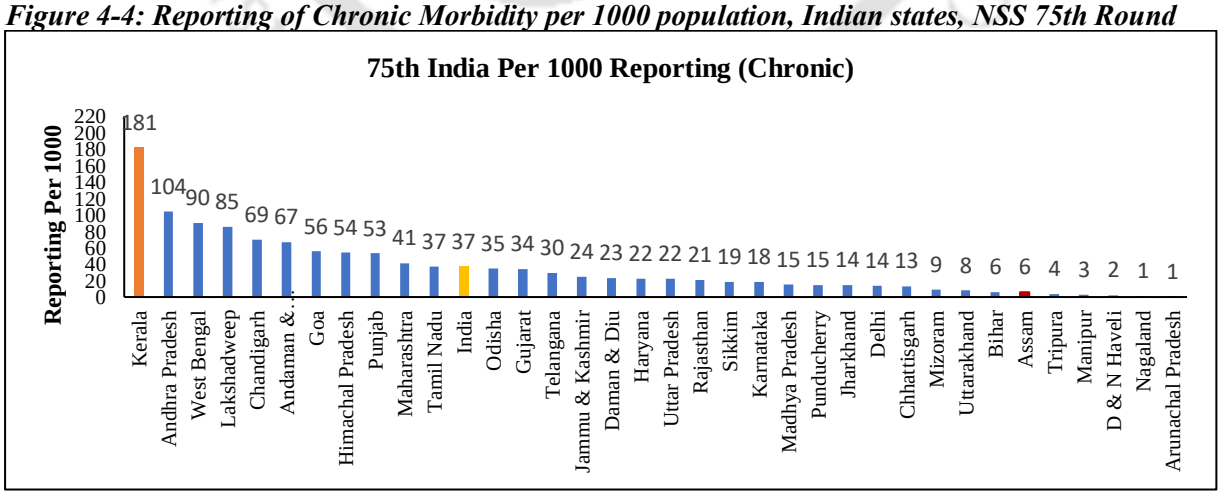
Source: Estimated from unit level data of NSS 75th round

Figure 4-3: Reporting of Chronic Morbidity per 1000 population, Indian states, NSS 71st Round



Source: Estimated from unit level data of NSS 71st round

Figure 4-4: Reporting of Chronic Morbidity per 1000 population, Indian states, NSS 75th Round



Source: Estimated from unit level data of NSS 75th round

Let us summarise the above findings. Between 2014 and 2017, overall morbidity reporting in India and states have declined. Past studies such as Paul & Singh (2017) estimated rise in morbidity reporting between the 52nd (1996), 60th (2004), and 71st (2014) rounds. It is important to re-iterate that except 52nd and 75th rounds, all other are thin rounds. Some of the more developed states such as Kerala and Andhra Pradesh show higher levels of chronic morbidity. Kerala is an outlier state in terms of high morbidity reporting. Assam and all the other North Eastern states have always had low reporting. Lastly, due to the definitional change in the ailment category *disability*, the NSS estimates of earlier rounds are not strictly comparable with that of the 71st and 75th rounds. The southern states have higher prevalence of chronic morbidity than the other regions of India.

4.2 Disease-Specific Morbidity in India

NSSO provides disease specific morbidity information by hospitalisation cases and by spell of ailment. Hospitalisation cases are for a 365 days reference period and spell of ailment are for a 15 days reference period. This section discusses disease specific morbidity per 1000 persons based on all the hospitalization cases. Disease-specific morbidity prevalence by hospitalisation cases indicate the disease profile of the population as well as the burden on the health sector of respective states. There are five broad disease categories under which we have discussed disease-specific morbidity. The five broad categories are in alignment with ICD-10. They are: Non-communicable diseases (NCDs), Infectious Diseases, Cardiovascular Diseases (CVDs), Disability and Other diseases.

4.2.1 Regional differences by hospitalization cases

Among all five categories of diseases, the prevalence of *other diseases* is highest among most Indian states. Some of the diseases listed under *other diseases* category are: fevers (which include malaria, typhoid and fever of unknown origin, fevers that do not have confirmed diagnosis), pain in abdomen (gastric and peptic ulcers/ acid reflux/ acute abdomen) etc.

In most states, prevalence of NCDs is higher than infectious diseases (Table 4.2, 71st round). Here too, Kerala has highest reporting. In North Eastern region (NER), except Mizoram and Sikkim, there is either equal prevalence or higher prevalence of infectious diseases compared to NCDs, indicating dual nature of disease prevalence. It is noteworthy that both Mizoram and Sikkim have relatively higher literacy rates compared to rest of the NER states. The prevalence of CVDs is highest in the Southern states, along with Punjab in Northern region and Lakshadweep, Goa, Maharashtra, and Gujarat in Western Region; West Bengal in Eastern Region.

Disabilities also contribute a sizeable portion of disease prevalence especially in the Southern states. Prevalence of disability is lower than the all-India average in the North Eastern and Central states. Disabilities mainly include joint or bone disease and accidental injury. Joint or bone diseases are generally prevalent as lifestyle disease as well as among the aging population.

The 75th round (table 4.2) also shows similar pattern of disease prevalence in most of the states as in the 71st round. Overall, in the 75th round also highest prevalence is in the category of other diseases, followed by NCDs and disabilities. *The North Eastern however show higher concentration of infectious disease*.

Except the southern states which show slightly higher prevalence of non-communicable diseases, all other states clearly show a mix of all kinds of diseases. Hospitalisation is relatively higher for NCDs, Disabilities and Other Diseases in most states. However, a clear pattern emerges in particular reference to the NER states where hospitalsiation is relatively higher for infectious diseases as compared to the rest of the Indian states. Thus, we can conclude that Indian states are still undergoing an epidemiological transition, however there are regional differences as witnessed in the case of the NER.

Table 4.2: Reporting of Disease Specific Morbidity for Hospitalization Cases, Per 1000 population, State regions, 71st and 75th Rounds

All India Disease Specific Morbidity for Hospitalization (per 1000 population)											
State Region	**State Name**	**71st Round**					**75th Round**				
		Infections	**CVD**	**NCD**	**Dis-ability**	**Other**	**Infections**	**CVD**	**NCD**	**Dis-ability**	**Other**
NORTHERN STATES	Chandigarh	2	2	5	8	9	1	4	4	4	6
	Delhi	2	3	5	3	13	5	4	9	3	13
	Haryana	3	4	9	8	11	5	3	6	5	10
	Himachal Pradesh	9	4	13	11	13	6	5	10	9	13
	Jammu & Kashmir	4	4	8	6	5	4	2	5	5	7
	Punjab	2	5	10	6	11	4	4	8	7	8
	Rajasthan	3	3	9	7	10	3	3	6	5	7
SOUTHERN STATES	Andaman & Nicobar	12	8	14	13	13	13	6	13	8	9
	Andhra Pradesh	4	8	13	11	17	4	4	10	9	11
	Karnataka	5	5	10	10	14	3	3	5	7	12
	Kerala	9	18	33	23	37	9	15	25	20	33
	Pondicherry	4	7	16	15	11	5	4	4	7	11
	Tamil Nadu	5	7	16	11	15	3	3	7	6	12
	Telangana	2	6	8	11	12	2	2	4	5	9
EASTERN STATES	Bihar	2	2	8	5	4	2	1	4	3	2
	Jharkhand	2	1	5	4	6	2	1	4	3	3
	Odisha	6	3	7	7	12	7	3	8	6	9
	West Bengal	7	5	11	8	12	7	6	10	7	12
WESTERN STATES	D & N Haveli	7	0	13	9	15	1	2	2	2	19
	Daman & Diu	10	3	29	3	15	0	1	2	2	5
	Goa	2	9	11	10	6	3	7	19	7	10
	Gujarat	6	5	11	6	10	4	4	5	4	7
	Lakshadweep	8	26	17	17	14	4	12	18	9	13
	Maharashtra	4	5	11	9	13	4	4	8	6	9
NORTH EASTERN STATES	Arunachal Pradesh	7	1	5	4	14	16	1	7	4	7
	Assam	3	1	3	2	5	1	1	3	2	2
	Manipur	7	1	4	5	5	5	2	4	3	7
	Meghalaya	3	1	2	1	6	7	1	2	2	4
	Mizoram	3	1	6	4	11	6	1	6	5	9
	Nagaland	3	0	3	3	5	3	1	3	3	3
	Sikkim	3	2	6	4	7	5	4	5	5	9
	Tripura	9	5	5	6	22	11	4	5	5	28
CENTRAL STATES	Chhattisgarh	4	1	9	4	8	3	2	6	4	5
	Madhya Pradesh	4	3	8	6	7	4	3	4	5	6
	Uttarakhand	2	2	8	6	4	2	2	4	4	5
	Uttar Pradesh	3	2	8	5	7	3	2	6	4	7
	India	**4**	**4**	**10**	**7**	**11**	**4**	**3**	**7**	**6**	**9**

Note: Highest Reporting Second Highest Reporting

Source: Calculated from unit level data of NSS 71st and 75th round

Table A 4.3 in Appendix (both 71st and 75th rounds) to Chapter 4 provides the disease list in each of the broad disease categories in India and state regions. The figures in the table are in percentage. The percentage calculated is the number of cases reported for each type of disease divided by the total number of cases reported for hospitalization cases.

We find striking difference in the types of ailments contributing to infectious and non-communicable disease categories. In rest of the disease categories, not much difference is noted in the types of ailments across state regions. Figure 4-5 (for NSS 75th round) shows the top four ailments contributing to infectious diseases in India as well as in state regions.

In Assam, the top contributor to infectious diseases is diarrhoea/dysentery (42 percent), fever with rash (12 percent), fever with loss of consciousness (9.8 percent) and tuberculosis (9.5 percent) (the percentage calculate for figure 4-5 is the percentage of the particular type of disease contributing to total infectious diseases). In the NER as a whole, the same ailments appear as top contributors except tuberculosis. In the eastern region of India, diarrhoea/dysentery contribute to 47 percent of all infectious diseases. In rest of the regions, contribution of diarrhoea/dysentery to all infectious diseases is 25 percent or less. Acute upper respiratory infection ailment figures in the top four ailments list only in the southern region (11.2 percent) and eastern region (5.9 percent).

Irrespective of the regions under consideration, we observe that diarrheal diseases appear as one of the most frequent ailments reported under the list of infectious diseases in India. The WHO literature on diarrheal diseases clearly point to unhealthy sanitation and hygiene, lack of safe drinking water, unhygienic storage and cooking of food as prime causes of diarrheal diseases. Thus, while we do observe an epidemiological transition underway in most Indian states, fragile and vulnerable socioeconomic conditions surely contribute to morbidity status of Indian population. States such as Assam also show relatively higher prevalence of tuberculosis along with diarrheal diseases as compared to the other regions,

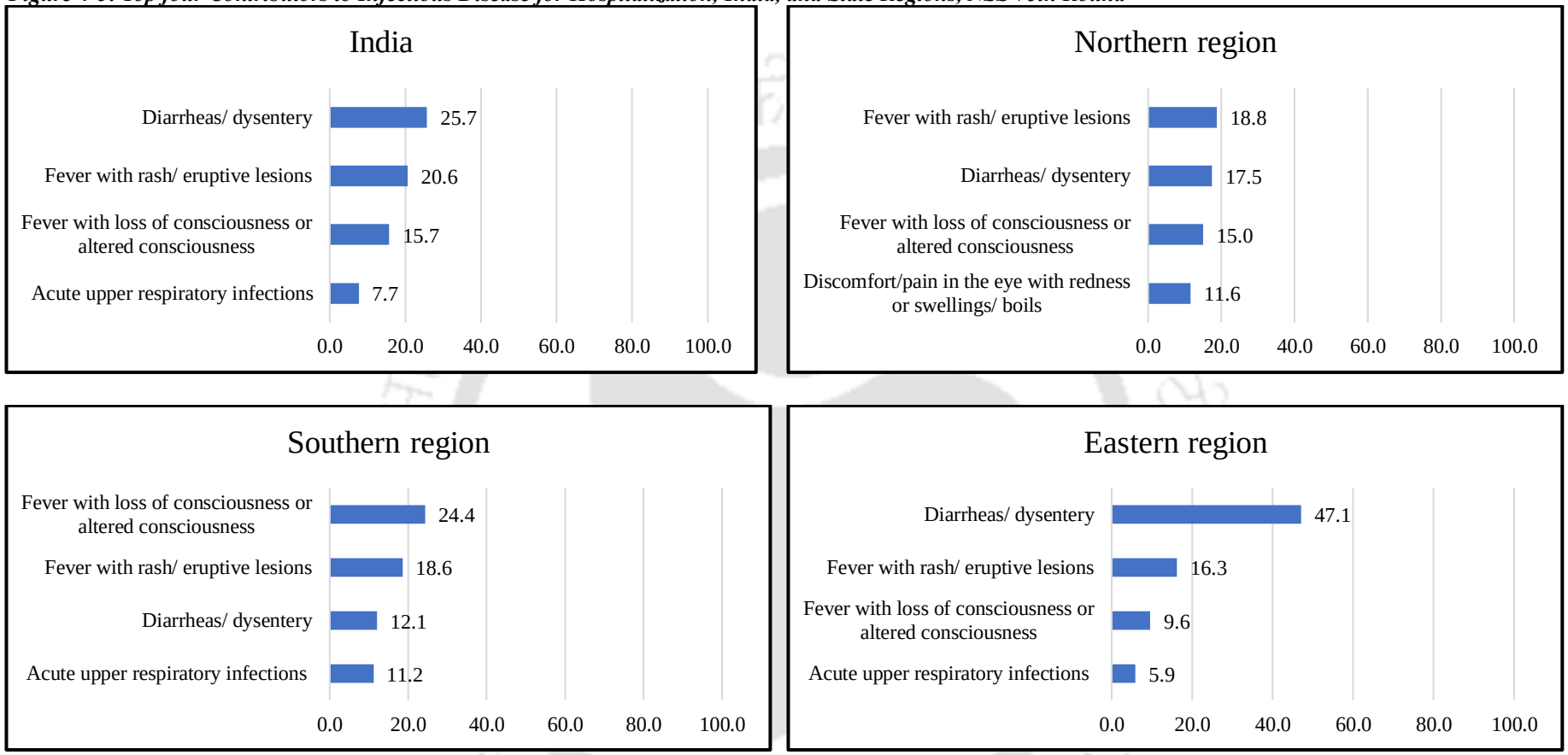
which indicates nutrition concerns. In this regard, the Eastern region of India also needs to be highlighted, due to the alarmingly higher prevalence of diarrheal diseases.

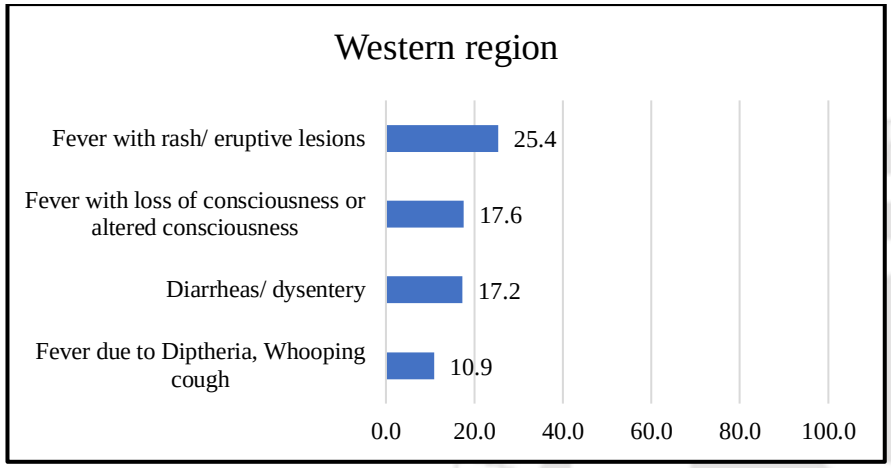
The NCDs reveal a mix picture (Figure 4-6). With jaundice and pregnancy with complications before or during labour being highest contributor in NER and Central region; which clearly shows the burden toward maternal and child health as well as nutritional status. Cancer and diabetes have been contributors in Northern and Southern regions respectively.

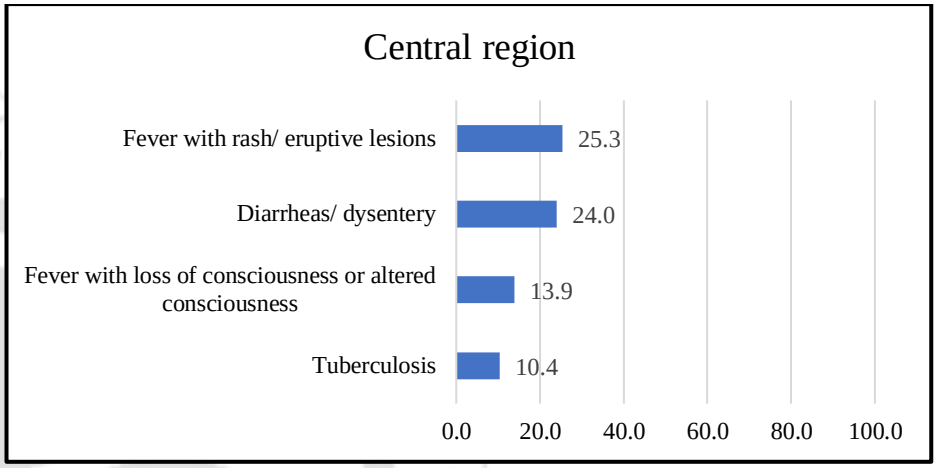
Figures 4-5 and 4-6 summarize and highlight the disease-specific morbidities prevalent in state regions for NSS 75th round. Among infectious list of disease, the Eastern and North Eastern Regions of India show prevalence of diseases that have nutrition linkages, such as diarrhoea. The Northern and Southern Region have lesser proportion of diarrhoea prevalence.

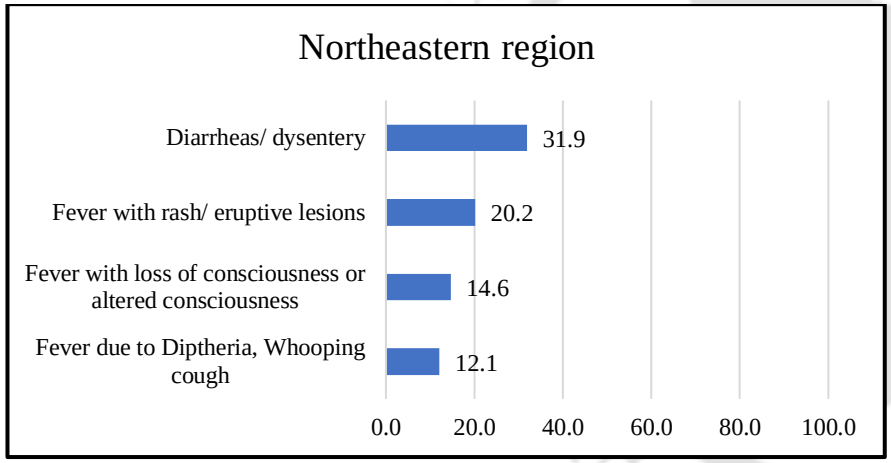
The prevalence of NCDs reveal a more mixed pattern. In India as a whole, proportions of ailing persons are more or less equally distributed between cancers, pregnancy complications, and bronchial asthma. It is worth highlighting however, that the high prevalence of pregnancy complications points to the poor state of maternal health during this stage of epidemiological transition. In the Northern region, cancer top the list. In the Southern region, diabetes and urination related problems are the biggest contributors. In the Eastern and Western regions, pregnancy complication and anaemia respectively. The nature of disease prevalence completely shifts as we move towards NER and Central region of India. We see the appearance of jaundice as one of the top contributors. In the NER as a whole, diabetes also emerges in the top four disease list indicating dual burden. However, in Assam, which is the focus of this research, we find overwhelming presence of jaundice, pregnancy complications, urination related issues and cataracts.

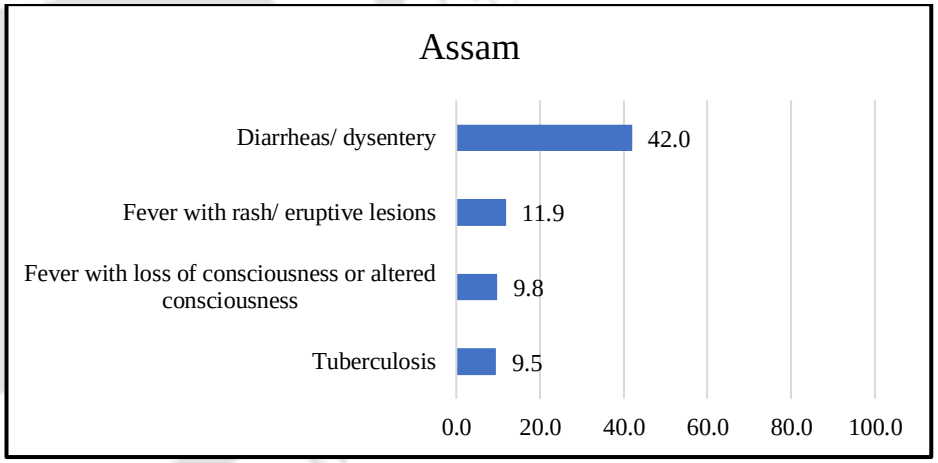
Figure 4-5: Top four Contributors to Infectious Disease for Hospitalization, India, and State Regions, NSS 75th Round





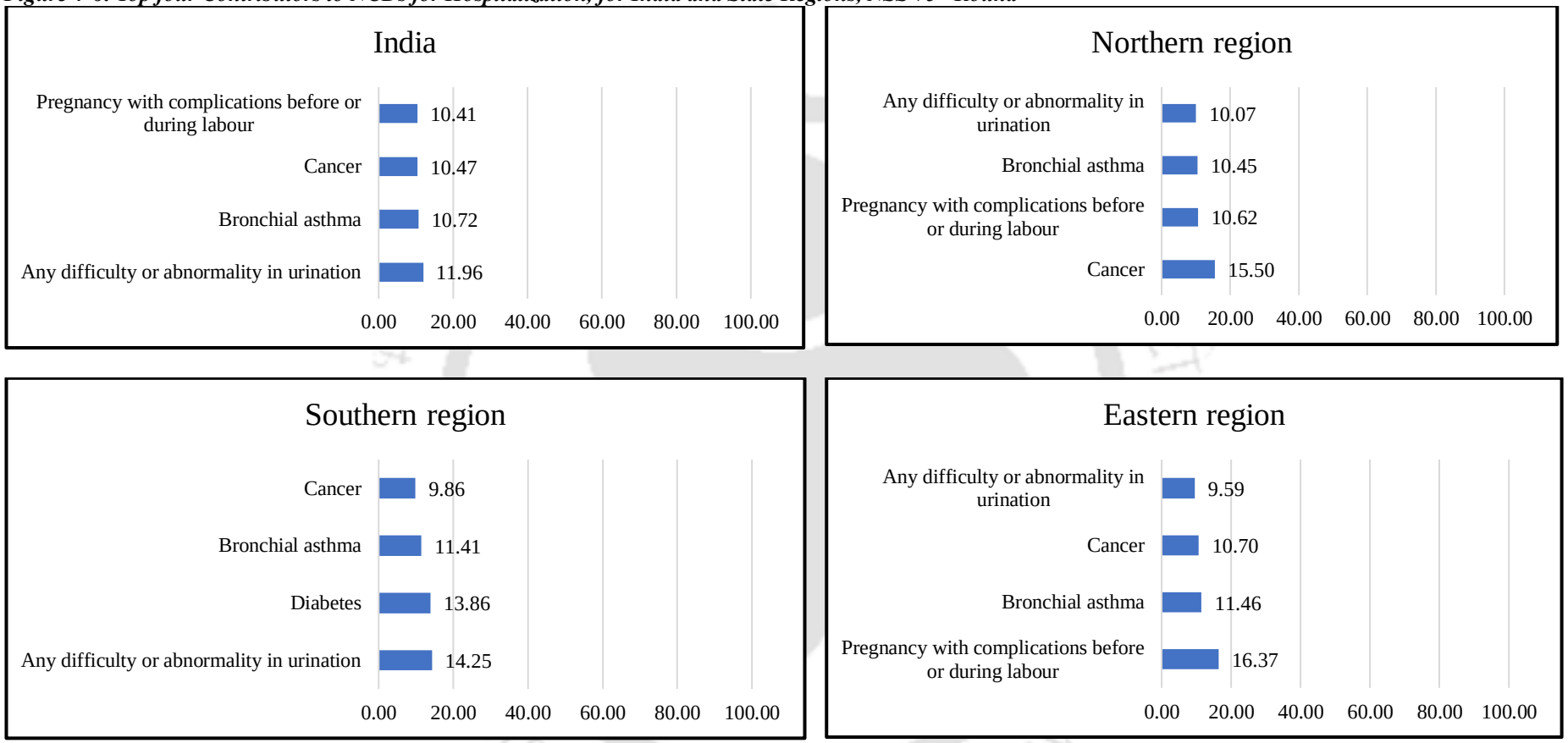


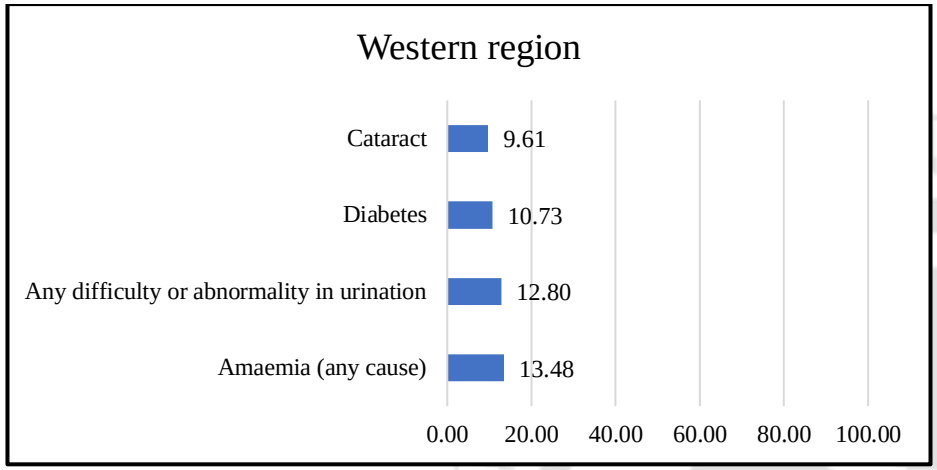


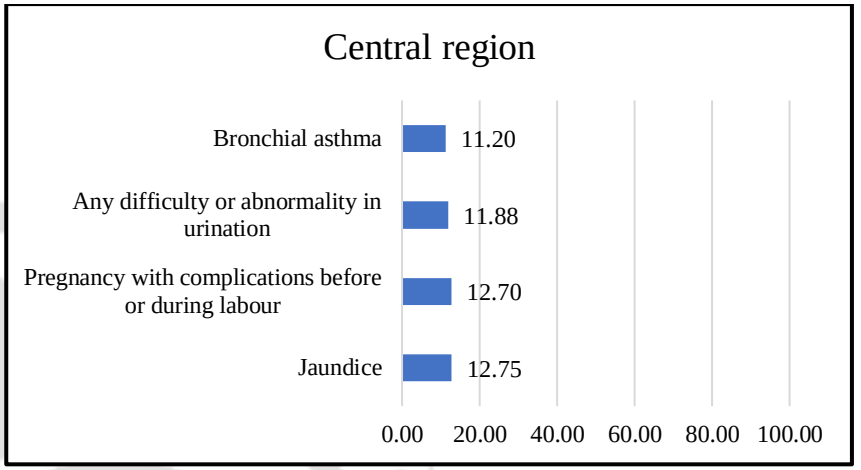


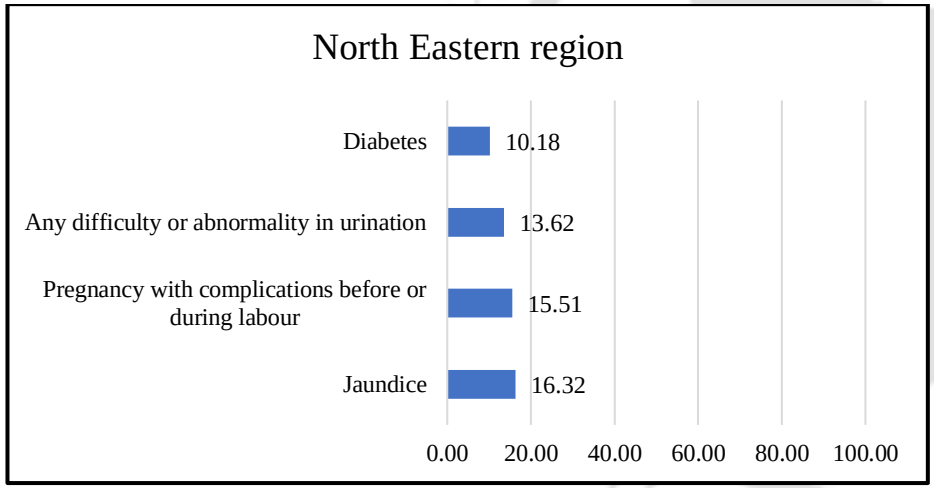
Source: Estimated from unit level data of NSS 75th round

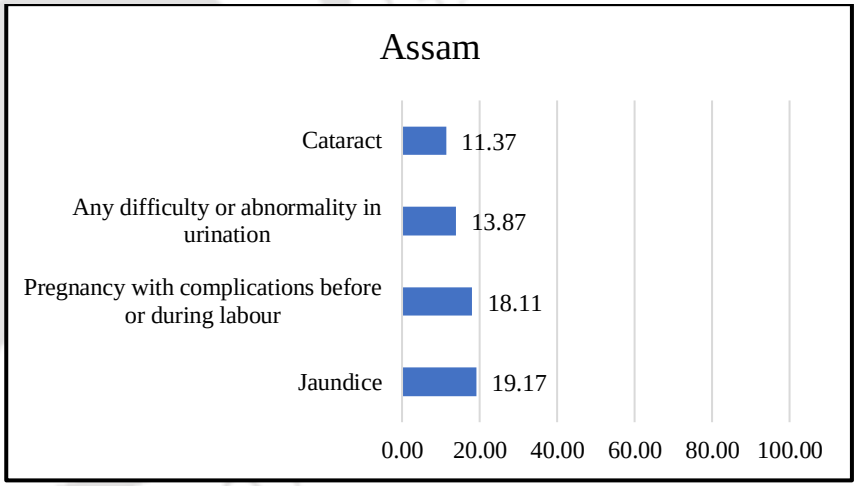
Figure 4-6: Top four Contributors to NCDs for Hospitalization, for India and State Regions, NSS 75th Round











Source: Estimated from unit level data of NSS 75th round

4.2.2 Regional Differences by Spell of Ailment

Disease specific morbidity for spell of ailment in the reference period of 15 days shows concentration in the categories of *infectious diseases* and *other diseases* in the 71st round in all state regions except the Southern states (Table 4.3). In the Southern states reporting is higher in the NCDs and CVDs category. At all India level as well as in the state level of Assam reporting is highest in the *other diseases* category followed by *infectious diseases*.

One of the reasons for higher reporting in the category of *infectious diseases* and *other diseases* may be due to the short reference and recall period of 15 days. However, despite the short recall period, the Southern states reveal a completely different pattern. Therefore, it can be concluded that the Southern states have truly moved forward in the process of epidemiological transition.

In the 75th round however, the pattern has slightly changed. While Southern states continue higher reporting of NCDs and CVDs, Delhi, Chandigarh, and Himachal Pradesh in the Northern region; West Bengal in Eastern region and Goa, Gujarat, and Lakshadweep in Western region have moved from higher reporting of infectious diseases to NCDs and CVDs. This shows slow but steady epidemiological transition in these states too. At all India level too, similar pattern can be seen with movement towards NCDs from infectious diseases. However, the North Eastern states, except for Sikkim, and the Central region states, report more infectious diseases. Clearly the NER and Central regions of India do not show a clear movement from communicable to NCDs.

Table 4.3: All India State Region wise Reporting of Disease Specific Morbidity for per 1000 persons for Spell of Ailment, (NSS 71st and 75th Round)

All India Disease Specific Morbidity for Spell of Ailment (per 1000 population)											
State Groups	State Name	71st Round					75th Round				
		Infectious	CVD	NCDs	Disability	Other	Infectious	CVD	NCDs	Disability	Other
NORTHERN STATES	Chandigarh	15	26	17	35	49	7	21	37	16	16
	Delhi	14	2	5	4	15	11	5	12	6	27
	Haryana	18	5	11	8	24	11	6	10	8	24
	Himachal Pradesh	17	12	15	25	15	19	17	26	15	29
	Jammu & Kashmir	14	13	5	20	8	32	13	9	7	12
	Punjab	33	30	30	31	45	37	19	20	17	22
	Rajasthan	18	2	16	10	17	13	6	8	9	15
SOUTHERN STATES	Andaman & Nicobar	71	37	21	41	27	13	28	33	8	5
	Andhra Pradesh	20	46	54	41	37	15	51	39	33	26
	Karnataka	19	19	19	19	25	7	10	9	6	13
	Kerala	39	82	102	65	81	25	83	93	47	46
	Pondicherry	44	52	78	30	43	2	6	9	3	5
	Tamil Nadu	25	32	58	29	37	5	12	26	7	14
	Telangana	10	24	14	19	32	6	12	14	8	17
EASTERN STATES	Bihar	21	3	5	11	18	8	0	2	3	11
	Jharkhand	15	3	13	13	20	21	4	7	8	28
	Odisha	25	10	8	19	41	19	11	13	15	36
	West Bengal	36	20	32	40	53	19	34	33	24	36
WESTERN STATES	D & N Haveli	11	18	23	41	19	0	1	1	1	60
	Daman & Diu	31	68	54	25	21	0	1	21	1	9
	Goa	80	34	49	2	15	1	24	30	3	2
	Gujarat	34	19	18	19	13	18	18	12	6	15
	Lakshadweep	59	55	51	47	38	9	48	31	27	6
	Maharashtra	28	9	12	13	15	20	18	20	10	23
NORTH EASTERN STATES	Arunachal Pradesh	33	2	9	11	33	18	1	2	3	6
	Assam	11	0	3	6	13	9	2	3	4	6
	Manipur	9	1	2	2	4	6	0	2	2	8
	Meghalaya	17	0	1	4	9	2	0	0	1	1
	Mizoram	6	0	6	6	10	10	4	5	6	9
	Nagaland	7	0	0	4	17	2	1	1	2	2
	Sikkim	8	5	2	13	12	6	4	10	6	8
	Tripura	9	3	2	6	19	8	3	4	2	14
CENTRAL STATES	Chhattisgarh	18	5	4	5	11	15	4	6	4	21
	Madhya Pradesh	16	5	8	8	23	10	5	7	5	12
	Uttarakhand	31	2	7	9	36	10	1	6	5	13
	Uttar Pradesh	20	5	10	15	23	18	4	10	9	34
	India	**23**	**15**	**21**	**20**	**27**	**15**	**14**	**16**	**11**	**23**

Note: Highest Reporting Second Highest Reporting

Source: Calculated from unit-level data of NSS 71st and 75th round

Disease prevalence among regions by spell of ailment

In the 71st round, acute respiratory infections are the biggest contributor in the infectious group of diseases at the all-India level and state regions, except the North Eastern region (See table A 4.4 appendix to chapter 4). Fever due to diphtheria, whooping cough contributed highest in the North Eastern region as well as in Assam. However, in the 75th round diarrheal diseases contributed highest to infectious diseases in the North Eastern region as well as in Assam. Other state regions continue with higher prevalence of acute respiratory infections.

Among CVDs, highest reporting is in the Southern region in both the rounds. The highest contributor to CVDs in all the state regions in both rounds is hypertension except for North Eastern region. Heart disease is the highest contributor to CVDs in the 71st round. NCDs reporting is highest in the Southern states in both the rounds. Diabetes contributes highest to NCDs in the Northern, Southern, Eastern and Western regions in the 71st round, whereas Bronchial asthma contributed highest in the North Eastern and Central state region. The pattern has changed in the 75th round, where diabetes is the highest contributor to NCDs for all the state regions including Assam.

The highest contributor to disabilities in the 71st round in all the regions except NER is joint or bone diseases, followed by back or body ache and accidental injury. In NER, the highest contributor is back or body ache followed by joint or bone diseases. In the 75th round, for all the state regions highest reporting was for joint or bone diseases. All other fever (which includes malaria, typhoid and fever of unknown origin and all specific fever that do not have confirmed diagnosis) followed by pain in abdomen (which includes gastric and peptic ulcers/ acid reflux/ acute abdomen) were the highest contributor of diseases in the *other category* in all the state regions in both the rounds.

4.3 State level Pattern of Morbidity in India: 71st and 75th rounds

From 71st to 75th round, overall reporting of morbidity has fallen in India. This is contrary to the results obtained in the previous rounds, where morbidity was shown to have risen between the 1990s and 2000s. The reason for this needs to be further investigated. This may be either due to some methodological issues or it can be due to some reporting and responding errors or we can consider at some point that overall health scenario in India has improved over years. We cannot come to any definite conclusion without further investigating the problem. Reporting of both chronic and acute morbidity is higher in the economically developed states of India, such as the southern states. Assam has reported lower than the Indian average. Kerala continues to be the highest reporting state.

By hospitalisation cases, we find that the disease burden is highest in the category *other diseases* followed by *NCDs* in majority of the states. By hospitalisation cases, in the North Eastern states, we find that apart from the burden of *other diseases* there is an almost equivalent spread of NCDs and infectious diseases. A similar pattern is observed for NER in both the NSS rounds. Overall hospitalisation cases in India are highest for *NCDs* and *other diseases*.

By spell of ailments (which includes non-hospitalisation and hospitalisation cases in the reference period of 15 days), a mixed picture emerges. Majority of states show a higher prevalence of *infectious diseases* and *other diseases*. However, in the Southern states and the UTs, disease prevalence has moved towards *NCDs*, followed by *CVDs*. By spell of ailments, we observe a proportionately higher prevalence of *infectious diseases* in the 71st round and *NCDs* in the 75th round.

It is observed that overall reporting of ailment in all categories is low for Assam as compared to the national average. The results show that overall, between 71st and 75th rounds, CVDs and NCDs have increased and there is a decline in infectious disease. This is however

not true of the North Eastern Region, where we witness higher prevalence of infectious group of diseases.

4.3.1 Discussion of the results

Based on self-reported morbidity across the states of India, we find that acute and chronic ailments are unevenly spread. One of the main limitations of self-reported morbidity measures is in terms of consistency and reliability but still is one of the reliable source for studying morbidity (Idler and Benyamini, 1997). It may be due to reporting bias. Various factors affect reporting of self-perceived morbidity, such as level of educational attainment, economic status, access to media, and awareness about healthcare services (Paul & Singh, 2017; Ghosh & Arokiasamy, 2009; Subramanian, et al. 2009). However, in a country like India, where there is a lack of robust data based on observed morbidity, self-reported morbidity helps us to understand the overall morbidity profile of the population.

Our results show that except for a few states and union territories, where the reporting of both acute and chronic ailment is high, the average reporting of morbidity is around 35-40 per 1000 population. Few states, such as the north eastern states, have morbidity reporting below the national average. Clearly, there is an uneven geographical spread across Indian states with respect to reporting of morbidity. This can be due to various reasons. Although the lower reporting states may have low health outcomes compared to high reporting states, self-reported morbidity to a great extent depends on cultural factors, health awareness, and access to healthcare services (Sundararaman & Muraleedharan, 2015).

Our literature review informs that prevalence of chronic ailments increase due to favourable socio-economic conditions with respect to education, income. It is interesting to note that reporting of chronic ailment is higher in some of the more developed states such as Kerala, Andhra Pradesh, Tamil Nadu, Punjab, Chandigarh, West Bengal, Goa and Maharashtra.

Assam has a population size of more than 30 million, however, is in the lower end of reporting of both acute and chronic ailments. Assam has lower health outcomes in terms of higher maternal mortality and child mortality compared to all India average.

Overall, the reporting is lower in case of hospitalisation compared to spell of ailment. This is mainly because only hospitalization cases have been considered, whereas for spell of ailment during last 15 days, any ailment including hospitalization in the reference period of 15 days was considered.

For disease-specific morbidity reporting too, there is uneven spread across states in terms of reporting of morbidity as well as the type of disease being reported. Except for a few north eastern states, all other states in India show higher incidence of NCDs compared to infectious diseases. This clearly indicates the changing pattern of disease prevalence in India, however, with regional imbalances. It points towards different phases of epidemiological transition different states of India currently stands (Prinja et.al, 2012 b). Some of the developed states like Kerala and Goa showed even higher prevalence of CVDs in comparison with infectious diseases. These states have clearly moved forward in terms of the phase of epidemiological transition, compared to other less developed states. At the same time, even though there is a rise in NCDs across states, there is clear evidence of infectious diseases prevailing across states simultaneously.

Most of the developed states in India have also reported significant proportion of disability, which clearly indicates, slow but steady change in the demographic characteristics. It indicates an increasing aging population in India. For disease-specific spell of ailment, most of the states showed higher reporting of infectious diseases, except for a few of the developed states, like Kerala and Andhra Pradesh that showed higher reporting of CVDs and NCDs. It is evident that with the reference period of 15 days, people are likely to report infectious diseases, given the type of diseases under infectious diseases. This also shows that, although there is

evidence of prevalence of NCDs and CVDs, we cannot deny the simultaneous prevalence of infectious diseases across the states.

Various studies report that self-reported morbidity is mainly influenced by accessibility of health care services, various socio-economic variables like poverty, educational level (especially female education) and working conditions. The difference can also arise due to variation in disease profiles across diverse groups of population (Ghosh & Arokiasamy, 2009; Yadav & Arokiasamy, 2014).

4.4 Limitation of using NSSO unit level data

The chapter provides an overall picture of the prevailing pattern of self-reported morbidity in India, based on population-based sample survey of NSS 71st and 75th rounds. However, there are a few limitations, which must be highlighted.

i. Self-reported morbidity, may be under-reported or in some cases over-reported too.

ii. Self-reported morbidity is affected by various factors, such as educational attainment, economic status, excess to media, awareness about healthcare services, availability and access to healthcare services.

iii. Reporting of some of the diseases under disease-specific morbidity needs proper diagnosis to be self-reported, especially some of the CVDs and NCDs. Without diagnosis by health personnel and adequate awareness of these diseases among the population it may lead to under-reporting of these diseases.

iv. Various diseases are impacted by the type of food we eat and our daily lifestyle activities (Prentice, 2006; Yadav et al., 2016) especially, CVDs and NCDs. Therefore, the inclusion of these data in the data set would have given clearer picture of the prevailing pattern of diseases in the population.

4.5 Conclusion

The analysis shows higher prevalence of self-reported morbidity in Kerala, Andhra Pradesh, West Bengal, and Punjab. The all-India pattern shows, between 71st and 75th rounds, reporting has also come down. As has been pointed earlier, definitional changes may contribute to such reporting pattern. However, with the present set of questions that we have, we cannot probe this further. For Assam and NER, we need to dig deeper into why morbidity reporting is very low. It needs deliberation at the policy level.

The dual nature of communicable and non-communicable diseases is inevitable in India and state regions. Southern states show dominance of CVDs and NCDs and northern states reflect coexistence of CVDs and NCDs along with infectious and other diseases. The dominance of other diseases and infectious diseases highlight the fact that majority of the Indian population is still afflicted by diseases that are caused by *low material conditions of living.*

In terms of programme and policy interventions, there is a need for provision of basic screening and treatment of both communicable and non-communicable diseases at the primary level. Preventive health care is important for coping with the dual nature of the disease prevalence. It requires constant monitoring of disease patterns and identifying the pockets where dual pattern is high.

Chapter 5 Socio-economic Determinants of Morbidity in Assam: A Binary and Multivariate Logistic Regression Analysis

We have already seen that Assam shows a deficient level of reporting of ailment for both acute (19 per 1000) and chronic aliment (6 per 1000) when compared with the highest reporting state of Kerala. Studies on morbidity, based on National Sample Survey (NSS) unit-level data on self-reported morbidity, for the state of Assam, is almost negligible. This analysis fills the gap by providing unit-level estimations on morbidity reporting in Assam. The objective is to understand the within Assam regional differences in morbidity.

Assam has a population size of more than 30 million, however, it is in the lower end of reporting morbidity. Health outcomes in terms of maternal and child mortality are not very encouraging as they are one of the highest in India. Being one of the states with higher burdens of infectious diseases as well as communicable diseases such as tuberculosis, low reporting of morbidity in Assam is inconsistent and needs further probe. One of the basic factors which affect reporting of morbidity is geographical location, as access to healthcare facilities, awareness about health, and availability of quality healthcare services are affected by geographical location. Therefore, we further narrow down to the NSS region level to understand the pattern of prevalence of morbidity within the state of Assam. It discusses the levels and pattern of acute, chronic, and overall morbidity in Assam. Morbidity by different diseases and disease groups are also discussed.

Section 5.1 estimates prevalence of morbidity and disease-specific morbidity by Assam's NSS regions. Section 5.2 analyses the *socio-economic determinants of self-reported morbidity* in Assam with the help of a binary logistic regression. Section 5.3 analyses the *socio-economic determinants of disease-specific morbidity* by fitting a multivariate logistic

regression. In conclusion, this chapter provides the population morbidity status in Assam, and an assessment vis-à-vis other Indian state.

5.1 Prevalence of Morbidity at the NSS Region Level, Assam

There are four NSS regions of Assam: Western Plains (WP), Eastern Plains (EP), Central Brahmaputra Plains (CBP) and Cachar Plains (CP). Table 5.1 shows morbidity estimates by NSS regions of Assam. To estimate morbidity, we have considered both acute and chronic ailment together as well as reporting of either acute or chronic ailment by the respondents.

During the 71st round, reporting was highest in the Central Brahmaputra Plains followed by the Western Plains region. In 75th round, morbidity prevalence was highest in the Western Plains region followed by the Eastern Plains region. Overall, prevalence has declined in Eastern Plains and Central Brahmaputra Plains and gone up in the Western Plains and Cachar Plains.

In order to understand this change from 71st to 75th rounds at Assam's region level, we need to look at the district sample and identify which districts under the NSS regions are contributing to this change. However, Assam's region level data does not make district level estimations reliable.[13,14] Acute and chronic morbidity estimates are shown separately in Table A5.2, Appendix to Chapter 5. Prevalence of acute ailment was highest in Central Brahmaputra Plains in the 71st round and in the Western Plains in the 75th round. For chronic ailment reporting was highest in the Western Plains region in both the rounds.

[13] District level estimates are possible only when central sample data collected by MOSPI and state sample data collected by state department are pooled together for a particular round. For the state of Assam, state sample data were not available for 71st and 75th round. Therefore, this remains a limitation of the thesis. There is a need for Assam state sample data to be churned out regularly for more robust analysis.

[14] NSSO central sample data: NSSO collects data for both central sample as well as state sample. The data provide by MOSPI comprise of only the central sample, whereas the state sample data is collected and remains with respective state government departments.

Table 5.1: Reporting of Morbidity Acute & Chronic Both and Acute or Chronic Either by NSS Regions of Assam

NSS Regions of Assam	71st Round		75th Round	
	Per 1000 Reporting	% of Reporting	Per 1000 Reporting	% of Reporting
Eastern Plains	25	2.5	18	1.8
Western Plains	34	3.4	49	4.9
Cachar Plains	3	0.3	12	1.2
Central Brahmaputra Plains	60	6	6	0.6

Source: Estimated from NSS unit-level data, 71st and 75th Rounds.

5.1.1 Disease-specific morbidity in NSS region of Assam

By hospitalization cases

Disease specific morbidity for hospitalization cases in the reference period of 365 days is depicted pictorially in the maps in figure *5-1* (71st round) and figure *5-2* (75th round) for NSS regions of Assam. For 71st round, infectious disease reporting is highest in Cachar Plains followed by Eastern Plains and Central Brahmaputra Plains. Reporting of CVDs was highest in Eastern Plains and Western Plains. NCDs reporting is highest in Eastern Pains, followed by Western and Central Brahmaputra Plains.

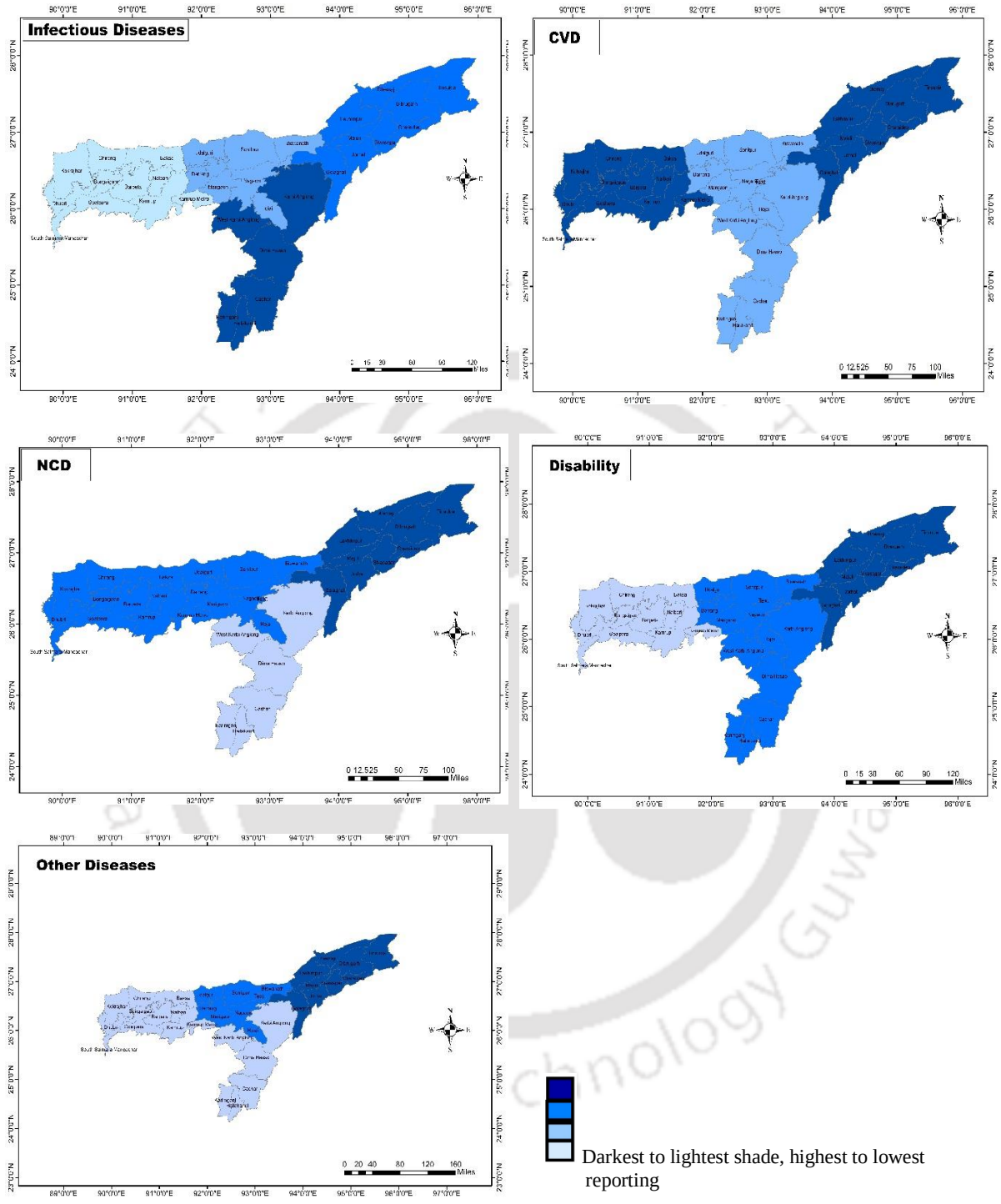
Disability reporting is also highest in Eastern Plains followed by equivalent reporting in Cachar and Central Brahmaputra Plains, and lowest reporting in Western Plains. Highest reporting of other diseases is in the Eastern Plains. Overall, out of the five categories of disease, reporting has been highest in the Eastern Plains region for category of disease except for infectious diseases. One of the reasons which can be inferred of high reporting of hospitalization cases is the concentration of two state medical college hospitals in the districts under Eastern Plains region. We assume reporting has increased with access to healthcare facilities.

In the 75th round, highest burden of infectious disease remains in Cachar Plains. Reporting of infectious diseases has increased in the Central Brahmaputra Plains. Prevalence of CVDs has shifted from Eastern Plains & Western Plains to Cachar Plains, with Cachar plains

reporting highest followed by Eastern Plains. Reporting of NCDs, disability and other diseases remains highest in Eastern Plains region. Infectious diseases reporting remains highest in the Cachar Plains followed by Central Brahmaputra Plains in both the rounds.

Both the figures of the maps of Assam by NSS regions with the spread of the diseases have been shown in the following next two pages.

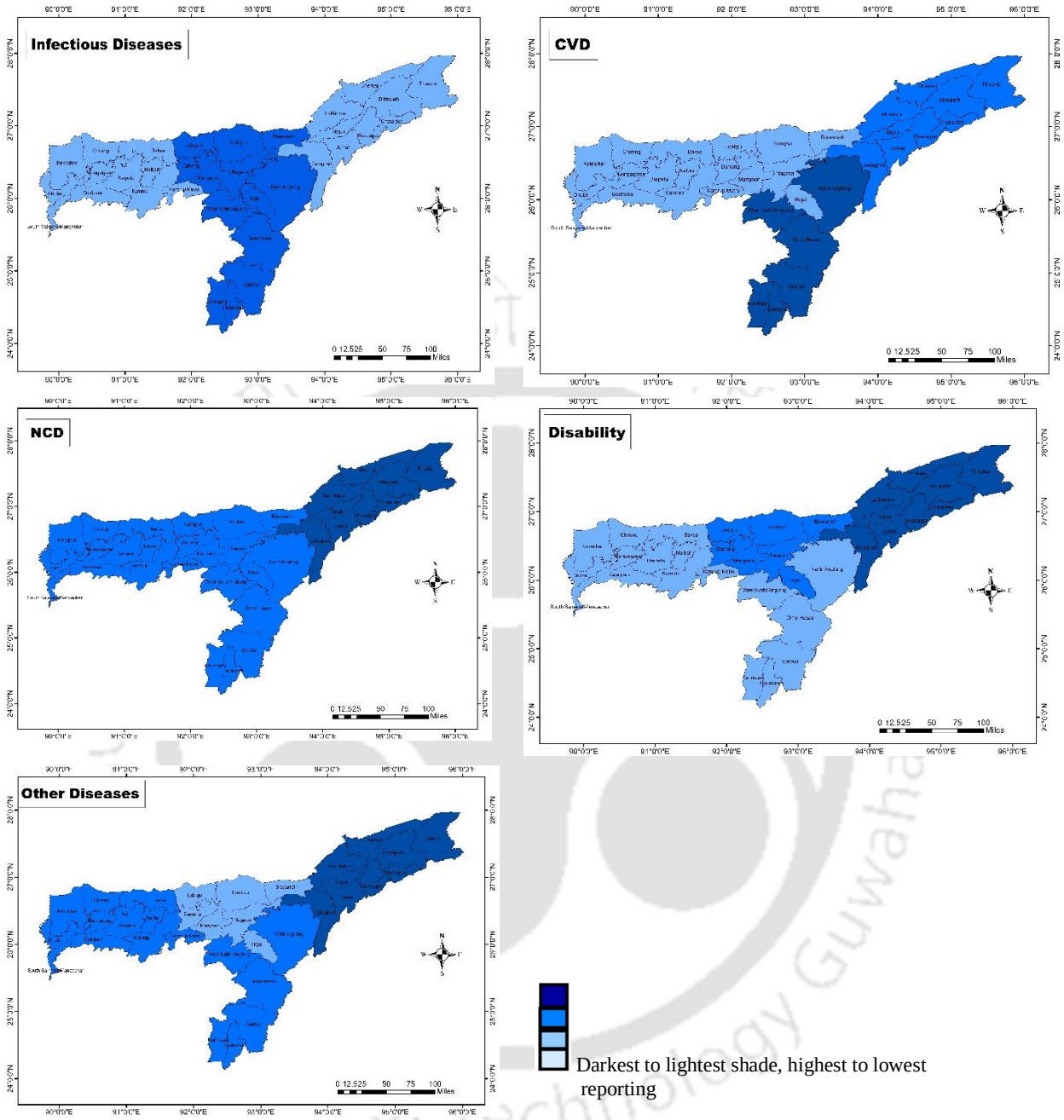
Figure 5-1: Disease-Specific Morbidity for Hospitalization by NSS Regions, 71st Round



Source: Estimated from unit level data of NSS 71st Round

Map Source: ArcGIS Hub, Esri India, GIS online; Date of release 14th September, 2021; Prepared in ArcGIS 10.2

Figure 5-2: Disease-Specific Morbidity for Hospitalization by NSS Regions, 75th Round



Source: Estimated from unit level data of NSS 75th Round

Map Source: ArcGIS Hub, Esri India, GIS online; Date of release 14th September, 2021; Prepared in ArcGIS 10.2

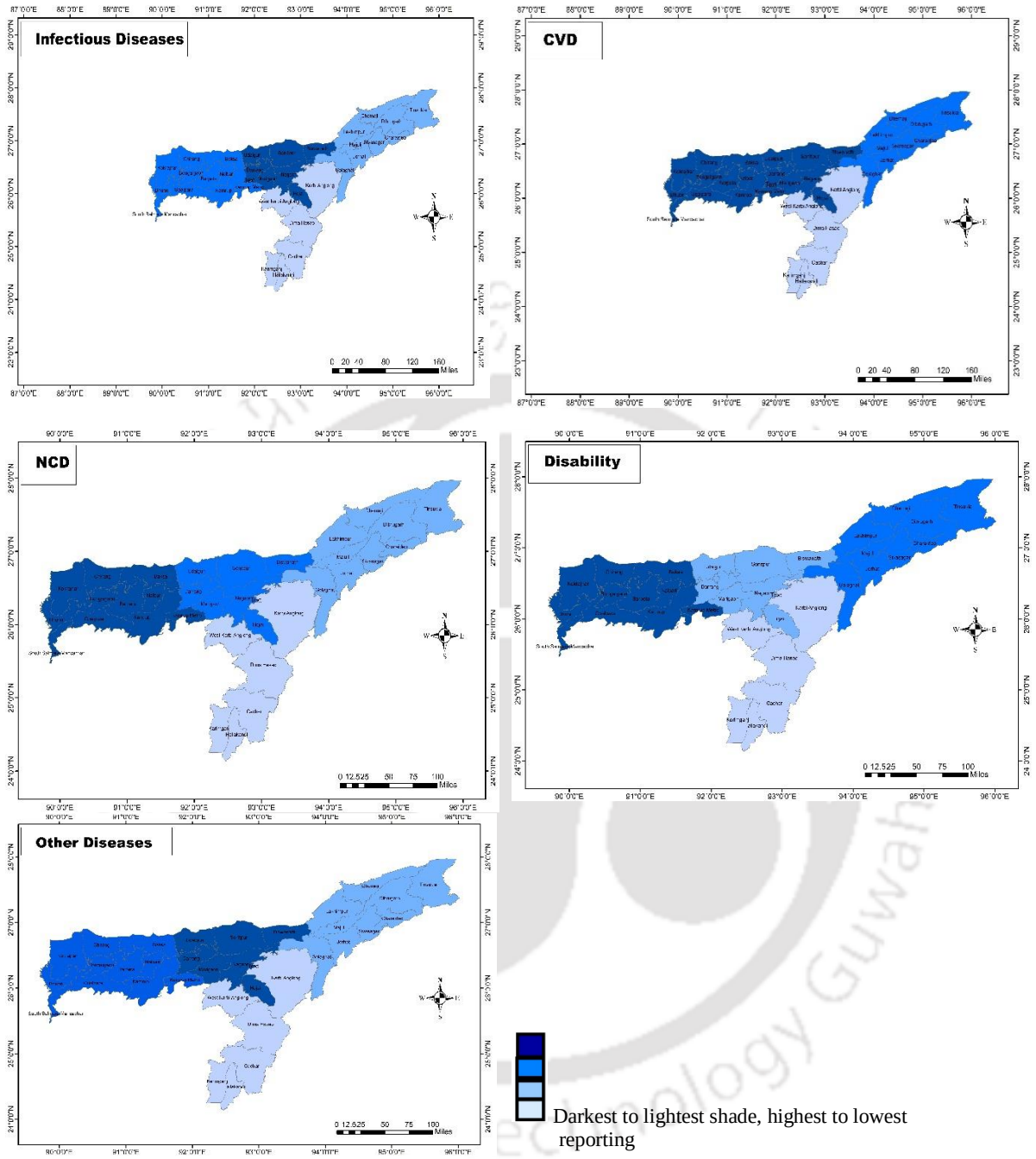
By spell of ailment

Figure *5-3* (71st round) and figure *5-4* (75th round) depicts the pictorial representation of diseases specific morbidity by spell of ailment in the NSS regions of Assam. In the 71st round, prevalence of infectious disease is highest in Central Brahmaputra Plains followed by the Western Plains. CVD reporting is highest in the Western and Central Brahmaputra Plains. NCDs and disability reporting is highest in Western Plain region. Central Brahmaputra Plains reported highest for other diseases. Overall, reporting of all categories of diseases are highest in the Western Plains region.

In the 75th round, morbidity prevalence is highest in the Western Plains region of Assam. Disease-specific morbidity, across all disease categories are also highest in the Western Plains region. In the category CVDs, Cachar Plain region has the second highest prevalence. In the category NCDs, Eastern Plains region has the second highest prevalence.

It is noteworthy that the Western Plains region of Assam is the most densely populated among all NSS regions of Assam. Moreover, we cannot help drawing attention to the fact that most of the aspirational districts (or poor development indicators districts) under the aspirational districts programme are also concentrated in the Western Plains region. However, in this thesis we are not establishing the link with development indicators but merely pointing to the morbidity patterns at the region level.

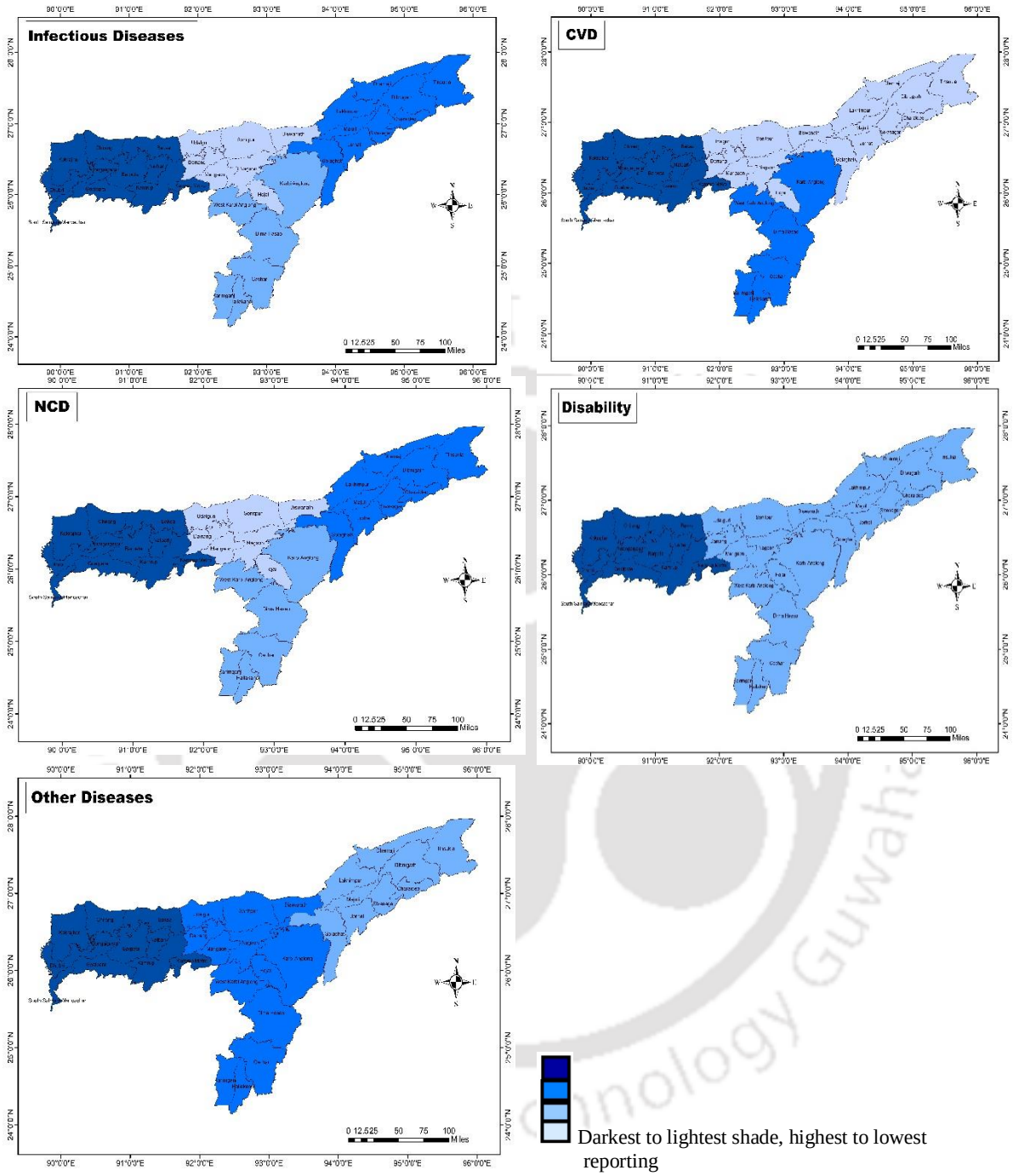
Figure 5-3: Disease-Specific Morbidity by Spell of Ailment by NSS Regions, 71st Round



Source: Estimated from unit level data of 71st round

Map Source: ArcGIS Hub, Esri India, GIS online; Date of release 14th September, 2021; Prepared in ArcGIS 10.2

Figure 5-4: Disease Specific Morbidity by Spell of Ailment by NSS Region, 75th Round



Source: Estimated from unit level data of NSS 75th Round

Map Source: ArcGIS Hub, Esri India, GIS online; Date of release 14th September, 2021; Prepared in ArcGIS 10.2

5.2 Social Determinants of Self-Reported Morbidity in Assam

5.2.1 Reporting of morbidity by various social determinants

Reporting of morbidity is affected by various factors. They can be demographic, socio-economic, and geographical. The different categories under the social determinants for descriptive statistic has been discussed in Table 5.2. The overall reporting of morbidity by different factors that can affect SRM are presented in table 5.3.

Table 5.2: Explanation of the categories of the social determinates for descriptive statistics

Category	Description
Gender	The data provide information on the sex of the individuals: Male & Female.
Age (in years)	For the age of the individuals, individuals have been categorized into five broad groups: 0-14, 15-30, 31-45, 46-59, 60 and above.
Marital Status	For marital status, two broad groups have been considered: Currently Married and Others (which includes never married, widowed, divorced/separated).
Social group	The data provides information on four social groups Scheduled Tribes (ST), Scheduled Caste (SC), Other Backward Castes (OBC) and Others.
Religion	Religion has been categorized into three groups Hindu, Muslim, and Others (Christian, Sikhism, Jainism, Buddhism, Zoroastrianism, others). (* For diseases specific morbidity however, two religion group considered Hindus and Others; others include Muslim, Christian, Sikhism, Jainism, Buddhism, Zoroastrianism, others)
Wealth Quintile (MPCE)	For descriptive analysis, we have categorized five wealth quintiles based on the monthly per capita consumption expenditure (MPCE) into Poorest, Poor, Medium, Rich, and Richest.
Education	Education level of the individuals categorized into four categories: Illiterate, Below Primary & Primary, Secondary & Higher Secondary, Graduate & above.
Type of Latrine used	Type of latrine used categorized into four groups: pit latrine, no facility, flush/septic tank, others. (*this category has not been considered for disease specific morbidity)
Drinking water	Drinking water categorized into four categories: pipe/tap water, tube well/pacca well, open sources and others. (*this category is not considered for disease specific morbidity)

Household Size	For descriptive analysis, we have categorized household size into three categories: 1-4 members, 5-7 members, 8 or more members.
Activity Status (only for 75th round)	The usual principal activity status of the individuals was broadly categorized into four categories: Employed, Unemployed, Others, and Not in workforce (which are children 0-4 years of age).
Health Insurance Coverage	Health insurance has been categorized into two broad categories: Covered under health insurance and not covered under health insurance. Covered under health insurance has been taken as the reference category.
Area of Residence	Based on the place of residence the data provides information on individuals residing in rural areas and urban areas.
NSS Region of Assam	Eastern Plains, Western Plains, Cachar Plains and Central Brahmaputra Plains.

Source: Authors classification

By gender, age, marital status, and social group

Females reported more than males in both the rounds. This has also been established by past studies, and is not different in case of Assam (Subramanian et.al, 2009). Morbidity reporting among older age (60 and above) population is highest and lowest in the age group of 31- 45 years in the 75th round. It was lowest in the age group of 15-30 years in the 71st round. Agrawal and Arokiasamy (2010); Ghosh and Arokiasamy (2009) have discussed about morbidity being higher in the oldest and lowest in the youngest age group (a J-shaped curve). By marital status, reporting was higher among 'others' category (which includes never married, widowed, and divorced/separated). By social groups, reporting is highest among the OBC population and lowest among ST population in the 71st round, whereas reporting is highest among the SC population in the 75th round. By religion, reporting is highest among the Muslim population in the 71st round, and other religion (includes all other religious groups other than Hindus and Muslims) category in the 75th round.

By education status, household size, activity status and wealth quintile

Educational status which is one of the important determinants of assessing health status of the individuals showed, reporting is highest among the least educated group in the 71st round. The phenomenon, is slightly different in the 75th round, with reporting being higher in the least and most educated groups. Studies previously based on Indian population have also shown similar results (Subramanian et.al, 2009). In terms of household size, reporting is highest for households having eight or more members in the 71st round, whereas households having 1-4 members reported highest in the 75th round. Activity status of the individuals showed that reporting is highest in the group of population which is not in workforce (children 0-4 years) in the 75th round. Reporting is higher among the richest and poorer wealth quintiles. Here too the J-shaped curve in terms of reporting of morbidity prevails for the 71st round. However, for the 75th round, reporting is higher in the higher wealth quintiles.

By insurance coverage, sanitation facilities, drinking water and place of residence

Reporting is higher among those covered under any health insurance scheme. The type of latrine used is an important indicator in terms of health outcomes. Reporting is highest in the category of flush/septic tank category during the 71st round. It can be inferred that people having access to flush/septic tank latrine are also relatively better off in the wealth quintile. In contradiction, during the 75th round, reporting was highest in the no facility category. Such contradictory results in two successive surveys need to be validated with more primary surveys. Respondent and investigator biases may also lead to such results. Drinking water facility showed reporting was highest among those using piped/tap water in both the rounds. By place of residence (rural and urban), reporting is higher in urban areas.

Table 5.3: Prevalence of Morbidity by social determinates, 71st & 75th rounds, Assam

Social Determinants	71st Round		75th Round	
	Reporting per 1000	% of Reporting	Reporting per 1000	% of Reporting
Gender				
Male	25	2.5	22	2.2
Female	43	4.3	28	2.8
Age				
0 - 14	31	3.1	36	3.6
15 - 30	20	2.0	14	1.4
31 - 45	32	3.2	10	1.0
46 - 59	55	5.5	33	3.3
60 and above	66	6.6	74	7.4
Marital Status				
Currently Married	29	2.9	19	1.9
Others	38	3.8	30	3.0
Social Group				
ST	18	1.8	21	2.1
SC	19	1.9	30	3.0
OBC	41	4.1	26	2.6
Others	36	3.6	25	2.5
Religion				
Hindu	31	3.1	24	2.4
Muslim	38	3.8	24	2.4
Others	8	0.8	46	4.6
Wealth Quintile				
Poorest	35	3.5	17	1.7
Poor	38	3.8	29	2.9
Medium	27	2.7	24	2.4
Rich	24	2.4	24	2.4
Richest	43	4.3	38	3.8
Education				
Illiterate	58	5.8	40	4.0
Below Primary & Primary	29	2.9	24	2.4
Secondary & Higher Secondary	20	2.0	14	1.4
Graduate & above	20	2.0	32	3.2
Household Size				
1-4 members	27	2.7	29	2.9
5-7 members	37	3.7	21	2.1
8 or more members	39	3.9	25	2.5
Usual Activity Status				
Employed	NA	NA	19	1.9
Unemployed	NA	NA	27	2.7
Others	NA	NA	17	1.7
Children (0-4 years)	NA	NA	46	4.6
Health Insurance				
Covered	34	3.4	25	2.5
Not Covered	33	3.3	25	2.5
Type of Latrine Used				
Pit Latrine	32	3.2	19	1.9
No facility	3	0.3	53	5.3
Flush/Septic Tank	37	3.7	29	2.9
Others	30	3.0	16	1.6
Drinking water				
Piped/Tap	40	4.0	36	3.6
Tube well/Pacca well	36	3.6	25	2.5
Open Source	1	0.1	12	1.2
Others	35	3.5	0	0.0
Area				

Rural	32	3.2	22	2.2
Urban	47	4.7	43	4.3
NSS Region				
Eastern Plains	25	2.5	18	1.8
Western Plains	34	3.4	49	4.9
Cachar Plains	3	0.3	12	1.2
Central Brahmaputra Plains	60	6.0	6	0.6

Source: Estimated from unit level data of NSSO 71st and 75th Round

Reporting of Acute and Chronic morbidity

Prevalence of acute and chronic ailment separately shows a slightly different picture *(See table A 5.2 appendix to chapter 5)*. Reporting of **acute ailment** showed females reported more compared to male. By age higher reporting in the older and youngest age groups. Reporting was lowest in age group of 15-30 years in 71st round and 31-45 years of age in the 75th round. Marital status showed higher reporting among the others category (which includes never married, widowed and divorced/separated). The OBC population group reported highest in the 71st round whereas the SC population reported highest in 75th round. Lowest reporting was among ST population. Wealth Quintile showed highest among the poor in the 71st round and among the richest in the 75th round. The illiterate group reported highest in the 71st round whereas in the 75th round it is highest among the graduate (25 per 1000 person) and above followed by the illiterate group (24 per 1000 person). By household size highest reporting in household having size 8 or more in 71st and household size 1-4 members in 75th. Reporting is equal in for those covered and not covered under health insurance. Reporting of acute ailment is equal in urban and rural areas in the 71st round on the contrary it is higher in the urban areas in the 75th round. Reporting is highest in Western Plains region in 75th round and in Central Brahmaputra Plains in the 71st round.

The prevalence of **chronic ailment** in Assam by various socioeconomic background showed, males reported more than females in 71st whereas equal reporting for both male and female in the 75th round. Reporting was highest in the oldest age group of sixty and above (30 and 41 persons per 1000 population) respectively in both 71st and 75th round. By marital status

reporting more among currently married. OBC category reported highest chronic morbidity in both the rounds. Prevalence of chronic ailment is highest in the richest quintile in both 71st and 75th round. By education, reporting is highest among the illiterates followed by graduate and above in both 71st and 75th round. Households having more than 8 members in 75th round and households with 1 – 4 members in 71st round have higher prevalence of chronic ailment. Reporting is equal in both categories in 71st round and higher for covered under any health insurance scheme in 75th. Prevalence is higher in urban areas in both the rounds. By NSS regions, reporting is highest in Western Plains region.

5.2.2 Social determinants of morbidity - results of binary logistic regression

A binary logistic regression has been carried out on the 71st and 75th round data separately. It was not possible to pool the data for both years due to (a) certain variables, such as information on activity status of the respondents was available for 75th round but not for the 71st round. WHO Disease Burdens studies have clearly established high morbidity status association with working age population. Therefore, work status or activity status is a critical determinant. (b) decoded and cleaned data for the 71st round was readily available, however the decoding for the 75th round unit level data had to be carried out. To avoid errors, regressions were carried out separately for both rounds.

For the analysis of morbidity reporting by background characteristics, logistic regression has been used. The results of the analysis have been interpreted in terms of odds ratio.

$$\textbf{Logit (Y)} = In[\frac{p}{1-p}] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \mu_i \text{ ---------- (II)}$$

Where p is the probability of occurring of the event and $[\frac{p}{1-p}]$ is the odds of success i.e., the ratio of the probability of the event occurring and probability of the event not occurring. α is intercept, β are regression coefficients, x_i is set of predictors and u is an error term. Odds

ratio has been used for interpreting the results of the regression in the data analysis (Abedin et. al, 2016; Uberti, 2022; Paul & Singh, 2017).

The estimates of the binary logistic regression model are presented in Table 5.5 The estimates are presented in terms of odds ratio. The dependent variable for the model is reporting acute and chronic ailments. The dependent variable taken for the model is *Reporting of morbidity (either acute or chronic) or (both acute and chronic)*. If yes, the variable takes value 1, or 0 otherwise. Based on the literature on indicators impacting morbidity status, and in alignment with the WHO Social Determinants of Health (SDoH) Framework, we have identified the independent variables. The independent variables considered for the model are discussed in table 5.4

Table 5.4: Description of the Independent variables considered for Reporting of Morbidity

Variable Name	Variable Description
Demographic Factors	
Gender	Female =1, Male =0
Age	60 and above (base category)
46-59	age in years
31-45	age in years
15-30	age in years
0-14	age in years
Marital Status	Currently Married = 1, 0 Otherwise
Social Group	Others (unreserved = base category)
ST	Schedule Tribe
SC	Schedule Cast
OBC	Other Backward Classes
Religion	Hindu (base category)
Muslim	
Others	Christian, Sikhism, Jainism, Buddhism, Zoroastrianism, others
Socio-Economic Factors	
Education	Illiterate (base category)
Below Primary & Primary	
Secondary & Higher Secondary	
Graduate & above	
Type of Latrine Used	Pit Latrine (base category)
No facility	
Flush/Septic Tank	
Others	
Drinking water	Piped/Tap water (base category)
Tube well/Pacca well	
Open Source	
Others	
Activity Status	Employed (base category)
Unemployed	
Others	

Not in workforce	which are children 0-4 years of age
Covered Under Health Insurance	Not Covered =1, Covered =0
log_mpce	MPCE has been taken as a continuous variable and the log of MPCE has been considered for the analysis
Household Size	household size has been taken as a continuous variable
Geographic Factors	
Area of Residence	Rural =1, Urban = 0
NSS Region	Western Plains (base category)
Eastern Plains	
Cachar Plains	
Central Brahmaputra Plains	

I. ***Summary by demographic variables:***

i. Age has a strong relationship and an important determining factor in both rounds. The younger age groups are less likely to report morbidity (significant at 1% level of significance) compared to the reference category of oldest group of 60 years and above. The marginal effect shows the youngest age of 0-14 years group is 7.2 percent (71st round) and 8 percent (75th round) less likely to report morbidity.

ii. Marital status shows strong relationship only in the 71st round. The currently married are less likely to report.

iii. Religion and social group have significant effect on reporting of morbidity. The Muslim population group, at 5% level of significance, and with a marginal effect 1 percent are more likely to report morbidity compared to base category of Hindus in the 71st round. In the 75th round, although Muslims are more likely to report than the Hindus, but the results are not significant. The OBC category is 1.8 percent more likely to report compared to base category of others in the 71st round. In the 75th round, the SC population is significantly more likely to report morbidity.

iv. Although gender is an important variable, and females are more likely to report morbidity, yet the results are not significant.

II. ***Summary by socioeconomic status and material conditions of living variables:***

i. Education level of the individual in the 71st round shows that compared to the reference category of illiterate group, those with higher levels of education are less likely to report. The three education group categories are significant at 1% and 5% respectively, for those being educated up till higher secondary (marginal effect of 2.4 percent) level and graduate and above level (marginal effect of 2.3 percent). Education and morbidity relationship is not significant in the 75th round, although, higher education groups are less likely to report.

ii. By type of latrine, in the 71st round, people using flush/septic tank are 0.8 percent less likely to report, compared to the reference category of pit latrine as base group. In the 75th round, the category with no latrine facility are 1.3 percent more likely to report at 5% level of significance.

iii. In 71st round, those using tube well/pucca well are more likely to report and results show 10% level of significance.

iv. Higher the MPCE, an individual is 1.2 percent and 0.8 percent more likely to report morbidity in both rounds (significant at 1% level of significance)

III. ***Summary by location variables:***

i. Rural population is 0.8 percent and 0.6 percent less likely to report morbidity respectively in 71st and 75th round.

ii. By NSS regions, for 71st round with Western Plains as the base category, Eastern plains and Cachar Plains are less likely to report morbidity, whereas Central Brahmaputra Plains is more likely to report morbidity. Cachar Plains is 1.5 percent less likely to report morbidity and significant at 1%. Central Brahmaputra Plains are 1.3 percent more likely to report morbidity and significant at 1% level of significance. Whereas for 75th round all NSS regions are less likely to report than the Western Plains, significant at 1% level of significance.

Table 5.5: Assam Binary Logistic Regression for Reporting of Both Acute & Chronic and Acute or Chronic Either

Social Determinants	71st Round			75th Round		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender						
Male^						
Female	1.04246	0.12339	0.00109	1.13341	0.14785	0.00257
Age						
60 and above^						
46-59	0.6131*	0.11051	-0.03130	0.38081*	0.06010	-0.05538
31-45	0.3668*	0.07263	-0.05296	0.12431*	0.02484	-0.08239
15-30	0.1390*	0.03134	-0.07440	0.09382*	0.01768	-0.08580
0-14	0.1634*	0.03202	-0.07203	0.13929*	0.02801	-0.08073
Marital Status						
Others^						
Currently Married	0.68460**	0.10597	-0.00993	0.81587	0.11210	-0.00417
Education						
Illiterate^						
Below Primary & Primary	0.59059*	0.08059	-0.01605	0.99347	0.14965	-0.00014
Secondary & Higher Secondary	0.38992*	0.08704	-0.02431	0.84574	0.16193	-0.00330
Graduate & above	0.40284**	0.14649	-0.02377	0.98085	0.24241	-0.00041
Type of Latrine Used						
Pit Latrine^						
No facility	0.25490	0.26545	-0.02303	1.72090**	0.42564	0.01327
Flush/Septic Tank	0.71915**	0.10251	-0.00840	1.10841	0.14018	0.00207
Others	1.36588	0.30184	0.01049	0.26884	0.27437	-0.01481

Drinking water						
Piped/Tap^						
Tube well/Pacca well	1.56586***	0.39136	0.01037	1.23581	0.22136	0.00402
Open Source	0.40301	0.22713	-0.01147	1.72375	0.57278	0.01202
Others	1.66788	0.59674	0.01219	0.91821	0.48209	-0.00142
Religion						
Hindu^						
Muslim	1.50554**	0.25963	0.01164	1.12425	0.15587	0.00239
Others	0.56856	0.34610	-0.01045	2.38669*	0.61244	0.02474
Social Group						
Others^						
ST	1.19677	0.25459	0.00442	0.88558	0.15924	-0.00234
SC	1.00052	0.24878	0.00001	1.47008**	0.25620	0.00926
OBC	1.82718*	0.30552	0.01802	0.94908	0.13605	-0.00104
Area of Residence						
Urban^						
Rural	0.74045***	0.12709	-0.00787	0.72962**	0.10614	-0.00646
NSS Region						
Western Plains^						
Eastern Plains	0.84185	0.13994	-0.00421	0.24236*	0.04035	-0.03138
Cachar Plains	0.44520*	0.13696	-0.01513	0.32034*	0.06288	-0.02793
Central Brahmaputra Plains	1.53223*	0.22972	0.01364	0.10033*	0.02529	-0.03781
Covered Under Health Insurance						
Covered^						
Not Covered	0.85209	0.27762	-0.00419	0.89577	0.21398	-0.00226
Activity Status						
Employed^						
Unemployed	NA	NA	NA	1.01348	0.16363	0.00026
Others	NA	NA	NA	1.17822	0.29654	0.00346
Not in work force	NA	NA	NA	1.41667	0.42522	0.00796
Household Size	1.01060	0.02925	0.00028	0.96227	0.02532	-0.00079
log_mpce	1.62641*	0.24700	0.01274	1.54436*	0.23331	0.00890

Source: Estimated from unit level data of NSSO 71st and 75th Round

* p <0.01, ** p< 0.05, *** p< 0.1

71st Round: Number of Observation = 11,411; Wald chi-square = 290.31; Probability = 0.0000; pseudo *R2 = 0.0997;* log pseudo likelihood = -1310.5014

75th Round: Number of Observation =18,463; Wald chi-square = 572.73; Probability = 0.0000; pseudo *R2 = 0.1499;* log pseudo likelihood = -1671.7369

^ Reference group or base category

To see if there are difference in results in terms of reporting of morbidity separately for acute and chronic ailment, logistic regression was carried out. The social determinants which were significant for ***acute and chronic ailment in the 71st*** are in *table A 5.3 appendix to chapter 5.* The significant variables for reporting of acute ailment are age, marital status, religion, social

group, and NSS region. Whereas for chronic ailment, the significant variables are age, education, social group, religion, NSS region and MPCE. Similarly, for ***75th round*** estimates are provided in *table A 5.4 appendix to chapter 5*. Age, marital status, no latrine facility, others category of religious group, SC category, all the NSS regions and MPCE are significant for acute ailment. For chronic ailment age, drinking water source, rural population, NSS regions, unemployed and log of MPCE are significant.

5.3 Socioeconomic Determinants of Disease-Specific Morbidity in Assam

5.3.1 Reporting of disease specific morbidity by hospitalization cases

This section discusses the findings of the prevalence of disease specific morbidity per 1000 persons (also in percentage) for all the hospitalization cases in the reference period of 365 days in Assam. For most of the categories of socioeconomic variable for 71st round, CVD reporting is lowest compared to NCDs, disabilities, infectious and other disease. Highest reporting is for cases of other diseases. Between infectious and NCDs, reporting of former was higher in the 71st round. In 75th round, CVD reporting is still lower than NCDs, disabilities, infectious and other diseases. However, reporting of infectious disease has come down and NCDs has slightly gone up.

71st Round

Reporting (see table 5.6) of **infectious diseases** for hospitalization is summarised as follows.

i. By gender, higher for males (3 per 1000 persons males; 2 per 1000 persons females).
ii. By age, highest in the age group of 60 and above (5 per 1000 persons) and lowest in the age group of 31-45 years (2 per 1000 persons).
iii. By marital status, higher in the population not currently married
iv. By social group, highest among the SC category.
v. By religion, higher among Hindus (3 per 1000 persons Hindus; 2 per 1000 others category). By wealth quintile, reporting is highest in the poor sections (4 per 1000 persons) and lowest in the richest quintile (2 per 1000 persons).
vi. By education group, highest among the illiterates (4 per 1000 persons) and lowest among the most educated. This shows the poor and the less educated are affected more by the infectious diseases. Previous studies have also showed similar trends.
vii. In terms of household size, reporting is highest among households with 1 – 4 members.

viii. By health insurance, reporting of infectious diseases as an in-patient of medical institution is equal among those covered and not covered.
ix. By location, reporting is higher in rural areas (3 per 1000 persons rural; 2 per 1000 persons urban).
x. By NSS region category, overall reporting of infectious disease is highest in the Cachar Plains of Assam.

Reporting (see table 5.6) of **CVDs** for hospitalization is summarised as follows:

i. By gender**,** equal reporting by both males and females.
ii. By age, highest in the oldest age group of 60 and above (6 per 1000 persons) and very low reporting in the youngest age groups (0- 30 years).
iii. By marital status, equal reporting by those currently married and others.
iv. By wealth quintile, reporting is highest in the richest quintile (4 per 1000 persons) and lower for poorer wealth quintiles.
v. By education, equal among the highest and the lower education groups (2 per 1000 population). Urban population reported higher CVDs.
vi. By NSS region, Easters and Western Plains reported higher.

Reporting (see table 5.6) of **NCDs** for hospitalization is summarised as follows:

i. By gender, higher among females as compared to males. One of the reasons may be the nature of diseases reported under NCD category. As discussed in *chapter 4*, in Assam, reporting has been higher in the category of disease like pregnancy with complications before or during labour. Anaemia and undernutrition too come under NCDs category which is usually prevalent more among females.
ii. By age, highest in the oldest age group.
iii. By marital status, it is higher among currently married
iv. By social group, it is highest among SC population.
v. By wealth quintile, highest among the richest quintile (8 per 1000 persons) and lower in the poorer quintiles.
vi. Urban population reporting is higher (7 per 1000 urban; 2 per 1000 rural)
vii. By health insurance, those covered report higher.
viii. By NSS region, Eastern Plains reports the highest NCDs for hospitalisation during last 365 days.

Reporting (see table 5.6) of **Disability** for hospitalization is summarised as follows:

i. By gender, higher among females.
ii. Higher in the oldest age group, urban population, covered under health insurance and currently married.
iii. Highest among ST population, richer wealth quintile, for population group of below primary & primary education group. NSS region of Eastern Plains reported highest disability.

Reporting (see table 5.6) of **Other diseases** for hospitalization is summarised as follows:

i. By gender, reporting is higher among females (4 per 1000 persons male; 5 per 1000 female) By marital status, currently married report.

ii. By age, hospitalisation-based morbidity is highest in the working age group of 46-59 years followed by 31- 45 years (7 per 1000 persons; 5 per 1000 persons).
iii. By social group, OBC group reported highest.
iv. By wealth quintile, highest reporting by the richest wealth quintile.
v. By education, among graduate & above educated group.
vi. By health insurance, those covered under health insurance.
vii. By location, reporting is higher among the urban population and in the NSS region of Eastern plains.

75th Round

In the 75th round, hospitalisation-based disease-specific morbidity shows a similar pattern as observed in case of the 71st round. Only noteworthy change is respect to the prevalence of hospitalisation-based morbidity for infectious diseases and NCDs. Infectious disease reporting has come down and NCDs reporting has gone up. In the 71st round, infectious and NCDs reporting was the same (3 per 1000 population). By the 75th round, NCDs had surpassed that of infectious diseases (3 and 1 per thousand respectively) at all Assam level. Estimates by various social determinants are tabulated in table 5.6.

The findings of disease specific morbidity reporting for hospitalization cases in Assam points towards the facts for certain diseases such as CVDs and NCDs which at times needs proper diagnosis before being able to be self-reported were more prevalent among the richer quintiles, educated and urban population groups. Accessibility and affordability of healthcare facilities in these population groups have affected the reporting.

Table 5.6: Disease Specific Morbidity Reported by Socioeconomic Factors in Assam for Hospitalization cases Per 1000 (also in percent)

Social Determinants	71st Round										75th Round									
	Infectious		CVD		NCD		Disability		Others		Infectious		CVD		NCD		Disability		Others	
	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%
Gender																				
Male	3	0.33	1	0.11	1	0.14	2	0.22	4	0.36	1	0.15	1	0.14	2	0.18	2	0.23	2	0.22
Female	2	0.23	1	0.08	3	0.31	3	0.25	5	0.52	1	0.13	1	0.11	3	0.31	2	0.17	2	0.22
Age																				
0 - 14	3	0.35	0	0.02	1	0.10	1	0.12	3	0.33	2	0.20	0	0.02	1	0.08	1	0.07	2	0.16
15 - 30	3	0.25	0	0.01	3	0.26	1	0.13	4	0.36	1	0.11	0	0.04	2	0.21	2	0.15	2	0.16
31 - 45	2	0.19	1	0.06	2	0.23	3	0.34	5	0.52	1	0.09	1	0.10	3	0.31	2	0.23	3	0.32
46 - 59	3	0.30	3	0.25	3	0.26	3	0.32	7	0.70	2	0.16	4	0.37	3	0.32	4	0.38	3	0.27
60 and above	5	0.47	6	0.61	4	0.43	7	0.66	4	0.43	2	0.18	6	0.64	7	0.74	6	0.57	4	0.41
Marital Status																				
Currently Married	2	0.24	1	0.14	3	0.31	3	0.28	5	0.52	1	0.12	2	0.17	4	0.35	3	0.25	2	0.25
Others	3	0.33	1	0.05	1	0.13	2	0.19	4	0.36	2	0.16	1	0.09	1	0.13	2	0.15	2	0.20
Social Group						0.13														
ST	4	0.38	1	0.09	2	0.17	5	0.50	4	0.37	1	0.13	1	0.08	2	0.20	1	0.09	1	0.11
SC	5	0.53	1	0.10	3	0.34	1	0.12	5	0.47	1	0.07	1	0.13	2	0.17	2	0.16	2	0.21
OBC	3	0.31	1	0.08	2	0.22	2	0.17	6	0.64	2	0.17	1	0.14	3	0.31	3	0.28	3	0.26
Others	2	0.22	1	0.10	2	0.22	2	0.21	4	0.36	1	0.14	1	0.14	2	0.23	2	0.21	2	0.25
Religion																				
Hindus	3	0.32	1	0.10	2	0.25	2	0.25	5	0.54	2	0.15	2	0.16	3	0.26	2	0.22	3	0.26
Others	2	0.22	1	0.09	2	0.18	2	0.21	3	0.28	1	0.12	1	0.08	2	0.21	2	0.17	2	0.15
Wealth Quintile																				
Poorest	2	0.21	1	0.08	2	0.19	1	0.06	3	0.29	1	0.12	1	0.11	2	0.18	2	0.48	2	0.19
Poor	4	0.39	1	0.08	2	0.19	1	0.13	5	0.46	1	0.12	1	0.06	1	0.13	2	0.16	2	0.19
Medium	3	0.33	1	0.09	1	0.14	2	0.19	4	0.36	2	0.15	1	0.14	2	0.19	2	0.06	2	0.18
Rich	3	0.31	1	0.07	3	0.30	6	0.58	5	0.45	1	0.15	1	0.12	4	0.39	2	0.00	2	0.20
Richest	2	0.18	4	0.38	8	0.84	4	0.43	10	0.97	2	0.24	5	0.54	7	0.68	4	0.37	6	0.61

Social Determinants	71st Round										75th Round									
	Infectious		CVD		NCD		Disability		Others		Infectious		CVD		NCD		Disability		Others	
	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%
Education																				
Illiterate	4	0.42	1	0.13	2	0.19	2	0.20	5	0.53	2	0.20	2	0.20	3	0.28	2	0.21	3	0.30
Below Primary & Primary	3	0.29	1	0.09	2	0.20	3	0.26	4	0.40	1	0.15	1	0.11	2	0.20	2	0.17	2	0.18
Secondary & Higher Secondary	2	0.16	1	0.07	3	0.32	2	0.23	4	0.41	1	0.10	1	0.11	3	0.30	2	0.19	2	0.25
Graduate & above	0	0.03	2	0.18	2	0.24	1	0.10	6	0.58	1	0.06	1	0.14	3	0.27	5	0.55	3	0.28
Household Size																				
1-4 members	4	0.38	1	0.06	2	0.24	2	0.21	5	0.51	2	0.20	1	0.13	3	0.31	2	0.23	3	0.27
5-7 members	2	0.23	1	0.11	2	0.19	3	0.29	4	0.39	1	0.12	1	0.13	2	0.20	2	0.20	2	0.21
8 or more members	2	0.19	2	0.18	3	0.27	1	0.12	4	0.39	0	0.05	1	0.10	2	0.19	2	0.16	1	0.13
Usual Activity Status																				
Employed	NA		NA		NA		NA		NA		1	0.14	2	0.17	2	0.21	3	0.29	2	0.21
Unemployed	NA		NA		NA		NA		NA		1	0.13	1	0.11	3	0.27	2	0.17	2	0.22
Others	NA		NA		NA		NA		NA		2	0.20	2	0.16	2	0.19	2	0.17	4	0.43
Not in work force	NA		NA		NA		NA		NA		3	0.32	-	-	1	0.13	0	0.03	1	0.12
Health Insurance																				
Covered	3	0.26	1	0.13	5	0.55	4	0.36	14	1.35	3	0.28	2	0.23	5	0.47	4	0.38	4	0.45
Not Covered	3	0.29	1	0.09	2	0.21	2	0.23	4	0.41	1	0.13	1	0.12	2	0.23	2	0.19	2	0.21
Area																				
Rural	3	0.30	1	0.10	2	0.24	2	0.22	4	0.42	1	0.13	1	0.12	2	0.24	2	0.18	2	0.21
Urban	2	0.19	3	0.34	7	0.66	4	0.39	8	0.79	2	0.23	3	0.33	4	0.36	4	0.37	4	0.37
NSS Region																				
Eastern Plains	3	0.28	2	0.15	6	0.55	4	0.39	9	0.92	1	0.15	2	0.18	3	0.34	4	0.37	4	0.35
Western Plains	1	0.09	2	0.16	2	0.23	1	0.13	3	0.30	1	0.10	1	0.09	2	0.22	1	0.15	2	0.24
Cachar Plains	9	0.93	1	0.07	1	0.15	3	0.28	3	0.27	2	0.17	3	0.25	2	0.22	1	0.14	2	0.23
Central Brahmaputra Plains	2	0.23	1	0.07	2	0.23	3	0.25	4	0.43	2	0.17	1	0.11	2	0.22	2	0.15	1	0.09

Source: Estimated from unit level data of NSSO 71st and 75th Round
Note: Under not in workforce, sub-category there was no reporting for CVDs

5.3.2 Reporting of disease specific morbidity by spell of ailment

Spell of ailment is mainly concentrated in the categories of infectious diseases and other diseases. The transition which can be observed while moving from 71st to 75th round is that, reporting of infectious disease has come down or remained equal by socioeconomic factors, whereas NCDs and CVDs has slightly gone up. The reporting of disabilities in the 15 days reference period has also come down.

71st Round

i. **Infectious disease** (see table 5.7) reporting is more among females (14 per 1000 persons female; 8 per 1000 males). In terms of age, it is highest in the older age group of 46-59 years followed by youngest age group (0-14 years). Reporting is higher among others group for marital status, rural population (12 per 1000 population rural; 3 per 1000 population urban) and those not covered under health insurance. Reporting of infectious disease in the last 15 days is highest in the NSS region of Central Brahmaputra Plains. Education group of illiterates (19 per 1000 persons) and poorest wealth quintile (13 per 1000 persons) reported highest infectious diseases. Amongst the social groups, ST and others social group reported the highest.

ii. For **NCDs and CVDs**, NCD reporting is higher among females. CVD and NCD reporting are highest for the older age group (60 years and above age group for CVDs; 31- 59 years of age for NCDs), highest wealth quintile of richest and in the education group of graduate and above. One of the reasons for higher prevalence of NCDs in the age group of 31- 59 years in Assam is because in recent years, population affected by diabetes have risen, which comes under diabetes (see table A 4.5 in appendix). In terms of geographic characteristics, reporting of both CVDs and NCDs is higher in urban regions and the NSS region of Western Plains.

iii. **Disability** reporting is higher among females (9 per 1000 persons females; 5 per 1000 persons male). Its reporting is highest among the oldest age group, among OBC social group, richest quintile, education group of graduate and above and in the NSS region of Western Plains.

iv. For **other diseases** too, reporting is higher among females, whereas for age groups, it is higher among the young age of 1-30 years. For socio-economic status, reporting is highest among richest wealth quintile, education group of illiterates and those covered under health insurance. For geographical region, reporting is higher among the urban population and in the NSS region of Central Brahmaputra Plains.

i. Higher reporting of **infectious diseases** among females, older age groups and richer wealth quintiles apart from urban population.

ii. For **CVDs and NCDs**, reporting is higher among males except for NCDs it is higher among females, higher wealth quintile, in the urban areas and in the NSS region of Western plains. But, overall, when comparing with the 71st round shows, the reporting of CVDs and NCDs has risen in most of the sub-categories and disability reporting has come down, with few exceptions. Reporting of CVDs has risen for the sub categories under gender, age, marital status, social group, and religion. Socio-economic variables like education and wealth quintile, where reporting was very low in the poorer quintiles and lower education groups have seen a sharp rise in CVDs and NCDs in the 75th round. Reporting also increased in the rural areas. Similar trends were seen for NCDs reporting too.

iii. By most socioeconomic categories, **disability** reporting has fallen.

Table 5.7 summarizes the estimates.

Table 5.7: Disease Specific Morbidity Reported by Socioeconomic Factors in Assam for Spell of Ailment Per 1000 (also in percent)

Social Determinants	71st Round										75th Round									
	Infectious		CVD		NCD		Disability		Others		Infectious		CVD		NCD		Disability		Others	
	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%
Gender																				
Male	8	0.75	0	0.03	2	0.21	5	0.46	11	1.09	8	0.82	3	0.27	2	0.24	3	0.30	6	0.58
Female	14	1.45	0	0.05	3	0.33	9	0.86	16	1.55	11	1.09	2	0.17	3	0.32	5	0.55	7	0.70
Age																				
0 - 14	15	1.51	0	0.004	0	0.01	2	0.17	14	1.41	21	2.06	0	0.003	0	0.03	3	0.28	12	1.23
15 - 30	3	0.26	0	0.03	-	-	3	0.25	14	1.42	6	0.64	1	0.08	1	0.06	2	0.25	4	0.38
31 - 45	4	0.42	0	0.02	7	0.75	8	0.81	12	1.20	2	0.21	3	0.30	0	0.05	2	0.18	3	0.25
46 - 59	32	3.20	1	0.08	6	0.60	5	0.49	12	1.17	5	0.51	5	0.52	8	0.78	6	0.62	8	0.83
60 and above	12	1.15	3	0.27	2	0.19	40	4.04	10	1.01	17	1.70	10	0.98	23	2.31	26	2.56	3	0.31
Marital Status																				
Currently Married	8	0.80	0	0.03	4	0.43	5	0.49	11	1.12	4	0.42	3	0.31	4	0.41	4	0.41	4	0.44
Others	13	1.35	0	0.05	1	0.09	8	0.80	15	1.49	15	1.46	1	0.14	1	0.15	4	0.43	8	0.83
Social Group																				
ST	11	1.06	0	0.002	0	0.04	5	0.50	2	0.17	4	0.43	1	0.08	2	0.15	5	0.46	10	1.00
SC	10	1.05	0	0.003	0	0.04	3	0.34	4	0.41	21	2.06	2	0.15	5	0.46	2	0.16	1	0.13
OBC	10	0.96	1	0.08	5	0.47	10	0.99	15	1.54	12	1.17	3	0.26	3	0.28	7	0.69	2	0.17
Others	11	1.13	0	0.04	3	0.26	6	0.57	16	1.60	7	0.75	3	0.27	3	0.29	3	0.28	9	0.93
Religion																				
Hindu	9	0.88	1	0.06	3	0.27	7	0.69	12	1.21	9	0.86	2	0.21	4	0.36	4	0.38	6	0.61
Others	14	1.38	0	0.02	2	0.25	6	0.58	15	1.46	11	1.10	2	0.25	1	0.13	5	0.48	7	0.68
Wealth Quintile																				
Poorest	13	1.30	0	0.03	0	0.04	7	0.74	14	1.37	7	0.69	2	0.20	1	0.07	3	0.33	4	0.38
Poor	14	1.43	0	0.04	5	0.49	7	0.74	11	1.13	13	1.28	1	0.15	4	0.43	4	0.43	6	0.61
Medium	10	0.99	0	0.01	1	0.12	3	0.33	13	1.26	10	0.97	2	0.20	1	0.13	5	0.50	6	0.62
Rich	6	0.61	0	0.03	3	0.32	2	0.24	12	1.18	6	0.55	2	0.20	3	0.34	6	0.57	9	0.92
Richest	8	0.78	1	0.13	4	0.45	13	1.25	17	1.72	13	1.27	6	0.58	6	0.58	3	0.33	11	1.08
Education																				
Illiterate	19	1.95	1	0.07	3	0.32	19	1.93	15	1.51	8	0.76	6	0.58	6	0.57	12	1.21	8	0.85
Below Primary & Primary	10	1.03	0	0.04	2	0.24	3	0.29	13	1.34	12	1.22	1	0.10	2	0.20	4	0.36	6	0.59
Secondary & Higher Secondary	4	0.40	0	0.002	0	0.01	3	0.34	12	1.17	5	0.54	2	0.19	2	0.23	1	0.06	4	0.38
Graduate & above	0	0.03	1	0.11	15	1.50	0	0.01	4	0.36	8	0.76	4	0.43	3	0.25	1	0.07	16	1.64

Social Determinants	71st Round										75th Round									
	Infectious		CVD		NCD		Disability		Others		Infectious		CVD		NCD		Disability		Others	
	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%	Per 1000	%
Household Size																				
1-4 members	8	0.77	0	0.004	3	0.25	6	0.57	11	1.11	10	0.97	2	0.24	3	0.34	6	0.59	9	0.87
5-7 members	11	1.10	1	0.06	3	0.28	7	0.73	16	1.55	10	0.97	2	0.17	3	0.25	2	0.18	6	0.57
8 or more members	19	1.92	1	0.09	2	0.24	6	0.56	10	1.05	8	0.78	3	0.35	2	0.23	8	0.85	3	0.30
Usual Activity Status																				
Employed	NA		NA		NA		NA		NA		4	0.37	4	0.43	4	0.37	4	0.43	4	0.42
Unemployed	NA		NA		NA		NA		NA		12	1.24	1	0.14	3	0.27	4	0.37	7	0.68
Others	NA		NA		NA		NA		NA		2	0.20	1	0.07	0	0.05	12	1.17	2	0.23
Not in work force	NA		NA		NA		NA		NA		20	2.02	-	-	0	0.03	0	0.00	26	2.61
Health Insurance																				
Covered	3	0.31	-	-	1	0.06	1	0.07	29	2.94	6	0.57	9	0.89	1	0.12	0	0.01	11	1.14
Not Covered	11	1.10	0	0.04	3	0.27	7	0.66	13	1.26	10	0.97	2	0.18	3	0.29	4	0.44	6	0.61
Area																				
Rural	12	1.18	0	0.03	2	0.23	6	0.63	11	1.09	9	0.87	2	0.16	2	0.22	4	0.43	6	0.58
Urban	3	0.32	1	0.12	5	0.54	8	0.76	30	2.97	15	1.52	7	0.68	7	0.73	4	0.36	11	1.08
NSS Region																				
Eastern Plains	5	0.55	0	0.03	2	0.18	7	0.69	10	1.00	13	1.34	0	0.01	2	0.17	1	0.15	1	0.14
Western Plains	8	0.75	1	0.06	4	0.40	9	0.94	13	1.27	14	1.43	5	0.46	6	0.61	10	0.98	14	1.40
Cachar Plains	2	0.15	-	-	-	-	0	0.01	1	0.08	4	0.41	4	0.37	1	0.13	1	0.08	3	0.34
Central Brahmaputra Plains	27	2.70	1	0.06	3	0.29	5	0.52	25	2.45	2	0.20	0	0.01	0	0.01	1	0.12	3	0.25

Source: Calculated from unit level data of NSSO 71st and 75th Round
Note: For a few of the sub-categories under certain disease group there were no reporting

5.3.3 Reporting of disease specific morbidity by socioeconomic determinants - results of multivariate logistic regression

For the analysis of disease-specific morbidity reporting by social determinants multivariate logistic regression has been used. In this model, each type of disease reported is treated as the dependent variable. The results of the analysis have been interpreted in terms of odds ratio.

The dependent variable taken for diseases specific morbidity for hospitalization cases, the first model is "*Reporting of infectious disease as in-patient of medical institution (hospitalization)*" if yes, the variable takes value 1, or 0 otherwise. Similarly, we take the second model, where the dependent variable is "*Reporting of CVD as in-patient of medical institution*" if yes, the variable takes 1, or 0 otherwise. Likewise, we consider three other models for which the dependent variables considered are: *reporting of NCDs as in-patient of medical institution*, *reporting of disabilities as in-patient of medical institution* and *reporting of other diseases as in-patient of medical institution*.

For multivariate analysis of reporting of disease-specific morbidity for spell of ailment in the last 15 days, the dependent variable considered for the model is: "*Reporting of infectious disease for spell of ailment in the last 15 days*" if yes, the variable takes value 1, or 0 otherwise and so on for all the five types of diseases for spell of ailment in the last 15 days.

The independent variables considered for the model has been described in table 5.8

Table 5.8: Description of the Independent variables considered for Reporting of Disease-Specific Morbidity

Variable Name	Variable Description
Demographic Factors	
Gender	Female =1, Male =0
Age	60 and above (base category)
46-59	age in years
31-45	age in years
15-30	age in years
0-14	age in years
Marital Status	Currently Married = 1, 0 Otherwise
Social Group	Others (unreserved = base category)

ST	Schedule Tribe
SC	Schedule Cast
OBC	Other Backward Classes
Religion	Hindu (base category)
Others	Muslim, Christian, Sikhism, Jainism, Buddhism, Zoroastrianism, others
Socio-Economic Factors	
Education	Illiterate (base category)
Below Primary & Primary	
Secondary & Higher Secondary	
Graduate & above	
Activity Status	Employed (base category)
Unemployed	
Others	
Not in workforce	which are children 0-4 years of age
Covered Under Health Insurance	Not Covered =1, Covered =0
log_mpce	MPCE has been taken as a continuous variable and the log of MPCE has been considered for the analysis
Household Size	household size has been taken as a continuous variable
Geographic Factors	
Area of Residence	Rural =1, Urban = 0
NSS Region	Western Plains (base category)
Eastern Plains	
Cachar Plains	
Central Brahmaputra Plains	

Disease specific for hospitalization - multivariate logistic regression

The results are presented in tables 5.9 and table 5.10 respectively, along with the standard error and the marginal effect. The estimates of the variables have been presented in terms of odds ratio. The *significant socioeconomic determinants* for ***71st round*** explaining diseases specific morbidity in Assam are summarised as follows.

i. For **infectious diseases**, gender, age, marital status, area of residence and NSS region
ii. For **CVDs** gender, age, social group of STs, area of residence
iii. Significant variable for **NCDs** reporting is age and area of residence
iv. For **disabilities**, gender, age, marital status, social group of ST category, NSS region and log of MPCE are significant
v. For **other diseases** the significant variables are gender, age, NSS region, health insurance coverage and household size.

The results of ***75th round*** shows:

i. For ***infectious diseases***, gender (females 2.9 percent less likely, significant at 5%), marital status (currently married less likely, significant at 1%), education (secondary and above are less likely to report), NSS region (Central Brahmaputra Plains is 3.9 percent more likely to report compared to Western Plains, significant at 1%), coverage under health insurance is significant.

ii. The *significant variables* for ***CVDs*** are gender (females 3.6 percent less likely to report, significant at 1%), age (younger age groups are less likely to report, all younger age groups significant at 1 %), marital status (currently married less likely to report) and NSS region (all the NNS regions compared to Western Plains are more likely to report).

iii. *Variables significant* for ***NCD*** reporting are age (younger age groups less likely to report, and significant at 1 %), religion (others category 3.9 percent more likely to report), ST & OBC social category (both the categories are more likely to report compared to the others category at 10% level of significance), NSS region (Eastern Plains 3.1 percent more likely to report compared to Western Plains region), and log of MPCE (higher the MPCE the individuals are 3.9 percent more likely to report).

iv. For ***disability***, gender (females less likely to report), age (age groups of 31- 59 are more likely to report, whereas youngest age of 0-30 years less likely to report), marital status, NSS region (Eastern Plains region is 5.7 percent more likely to report whereas Cachar Plains is 5.6 percent less likely to report, significant at 1%) are significant.

v. Gender (females are 4.5 percent less likely to report), age (except for the age group of 15- 30 years, all other younger age groups are more likely to report), and marital status is significant for ***other disease***

Table 5.9: Assam Disease Specific Morbidity Reporting for Hospitalisation Cases- Multivariate Logistic Regression 71st Round

Socioeconomic Factors	Infectious			CVD			NCD			Disability			Other		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds ratio	Robust SE	dy/dx
Gender															
Male^															
Female	0.48738*	0.10517	0.05550	0.34520*	0.11222	-0.04818	0.97829	0.17944	-0.00232	0.40298*	0.07914	-0.07377	0.42619*	0.06613	-0.11475
Age															
60 and above^															
46-59	1.34487	0.42480	0.02981	0.51355**	0.15250	-0.07037	0.89114	0.23158	-0.01916	1.08579	0.30934	0.00964	2.93330*	0.82615	0.14406
31-45	0.82188	0.28910	0.01682	0.22069*	0.08819	-0.12233	0.50715**	0.14130	-0.09580	0.99338	0.30829	-0.00076	3.80908*	1.14099	0.19147
15-30	0.44611**	0.15819	-0.05638	0.05209*	0.03069	-0.15697	0.26495*	0.07870	-0.15313	0.26003*	0.08320	-0.10557	1.02847	0.32176	0.00272
0-14	1.35567	0.45992	0.03069	0.05523*	0.03694	-0.15628	0.56217***	0.17993	-0.08384	0.23302*	0.08139	-0.11057	1.99397**	0.61031	0.08272
Marital Status															
Others^															
Currently Married	0.42901*	0.11049	0.06535	0.81925	0.27858	-0.00903	0.80066	0.19361	-0.02351	0.23023*	0.05359	-0.11921	0.42053*	0.08433	-0.11654
Education															
Illiterate^															
Below Primary & Primary	0.74637	0.18298	0.02500	0.78284	0.25410	-0.01197	1.26279	0.27676	0.02326	0.84943	0.20086	-0.01361	0.85364	0.16425	-0.02210
Secondary & Higher Secondary	0.55727***	0.20245	0.04566	0.60936	0.25702	-0.02234	1.40056	0.39630	0.03481	0.92562	0.27903	-0.00661	0.76498	0.19360	-0.03648
Graduate & above	0.34045	0.31349	0.07214	0.63991	0.39742	-0.02046	1.17562	0.46726	0.01573	0.58998	0.33127	-0.03934	0.72728	0.29671	-0.04284
Religion															
Hindu															
Others	0.86827	0.22777	0.01070	0.67109	0.23269	-0.01700	1.22461	0.24671	0.02210	1.35606	0.33600	0.02580	1.03187	0.18884	0.00423
Social Group															
Others^															
ST	0.89071	0.23684	0.00922	0.49788***	0.20965	-0.02920	0.85868	0.21717	-0.01530	2.25402*	0.59834	0.07717	0.83829	0.18854	-0.02288
SC	1.00984	0.31555	0.00081	0.63165	0.25511	-0.02078	1.11706	0.30598	0.01215	1.01294	0.36708	0.00095	1.10029	0.26402	0.01322
OBC	0.68168	0.18393	0.02809	0.73446	0.25862	-0.01466	1.04990	0.23371	0.00524	1.00492	0.28571	0.00036	1.03797	0.20199	0.00509

Area of Residence															
Urban^															
Rural	1.88723**	0.49907	0.04904	0.55668**	0.14698	-0.02653	0.64126**	0.11905	-0.04698	1.41150	0.34879	0.02798	1.02761	0.18308	0.00366
NSS Region															
Western Plains^															
Eastern Plains	2.12180*	0.59954	0.04566	0.72654	0.23538	-0.01385	1.20802	0.25702	0.02071	1.26138	0.29558	0.02146	0.90334	0.16325	-0.01454
Cachar Plains	5.21343*	1.47631	0.13885	1.64782	0.61997	0.02820	0.86454	0.21038	-0.01423	0.66174	0.19581	-0.03135	0.45203*	0.11161	-0.09587
Central Brahmaputra Plains	2.55876*	0.74954	0.06125	0.63251	0.24672	-0.01897	1.03145	0.23501	0.00322	0.57908**	0.16127	-0.03976	0.89932	0.16438	-0.01516
Health Insurance															
Covered^															
Not Covered	0.88204	0.47008	-0.00969	4.20329***	3.73360	0.06504	0.59290	0.19585	-0.05527	2.19701	1.25404	0.06389	0.52842***	0.17296	-0.08582
log_mpce	0.71123	0.17392	0.02631	0.74238	0.20769	-0.01349	1.10110	0.20413	0.01018	1.95317*	0.41696	0.05434	1.31370	0.25491	0.03671
Household Size	0.97537	0.04683	0.00193	1.05155	0.05481	0.00228	0.97922	0.04042	-0.00222	0.99124	0.04442	-0.00071	0.93679***	0.03396	-0.00879

Source: Calculated from unit level data of NSSO 71st Round

* p <0.01, ** p< 0.05, *** p< 0.1

^ Reference group or base category
Observation: 1629

Table 5.10: Assam Disease Specific Morbidity Reporting for Hospitalisation Cases- Multivariate Logistic Regression 75th Round

Socioeconomic Factors	Infectious			CVD			NCD			Disability			Other		
	Odds Ratio	Robust SE	dy/dx	Odds ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender															
Male^															
Female	0.66389**	0.11973	-0.02949	0.56003*	0.12313	-0.03633	0.76746	0.12746	-0.02981	0.26938*	0.04738	-0.12789	0.63220*	0.11142	-0.04522
Age															
60 and above^															
46-59	1.57994	0.49280	0.02883	0.82777	0.19039	-0.02965	0.60386**	0.12665	-0.09386	1.78399**	0.46838	0.06200	1.74972**	0.44043	0.06626
31-45	1.38519	0.45096	0.01949	0.25109*	0.06885	-0.15493	0.37016*	0.08106	-0.16305	1.70392**	0.43380	0.05639	1.90479**	0.49974	0.07846
15-30	1.12487	0.35147	0.00648	0.04450*	0.01571	-0.21453	0.19110*	0.04135	-0.22560	0.89996	0.22888	-0.00932	0.49966*	0.12956	-0.05280
0-14	5.40965	1.73824	0.16753	0.04948*	0.02302	-0.21296	0.37441*	0.10020	-0.16168	0.56676***	0.16909	-0.04365	1.14487	0.32239	0.01387
Marital Status															
Others^															
Currently Married	0.34550*	0.06937	-0.07650	0.60507**	0.12283	-0.03148	0.85273	0.14396	-0.01794	0.28352*	0.04492	-0.12290	0.38618*	0.06765	-0.09382
Education															
Illiterate^															
Below Primary & Primary	0.68421	0.16176	-0.03105	1.20462	0.26980	0.01197	1.10733	0.20055	0.01114	0.74122	0.15519	-0.03001	0.77269	0.14857	-0.02537
Secondary & Higher Secondary	0.57360**	0.16272	-0.04324	0.99644	0.27291	-0.00022	1.14885	0.24675	0.01534	0.77555	0.18551	-0.02579	1.02648	0.23264	0.00282
Graduate & above	0.42851***	0.19404	-0.06060	0.55269	0.23740	-0.03007	1.17465	0.37202	0.01793	1.32825	0.41464	0.03310	0.93800	0.30753	-0.00670
Religion															
Hindu															
Others	0.98169	0.18751	-0.00133	0.74330	0.15957	-0.01790	1.39525**	0.21050	0.03909	1.18772	0.19539	0.01707	1.09993	0.18641	0.00951
Social Group															
Others^															
ST	1.40233	0.31647	0.02686	0.86415	0.23409	-0.00879	1.42393***	0.26683	0.04080	0.67511***	0.14882	-0.03691	0.78032	0.16837	-0.02255
SC	0.68549	0.19586	-0.02430	1.37900	0.43487	0.02213	1.03984	0.24896	0.00407	0.78271	0.20242	-0.02399	1.10764	0.26192	0.01045
OBC	0.92592	0.18884	-0.00542	0.97230	0.19700	-0.00175	1.31439***	0.20498	0.03075	0.83811	0.14438	-0.01762	1.08167	0.17771	0.00796
Area of Residence															
Urban^															
Rural	1.18107	0.21891	0.01198	0.96914	0.20166	-0.00196	1.40535	0.22987	0.03833	0.83026	0.14260	-0.01814	0.90345	0.14573	-0.01001
NSS Region															
Western Plains^															
Eastern Plains	0.88004	0.19513	-0.00823	1.52792***	0.35126	0.02346	1.31927***	0.21609	0.03185	1.68750*	0.28259	0.05745	0.83630	0.13506	-0.01954
Cachar Plains	1.17185	0.28037	0.01116	2.49516*	0.62189	0.05906	0.95807	0.17708	-0.00443	0.47055*	0.11413	-0.05681	0.79155	0.15069	-0.02511
Central Brahmaputra Plains	1.65409*	0.30919	0.03934	1.77209**	0.39914	0.03323	1.18338	0.18794	0.01868	1.03239	0.17680	0.00305	0.49510	0.08921	-0.06496

Health Insurance															
Covered^															
Not Covered	0.56037**	0.16167	-0.04169	1.36125	0.43801	0.01932	0.86769	0.19616	-0.01599	0.91717	0.23573	-0.00843	1.00091	0.26108	0.00009
Activity Status															
Employed^															
Unemployed	0.46921*	0.10478	-0.05970	0.86405	0.20302	-0.00931	1.01762	0.19541	0.00195	0.76539	0.14785	-0.02785	1.08766	0.22857	0.00829
Others	0.67542	0.23947	-0.03420	0.80773	0.32143	-0.01334	0.98610	0.32647	-0.00155	0.46595***	0.18632	-0.06916	0.92284	0.34349	-0.00750
Not in workforce	0.66763	0.31421	-0.03510	-	-	-	1.69457	0.85139	0.06896	0.21181**	0.14693	-0.11148	0.56486	0.31397	-0.04512
log_mpce	1.11840	0.21060	0.00805	1.25546	0.26657	0.01425	1.42625**	0.23063	0.03999	0.82046	0.14536	-0.01929	0.93019	0.15161	-0.00714
Household Size	0.95612	0.03990	-0.00323	0.94815	0.04513	-0.00334	0.98359	0.03204	-0.00186	0.96940	0.03563	-0.00303	0.94338	0.03637	-0.00575

Source: Calculated from unit level data of NSSO 75th Round

* p <0.01, ** p< 0.05, *** p< 0.1

^ Reference group or base category

Observation: 2692

Disease specific for spell of ailment- multivariate logistic regression

Table 5.11 shows the results of multivariate regression for spell of ailment for the ***71st round***.

i. ***Age*** is a significant variable for infectious diseases, NCDs, disabilities and other diseases. For age younger age groups are more likely to report for infectious diseases and other diseases (significant at 5 % level of significance), whereas they are less likely to report disabilities. For NCDs the age group between 31- 59 are more likely to report compared to the base category of 60 years and above.

ii. Higher ***education groups*** are less likely to report infectious diseases compared to the base category of illiterates (below primary and primary level significant at 5%); whereas for other diseases higher education groups are more likely to report (below primary and primary level 12 percent more likely to report, significant at 10%).

iii. ***NSS regions*** of Eastern Plains (significant at 5%) and Central Brahmaputra Plains (significant at 1%) are more likely to report infectious diseases; on the contrary, Cachar Plains (significant at 5%) and Central Brahmaputra Plains (significant at 1 %) are less likely to report disability compared to base category of Western Plains.

iv. As **MPCE** of the individuals increase, a person is 11 percent less likely to report disability (significant at 5 %) and 10 percent more likely to report other diseases (significant at 10 %).

In the ***75th round*** (see table 5.12),

i. By ***gender***, females are 15 percent less likely to report CVDs (significant at 1 %) whereas 10 percent more likely to report NCDs (significant at 10%).

ii. By ***age*** group, younger age groups are less likely to report CVDs, NCDs and disabilities; on the contrary they are more likely to report infectious diseases and other diseases. The youngest age group of 0- 14 years is 38 percent more likely to report infectious diseases (significant at 1 %).

iii. By ***education***, higher education groups are more likely to report NCDs and other diseases; whereas less likely to report infectious diseases (graduate and above group 22 percent less likely to report, significant at 10%). Compared to the base category of others for **social groups**, all the categories (ST, SC and OBC) are more likely to report disability and less likely to report other diseases. **Rural areas** are 8.8 percent less likely to report CVDs (significant at 10%). For ***NSS regions***, Eastern Plains region is more likely to report infectious diseases (significant at 1 %) and less likely to report other diseases (significant at 5 %).

Table 5.11: Assam Disease Specific Morbidity Reporting for Spell of Ailment in the last 15 days - Multivariate Logistic Regression 71st Round

Socioeconomic Factors	Infectious			CVD			NCD			Disability			Other		
	Odds ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds ratio	Robust SE	dy/dx
Gender															
Male^															
Female	0.78229	0.23831	-0.03809	0.62948	0.34619	-0.02195	1.08074	0.54131	0.00673	1.42651	0.50213	0.04761	0.85167	0.23097	-0.03322
Age															
60 and above^															
46-59	4.91953*	2.78816	0.18740	0.43202	0.36075	-0.05299	3.08422	1.72131	0.10886	0.27032*	0.12034	-0.26057	1.07740	0.47528	0.01355
31-45	3.84785**	2.29884	0.14721	0.50143	0.43349	-0.04585	1.86656**	1.35581	0.05014	0.23147*	0.11478	-0.28539	1.77414	0.82315	0.11358
15-30	5.07195**	3.30539	0.19267	0.17514	0.21472	-0.08156	-	-	-	0.13172*	0.07978	-0.36078	2.90086**	1.45234	0.22306
0-14	10.84050*	6.23838	0.33990	0.25003	0.22169	-0.07283	0.70834	0.58925	-0.01895	0.01855*	0.01525	-0.47834	2.97332**	1.32635	0.22868
Marital Status															
Others^															
Currently Married	1.54138	0.62457	0.06713	0.60609	0.34753	-0.02375	1.08720	0.70127	0.00725	0.57757	0.23234	-0.07357	1.09054	0.40387	0.01793
Education															
Illiterate^															
Below Primary & Primary	0.45548**	0.15742	-0.12601	1.21544	0.86321	0.00932	0.83507	0.42710	-0.01594	1.23510	0.48996	0.02707	1.80486***	0.56534	0.12389
Secondary & Higher Secondary	0.46984	0.30139	-0.12167	0.61208	0.79333	-0.01785	0.47046	0.41594	-0.05500	2.67305	1.66531	0.14180	1.22061	0.66377	0.04000
Graduate & above	0.49564	0.57313	-0.11406	2.35801	2.57375	0.05326	1.44339	1.87652	0.03863	0.44700	0.52456	-0.08350	1.22170	0.93686	0.04018
Religion															
Hindu															
Others	0.34701**	0.15799	-0.15187	0.37765	0.33095	-0.03986	0.77174	0.36438	-0.02197	1.78962	0.84147	0.08077	1.51908	0.53630	0.08811
Social Group															
Others^															
ST	0.91440	0.47582	-0.01433	0.47578	0.75133	-0.02636	0.72484	0.47432	-0.02419	2.16072	1.23846	0.10484	0.66238	0.30066	-0.08490
SC	1.17451	0.70957	0.02667	0.70607	0.79719	-0.01434	1.76993	1.47910	0.05781	0.91101	0.67531	-0.01077	0.69584	0.39084	-0.07519
OBC	0.61611	0.29178	-0.07270	1.45063	1.10349	0.02025	1.13369	0.66054	0.01099	2.02451	0.96843	0.09498	0.76236	0.28007	-0.05685
Area of Residence															
Urban^															
Rural	1.80868	0.75959	0.09194	0.69839	0.51215	-0.01703	1.54300	0.84286	0.03759	0.94418	0.40230	-0.00770	0.67657	0.22878	-0.08084
NSS Region															
Western Plains^															
Eastern Plains	2.06324***	0.90102	0.10494	1.73376	1.76362	0.02365	0.20753**	0.13351	-0.13372	0.75946	0.32634	-0.04193	1.09223	0.38707	0.01823
Cachar Plains	0.84099	0.64415	-0.01990	-	-	-	-	-	-	0.28096**	0.17833	-0.16088	2.13044	1.24380	0.16354
Central Brahmaputra Plains	3.47715*	1.35872	0.20013	2.40163	2.11609	0.04291	0.28734**	0.16716	-0.11737	0.27038*	0.12125	-0.16441	1.06279	0.36707	0.01255
Health Insurance															
Covered^															
Not Covered	0.71953	0.67642	-0.05107	-	-	0.00000	0.40713	0.50889	-0.07788	2.32422	2.72264	0.11304	0.66274	0.45809	-0.08511
log_mpce	0.64557	0.28709	-0.06789	2.83838	1.84470	0.04948	0.89279	0.37716	-0.00983	0.42099**	0.18546	-0.11595	1.69923***	0.51903	0.10969
Household Size	1.00424	0.06517	0.00066	1.08220	0.13606	0.00375	1.01881	0.09450	0.00161	0.81289*	0.06314	-0.02777	1.15743*	0.06329	0.03025

Source: Calculated from unit level data of NSSO 71st Round
* p <0.01, ** p< 0.05, *** p< 0.1
^ Reference group or base category
Observation: 317

Table 5.12: Assam Disease Specific Morbidity Reporting for Spell of Ailment in the last 15 days - Multivariate Logistic Regression 75th Round

Socioeconomic Factors	Infectious			CVD			NCD			Disability			Other		
	Odds Ratio	Robust SE	dy/dx	Odds ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender															
Male^															
Female	1.06397	0.31744	0.00999	0.18835*	0.08283	-0.15552	2.04409***	0.78884	0.10468	1.29289	0.52999	0.03228	0.91454	0.30099	-0.01197
Age															
60 and above^															
46-59	0.88141	0.39772	-0.01669	1.14394	0.56352	0.01567	0.78084	0.27329	-0.05263	0.82665	0.36375	-0.02972	2.45794***	1.21400	0.06979
31-45	1.58514	0.75643	0.07103	0.78774	0.46028	-0.02513	0.32716**	0.15522	-0.20376	0.54300	0.32267	-0.08621	8.75567*	4.73787	0.25499
15-30	1.81097	0.82392	0.09445	0.24619***	0.20856	-0.10522	0.27333*	0.12888	-0.22743	0.75694	0.42116	-0.04261	6.39997*	3.49270	0.19966
0-14	7.38239*	3.53680	0.38885	0.18650**	0.15603	-0.11619	0.02876*	0.03128	-0.36146	0.13925*	0.09044	-0.19171	12.33498	8.86747	0.32109
Marital Status															
Others^															
Currently Married	0.80233	0.27047	-0.03549	0.81424	0.38130	-0.01914	1.64373	0.54340	0.07277	0.45778**	0.16980	-0.09820	1.79405	0.78867	0.07833
Education															
Illiterate^															
Below Primary & Primary	0.75105	0.28413	-0.04873	0.43018***	0.19343	-0.08468	2.28348**	0.87813	0.12155	0.90691	0.37186	-0.01336	0.89430	0.45195	-0.01325
Secondary & Higher Secondary	0.73437	0.35828	-0.05238	0.42073	0.27217	-0.08645	1.28626	0.62798	0.03293	0.47850	0.28372	-0.08443	3.31614**	1.73468	0.18163
Graduate & above	0.19187***	0.17049	-0.22069	0.56616	0.42237	-0.06093	1.40971	0.91153	0.04588	0.71868	0.56072	-0.04245	1.84438	1.40376	0.08455
Religion															
Hindu															
Others	0.99718	0.33279	-0.00045	0.57254	0.27467	-0.04936	0.96589	0.34142	-0.00507	2.12188***	0.91865	0.10063	0.77009	0.24688	-0.03438
Social Group															
Others^															
ST	0.93282	0.39077	-0.01064	0.63631	0.40840	-0.04305	0.81149	0.38070	-0.02793	2.80636**	1.32549	0.14279	0.67520	0.26555	-0.05825
SC	1.56225	0.70089	0.07358	0.44851	0.31637	-0.06946	1.70744	0.79153	0.08273	2.00165	1.10458	0.08788	0.38328***	0.20453	-0.12552
OBC	1.74729	0.63413	0.09334	0.59930	0.33091	-0.04799	1.48367	0.56016	0.05961	1.59681	0.71082	0.05556	0.28165*	0.12609	-0.15387
Area of Residence															
Urban^															
Rural	1.05520	0.37734	0.00866	0.38578***	0.19853	-0.08873	1.26633	0.43649	0.03457	0.87342	0.38311	-0.01701	1.55115	0.62267	0.05884
NSS Region															
Western Plains^															
Eastern Plains	3.25890*	1.37374	0.21290	0.48492	0.31535	-0.06090	0.83789	0.47216	-0.02540	1.40189	0.67974	0.04595	0.24652**	0.15612	-0.13940
Cachar Plains	1.25330	0.56209	0.03657	0.61302	0.33626	-0.04394	0.87525	0.37555	-0.01930	0.89419	0.38736	-0.01349	1.93268	0.92071	0.10337
Central Brahmaputra Plains	1.97450	1.17335	0.11694	0.47907	0.52561	-0.06171	0.97144	0.63921	-0.00428	0.84804	0.58544	-0.01959	0.61358	0.47688	-0.06140
Health Insurance															
Covered^															
Not Covered	1.11072	0.70021	0.01692	0.23186**	0.14087	-0.13616	0.78795	0.46451	-0.03489	3.21394	3.69412	0.14673	2.69165	2.25559	0.13271

Activity Status															
Employed^															
Unemployed	0.55788	0.20521	-0.09586	1.19691	0.58913	0.01626	0.81629	0.33745	-0.02975	0.99742	0.48370	-0.00032	2.37429***	1.10267	0.10547
Others	0.36601	0.25577	-0.15573	1.53678	0.91775	0.04154	0.76059	0.46126	-0.03959	1.18686	0.69695	0.02238	2.11670	1.63669	0.08908
Not in workforce	0.56111	0.37684	-0.09499	-	-	-	2.96271	4.44473	0.18423	-	-	-	2.39519	1.84934	0.10675
log_mpce	0.71471	0.24921	-0.05412	1.03893	0.44497	0.00356	1.46100	0.54636	0.05551	0.68402	0.32784	-0.04773	1.22775	0.44675	0.02750
Household Size	1.07244	0.06317	0.01127	1.09959	0.08034	0.00884	0.98432	0.06248	-0.00231	0.91029	0.06148	-0.01181	0.97650	0.06763	-0.00319

Source: Calculated from unit level data of NSSO 75th Round

* p <0.01, ** p< 0.05, *** p< 0.1

^ Reference group or base category
Observation: 419

5.4 Assam state level pattern of Morbidity: Summary

The main aim of the chapter was to understand the prevalence of self-reported morbidity in Assam based on unit level data from NSS 71st and 75th round. Similar to all India results, as discussed in chapter 4, overall reporting in Assam has fallen too from 71st to 75th round. Overall, Assam has reported lower than the Indian average. It is observed that overall reporting of ailment in all categories is low for Assam as compared to the national average for disease specific morbidity. Assam has a population size of more than 30 million, however, is in the lower end of reporting both acute and chronic ailment. Assam has lower health outcomes in terms of higher maternal mortality and child mortality compared to all India average. Therefore, low reporting of morbidity in Assam is inconsistent and needs further investigation. There is a need for Assam state sample data to be churned out regularly for more robust analysis.

Based on *WHO's social determinants framework* (Solar & Irwin, 2010; WHO 2010) and the larger literature of factors affecting self-reported morbidity, various social determinants under three broad categories demographic factors, socioeconomic factors and geographical factors were considered for estimating morbidity prevalence as well as disease specific morbidity prevalence in Assam.

Overall prevalence of morbidity in Assam

Analysis of morbidity prevalence at the state level of Assam by various social determinants shows an uneven spread across demographic variables, socioeconomic characteristics, and geographical areas. Women, younger and older age population suffer more acute morbidities. Reporting is highest in Western Plains region in 75th round. Higher wealth quintile reflects more chronic diseases. Age has been an important factor. J-shaped relation exists between reporting of acute ailment, with reporting being higher in the youngest age group and older age groups (Ghosh & Arokiasamy, 2009). On the other hand, reporting of chronic ailment is higher

in the older age group. As evident from existing literature, reporting of ailment is more for females (Srinivasan, et al. 2017; Paul & Singh, 2017). As for the wealth quintile, reporting of chronic ailment is higher among the higher wealth quintile. Studies suggest that this may be due to life-style related nature of chronic ailment resulting in higher burden of chronic ailment among the economically better-off groups. At the same time the economically better off groups, are generally more aware of health issues and have better access to health care facilities both government and private facility. Therefore, they are more likely to report morbidity (Dilip, 2002). Education has been an important determining factor in the 71st round, with the lower education groups reporting higher both acute and chronic morbidity. This has been evident in previous studies too carried out based of large sample secondary data (Subramanian et.al, 2009). There is a significant rural-urban gap in reporting of morbidity in Assam. This variation also spreads across NSS regions, reporting being higher in the Western Plains especially in the 75th round. These variations clearly signify a difference in access and availability of health care facilities within Assam. It may also be due to the healthcare-seeking behaviour and availability of the health care services for the population. People may not be aware of these diseases, due to lack of awareness and at the same time due to not availing the health care services.

Disease pattern by socio-economic category

In Assam, overall morbidity reporting for disease-specific morbidity too has fallen for infectious, disabilities and others from 71st to 75th round. However, reporting of CVDs and NCDs has slightly gone up in 75th round, compared to 71st round. For various social determinants, a similar pattern can be observed in the reporting of disease-specific morbidity for both cases of hospitalization in the last 365 days and reporting of spell of ailment in the last 15 days. For disease specific morbidity in Assam; age, gender, education, residence of rural or urban areas, MPCE and NSS regions have been determining factors.

Here, too age has been an important factor. J-shaped relation exists for reporting of infectious diseases, with reporting being higher in the youngest age group and older age groups. On the other hand, reporting of CVDs, NCDs and disability are higher in the older age group. Females reporting more morbidities, especially NCDs is evident from the fact that recent studies have shown there has been a rise in NCDs among females in India, especially urban females (Agrawal and Arokiasamy, 2010; Ghosh and Arokiasamy, 2009). Higher prevalence of both communicable diseases (infectious) and non-communicable diseases (CVDs & NCDs) among the richest wealth quintile clearly indicate the dual nature of disease prevalence in the population. At the same time, it is interesting to note higher prevalence of CVDs and NCDs among the lowest education group in the 75th round. Overall, for all types of diseases reporting is higher in urban areas, but higher prevalence of infectious diseases in urban areas in the 75th round is also a matter of concern, which needs to be further investigated. Therefore, we can say that the dual nature of both communicable and non-communicable disease prevalence is inevitable.

For disease-specific morbidity reporting for *spell of ailment*, reporting has been higher in the Western Plains region in the 75th round. From 71st to 75th round there has been an increase in reporting of disease specific morbidity, especially CVDs and NCDs. When comparing among infectious disease, CVDs and NCDs in each of the rounds of 71st and 75th, it shows for each individual round the reporting of infectious disease is higher when compared with CVDs and NCDs in both the rounds in most of the cases except for a few cases of oldest age group in the 75th round and for the education group of graduate & above in the 71st round. The overall, reporting of disability and other disease has also been high in both the rounds.

Hospitalization due to NCDs slightly higher in 75th round, by all socio-economic categories. Hospitalization due to NCDs and disabilities higher among older age groups in 71st round. Hospitalization due to NCDs slightly higher in 75th round, by all socio-economic

categories. By hospitalization cases, disease prevalence highest in Eastern Plains region of Assam in both 71st and 75th rounds. The availability of hospital facilities may impact hospitalization cases. However, we cannot segregate such information based on NSSO data.

5.5 Limitation of using NSSO unit level data for state level analysis & Conclusion

This chapter made an attempt to understand the socioeconomic determinants that affect morbidity and disease-specific morbidity in Assam, based on NSS unit level data. There are no published studies on Assam to the best of our knowledge. The state level analysis of Assam gives us an overall picture of the prevailing morbidity status of the population. However, there are a few limitations.

At the state level, there is a lack of robust consolidated data sets providing information on the health status of the population. NSS data has been a continuous source in this aspect. However, NSS unit level sampling is based on a central sample pool and state sample pool. The morbidity estimates should ideally be based on the pooled sample – central and state. However, Assam's state sample pool is yet not available for analysis. Therefore, going further down to district level analysis is not possible. Other states, such as Kerala, makes state sample pool regularly available. Therefore, the Kerala morbidity estimates are relatively robust.

It is evident from the data that overall reporting of morbidity has been low in Assam. Although reporting of acute ailment is higher than chronic ailment, this makes sense as the reference period for acute ailment is shorter compared to chronic ailment in terms of recall by the respondent. Since overall reporting of morbidity has been low in Assam, it would have been fruitful to further look into the district level estimates for further analysis. There are limitations of estimating at the district level with only the central sample data as the sample size at the district level are small. Exploring morbidity estimates with pooled data of central and state samples may possibly give us better results.

Following the all-India pattern, between 71st and 75th rounds, Assam's reporting has also come down. As has been pointed earlier, definitional changes may contribute to such reporting pattern. However, with the present set of questions that we have, we cannot probe this further. The NSSO 75th round report also shows that Assam's dependence on the public health sector is very high. In other words, people seeking healthcare in government health facilities is higher. Could access, availability of health facilities and health seeking behavior impact reporting of morbidity? Based on morbidity reporting it looks like the status of health of the population in Assam and other north-eastern states is better off, however, we need to deliberate why morbidity reporting is very low. It needs deliberation at the policy level to understand the low reporting of morbidity in Assam.

The findings, mainly focus on structural determinants under which we focus on gender, education, occupation, income as well as place of residence which contributes to the lager health and wellbeing of an individual. Therefore, at policy level we need better intervention at various level which affects health status at various level. It affects at individual level, community level, health systems level and government policy level. Another important determining factor which affects health status is the access and availability to food and nutrition. But NSSO health rounds do not provide on consumption or consumption expenditure.

Chapter 6 Morbidity Prevalence and Disease Profile of Tea Plantation Workers of Assam: A Cross Sectional Analysis

This chapter discusses the status of self-reported morbidity among tea plantation workers of Assam. The chapter is based on primary data collected at household level of tea plantation workers in four tea garden dominated districts of Assam (Dibrugarh, Tinsukia, Sibsagar and Jorhat). We discuss self-reported morbidity at the household level and worker level.

Section 6.1 discusses the rationale of taking tea plantation workers as unit of primary study. Section 6.2 discusses demographic profile of the overall survey population, anthropometric status, diet, and workplace hazard of the worker population. Section 6.3 discusses the morbidity status of the survey population. We also estimate self-reported morbidity by specific socioeconomic characteristics. Section 6.4 discusses the morbidity status at tea plantation workers by different factors affecting morbidity. A binary logistic regression analysis is also carried out. The spread of different types of diseases among the plantation workers is also discussed. In conclusion, the chapter provides a view of and discusses the status of morbidity prevalence among the tea plantation workers based on their disease profile. The chapter also has an elaborate appendix (*appendix to Chapter 6*). The appendix is divided to three parts. The first appendix (*appendix 6 A.1*) has brief none on dietary diversity. The second appendix (*appendix 6 A.2*) discusses the findings on healthcare seeking behaviour of the tea plantation workers and the third appendix comprise pf the tables (*appendix 6 A.3*).

Further, Chapter 7 is an extension of chapter 6. It, discusses the qualitative findings based on in-depth interviews with health facilitators of Tinsukia district to understand health status, healthcare facilities and constrains in provision of health care among the tea plantation workers.

6.1 Rationale for tea plantation workers as unit of primary study

The socio-economic literature surrounding the tea gardens highlight them as one of the most vulnerable and marginalized group in the state of Assam. Widespread hunger, malnutrition, and severe anaemia among children and women has been discussed in academic as well as policy circles. Tobacco and alcohol consumption is also reported to be very high among the tea plantation worker community (Hazarika et. al, 2002). Morbidity directly affects work productivity, resulting in earnings losses. The NSSO does not provide data at the community level, therefore the study makes a significant contribution in ascertaining the health status of tea plantation workers in Assam.

According to the last Human Development Report of Assam 2014, districts in Assam with life expectancy at birth below state average of 62 years are Cachar, Karimganj, Hailakandi, Tinsukia, Sonitpur, Dibrugarh and Sibsagar. The report also highlights that life expectancy is lowest in the Tea Garden areas of Assam along with high prevalence of communicable and non-communicable. Various clinical studies in tea garden areas also points toward the same (Mahanta et al 2016; Mahanta et al, 2015; Mahanta et al, 2013; Rane et al 2019; Biswas 2002). The reliance on government health facilities is also high in the Tea Garden areas (OKD Institute of Social Change and Development, Guwahati & Institute for Human Development, New Delhi, 2014). A study at household level and worker level self-reported morbidity in the tea garden areas will be add value to the social science literature. The WHO disease burdens study point to high levels of disability reporting among working age population, which gives us another reason to probe into the health status of specific groups of worker population. We try to overcome some of the limitations of secondary data by linking nutritional status and workplace conditions of the workers with their health status.

6.2 Descriptive statistics from the primary survey

6.2.1 General information

The household surveys in the tea garden districts of Assam were executed in four phases during September 2021 to May 2022. In each phase, only one district was chosen to study. In the first phase in September-October 2021, 201 households were enumerated in Dibrugarh district; in the second phase in February 2022, 258 households were enumerated in Tinsukia district. In the third and fourth phases, 150 households in Sibsagar and 114 households in Jorhat were enumerated. A total of 31 tea estates were covered in all the four districts. The tea estates were randomly selected. The tea estates covered under the survey are mostly large tea estates with their own factory and line quarters[15] within the tea estate. We visited the line quarters in the tea estate to conduct our interviews. The survey was conducted at household level. The households in the line quarters were randomly selected but with the condition that at least one member is currently working as tea plantation worker, either permanent or temporary.

A total of 723 tea plantation worker households were surveyed in the four districts. The sample population covered is 3525. The sample of tea plantation workers whose detailed information on self-reported morbidity was collected was 1269. The districts considered for the study are the central tea garden dominated districts of Assam, viz., Dibrugarh, Tinsukia, Sibsagar and Jorhat in Upper areas of the Brahmaputra valley. The district wise division of the sample population under the survey has been summarized in table 6.1.

[15] Line quarters: These are housing facilities provided by the tea management to the permanent workers within the tea plantation. These are adjacent housing facilities in a line which are often very congested. The line quarters are either *pacca* or *katcha* or semi-*pacca.*

Table 6.1: General Information of the Survey Districts

	Tinsukia	Dibrugarh	Jorhat	Sibsagar	Total
Households surveyed	258	201	114	150	**723**
Total Population Surveyed	1306	974	535	710	**3525**
Total Tea plantation workers Surveyed	440	337	226	266	**1269**
Sample Tea Gardens Surveyed	10	10	4	7	**31**
Survey Time Period	Feb 2022	Sep-Oct 2021	Mar-Apr 2022	Apr 2022	

Source: Primary data collected from household survey, September 2021 – May 2022

6.2.2 Demographic profile of households

Gender and age

Table 6.2 shows the gender division of the sample population along with the district level division. The total percentage of female population is 51.63% and male population is 48.37%. Overall, at the districts level too, there is a positive sex ratio in the sample population

Table 6.2: Gender Division of the Sample Population

Gender	Tinsukia		Dibrugarh		Sibsagar		Jorhat		Total	
Female	51.53%	673	50.62%	493	52.82%	375	52.15%	279	51.63%	1820
Male	48.47%	633	49.38%	481	47.18%	335	47.85%	256	48.37%	1705
Total	**100.00%**	**1306**	**100.00%**	**974**	**100.00%**	**710**	**100.00%**	**535**	**100.00%**	**3525**

Source: Primary data collected from household survey, September 2021 – May 2022

The age profile (see table 6.3) of the sample population by different age groups and gender division shows that the sample population is relatively very young. Highest concentration of population is in the age group from 0-14 years to 26-35 years. It is seen that life expectancy is low for the sample population as the percentage of older age population is relatively low; which itself is an important indicator of health status of the sample population. The fact of low life expectancy among the tea plantation workers has also been pointed out in the Assam Human Development Report, 2014. The total percentage of population in the working age group is 72.15 percent (this includes from age group 15-25 years to 56-65 years).

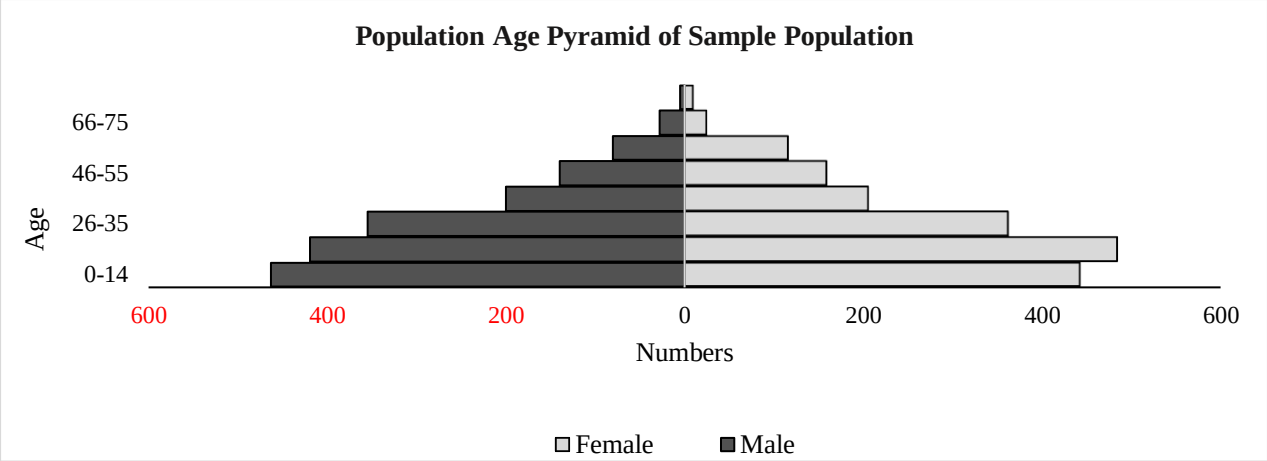
The total percentage of females in the working age population is 37.98 percent of the total sample population whereas the total male population in the working age group is 34.17 percent. The percentage of dependent population mainly comprise of children 0-14 years (25.9%) of age, whereas the percentage of dependent population in the old age group is relatively lower. From the gender profile overall, there is a positive sex ratio in the sample population, but with further division with age it is seen there is a negative child sex ratio, with higher percentage of male children.

Table 6.3: All Districts Age and Gender Distribution

Age Group	Female	% Female by Female Population	% Female by Total Population	Male	% Male by Male Population	% Male by Total Population	Total	% Total
0-14	442	24.5	12.65	463	27.4	13.25	905	25.9
15-25	484	26.83	13.85	419	24.79	11.99	903	25.84
26-35	362	20.07	10.36	355	21.01	10.16	717	20.52
36-45	206	11.42	5.9	200	11.83	5.72	406	11.62
46-55	159	8.81	4.55	140	8.28	4.01	299	8.56
56-65	116	6.43	3.32	80	4.73	2.29	196	5.61
66-75	25	1.39	0.72	28	1.66	0.8	53	1.52
75 and above	10	0.55	0.29	5	0.3	0.14	15	0.43
Total	**1,804**	**100**	**51.63**	**1,690**	**100**	**48.37**	**3,494**	**100**

Note: Some of the entries for age were left blank by investigators, total 31 blanks out of 3525, considered 3494
Source: Primary data collected from household survey, September 2021-May 2022

Figure 6-1: Population Age Pyramid of Sample Population



Literacy level

The literacy level (Table 6.4) of the population is an important factor which affects the overall health status of the population. It is seen that the percentage of illiterates (32.3%) is very high in the sample population. The percentage of illiterates is more for females (42.2%) than males (21.8%) (see table 6.4). For the study, for calculating the literacy level, children population from 0-6 years of age who are not going to school, has not been considered. This was considered, as the survey was conducted post covid lockdown and the schools had not reopened. Many of the beginners at the school going age were not able to enrol in schools as the schools were shut down during the survey period. The literate population has been broadly divided into two groups: literates without formal schooling (3.9%) and literate through formal schooling (63.8%). Among the literates, highest percentage of population of population is in the group of upper primary/middle school (18.5%). Overall, the percentage of literate population above secondary level is very less.

Table 6.4: Education Status of the Sample Population by Gender Division

Literacy Level	Female	%	Male	%	Total	%
Not literate	697	42.2	335	21.8	1032	32.3
Literate Without Formal Schooling						
Literate without any schooling	47	2.8	31	2	78	2.4
Literate without formal schooling: others	9	0.5	17	1.1	26	0.8
Literate without formal schooling: through NFEC	6	0.4	9	0.6	15	0.5
Literate through TLC/ AEC	1	0.1	4	0.3	5	0.2
Literate Though Formal Schooling						

Below primary	248	15	269	17.5	517	16.2
Primary	228	13.8	292	19	520	16.3
Upper primary/middle	242	14.6	348	22.6	590	18.5
Secondary	111	6.7	139	9	250	7.8
Diploma /certificate course (up to secondary)	1	0.1	5	0.3	6	0.2
Higher secondary	46	2.8	66	4.3	112	3.5
Diploma/certificate course (higher secondary)	1	0.1	5	0.3	6	0.2
Graduate	11	0.7	14	0.9	25	0.8
Diploma/certificate course (graduation & above)	4	0.2	5	0.3	9	0.3
Grand Total	**1652**	**100**	**1539**	**100**	**3191**	**100**

Note: Some of the entries were left blank by investigators, total blanks 20
Not Applicable 314 has not been considered
NFEC: Non-formal education course; TLC/AEC: Total literacy campaign/Adult education centres
Source: Primary data collected from household survey, September 2021-May 2022

Work related entitlements, Wages, Occupational and Activity status

The workers in the tea plantations can be categorized into two groups: permanent workers and temporary workers. Permanent tea plantation workers are those who are employed by the tea garden company management as permanent workers up-till their retirement age of 60 years. They are engaged in various types of works as labourers either in the tea gardens or in the company owned tea factories. They are also entitled to certain benefits other than the wages/salary from the tea company. They receive certain health benefits under the tea estate hospital/dispensary and even reimbursement for referral services. They also receive residential quarters in the line within the tea estates. In-kind wages in the form of dry rations (rice, wheat and tea) are also available.

We found that the daily wage rate for temporary workers across the tea estates was fixed at Rs. 205. However, there are differences among permanent workers, by type of work. Wage distribution takes place fortnightly. For permanent workers, apart from their fixed wages or salaries as the case may be, they also receive a yearly bonus based on their work performance and overtime. The working hours are usually from morning 7 AM to evening 4 PM, with a tea/water break of around 30 minutes at 10 AM and a lunch break of one hour at 12 noon. On the other hand, temporary tea plantation workers are employed only seasonally. They are employed during the peak plucking season of tea leaves which starts from the month of April

and goes up-till the month of October - November. During the plucking season, they are entitled to free health facilities of the tea estate hospital/dispensary. The seasonal workers also received wage of Rs. 205 per day along with dry ration.

The temporary workers are however, not entitled to line quarters. During the field survey it was observed, if none of the family members of the household were permanent workers, those households reside in houses built by themselves along the line quarters on empty land spaces within the tea estates. In some of the tea estates, we observed the tea company has built *kutcha* houses within the tea estates for temporary workers.

The demographic division of the occupational status (see table 6.5) shows 20.2 percent of females are permanent tea plantation workers and 20.5 percent are temporary tea plantation workers. There are more male permanent workers. Among temporary workers, the female share is more. The female workers are mainly engaged in tea plucking, which is seasonal. A sizeable percentage of both female and male population is students, this is because as already mentioned the sample population is of relatively of young age. Also, a sizeable percentage of population are children below 6 years of age, old people and people who are unemployed.

Table 6.5: Occupation Status of the Sample Population by Gender Division

Occupation Status	Female	%	Male	%	Total	%
Permanent tea plantation worker	367	20.2	394	23.1	761	21.6
Temporary tea plantation worker	372	20.5	235	13.8	607	17.3
Retired tea plantation worker	112	6.2	86	5	198	5.6
Temporary tea plantation worker, Petty business/self-employed	1	0.1	.	0	1	0
Retired tea plantation worker, Petty business/self-employed	.	0	1	0.1	1	0
Agricultural labourer	1	0.1	7	0.4	8	0.2
Agriculture & Allied	1	0.1	7	0.4	8	0.2
Daily wage non-agricultural worker	22	1.2	159	9.3	181	5.1
Salaried but casual	13	0.7	42	2.5	55	1.6
Salaried service (reg)	10	0.6	19	1.1	29	0.8
Petty business/self-employed	10	0.6	23	1.3	33	0.9
Trade/business	.	0	10	0.6	10	0.3
Pensioner	1	0.1	.	0	1	0
Household Work	250	13.8	9	0.5	259	7.4
Student	367	20.2	375	22	742	21.1
Not applicable	286	15.8	337	19.8	623	17.7

Grand Total	**1813**	**100**	**1704**	**100**	**3517**	**100**

Note: Some of the entries were left blank by investigators, total blanks 8
Source: Primary data collected from household survey, September 2021-May 2022

Table 6.6 shows the activity status of the sample population. 29.5 percent of the total population are engaged as currently fully employed. Also, a sizeable portion of the sample population comes under the category of *not available for work* (41.8 percent). They are the dependent population of children (0-6 years), older age population and school or college going students.

Table 6.6: Activity Status of the Sample Population

Activity Status	Tinsukia		Dibrugarh		Sibsagar		Jorhat		Total	
Currently employed full time	333	25.6	294	30.2	217	30.8	192	36	1036	29.5
Currently employed part time	214	16.5	209	21.5	102	14.5	76	14.3	601	17.1
Household work/childcare	99	7.6	81	8.3	70	9.9	35	6.6	285	8.1
Not Available for work (Total)	589	45.3	363	37.3	294	41.7	221	41.5	1467	41.8
Not Available for work (Student)	299	23	182	18.7	131	18.6	130	24.4	742	21.1
Not Available for work (0-6 years not going to school)	115	8.9	90	9.2	70	9.9	38	7.1	313	8.9
Not Available for work (Others)	184	14.2	92	9.5	61	8.7	92	17.3	412	11.7
Not working but seeking or available for work	64	4.9	26	2.7	22	3.1	9	1.7	121	3.4
Grand Total	**1299**	**100**	**973**	**100**	**705**	**100**	**533**	**100**	**3510**	**100**

Note: Some of the entries were left blank by investigators, total blanks 15
Source: Primary data collected from household survey, September 2021-May 2022

6.2.3 Anthropometric profile of worker population

Anthropometric profile in terms of adult height and weight of the tea plantation workers were collected for the study to understand overall role of nutritional outcome on the health status of the tea plantation workers. Past studies have established link between improved nutritional status with health status of the population (Mc Keown, 1950-1980; Colgrove, 2002). There is a causal relation between adult height and childhood diseases, as undernutrition in childhood is often reflected in stunted adult height and late life diseases (Bozzoli et. al, 2009). WHO identifies Body Mass Index (BMI, measured by kg/m^2; where kg is person's weight in kilograms and m^2 is the height of the person in meters square) as a measure for nutritional status of adults.

BMI of the tea plantation workers were calculated from the weight and height data collected during the survey (see table 6.7). The WHO standards were considered for

categorizing the workers in terms of BMI standards: **low BMI**, **normal BMI**, **overweight** and **obese**. The cut-off points are:

Low BMI (18.5 kg/m^2<)

Normal BMI (<18.5 kg/m^2 – 24.9 kg/m^2)

Overweight (< 25 kg/m^2 – 29 kg/m^2<)

Obese (30 kg/m^2 >)

The percentage of workers with low BMI is 34.7 percent and with normal BMI is 59.3 percent. The percentage of overweight and obese is relatively low (approximately 7 percent of the worker population). The female-male comparison of BMI shows higher percentage of female workers (37.7 percent) having low BMI compared to males (30.2 percent).

Table 6.7: All Districts BMI Count of the Sample Tea plantation workers

BMI Category	Female		Male		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Low BMI (18.5 <)	209	37.7	113	30.2	322	34.7
Normal BMI (< 18.5 - 24.9 <)	316	57	234	62.6	550	59.3
Overweight (< 25 - 29 <)	25	4.5	24	6.4	49	5.3
Obese (30 >)	4	0.7	3	0.8	7	0.8
Total	**554**	**100**	**374**	**100**	**928**	**100**

BMI= kg/m^2, BMI categorization by WHO standards
Source: Primary data collected from household survey, September 2021-May 2022

A sizeable proportion have low BMI, especially females. This is also evident from the in-depth interview with the health facilitators in Tinsukia, who pointed the prevalence of underweight and nutrition deficiency among the workers especially among the females (*see chapter 7, section 7.3*). To further understand the issue, the mean of different BMI categories has been calculated. We categorised BMI into four groups in different combinations: **BMI_Low** (which comprise of the workers having low BMI); **BMI_Normal** (which comprise of the workers having normal BMI); **BMI_Above** (this category consists of both overweight and obese observations) and **BMI_NormalAbove** (this category consists of normal, overweight and obese observation). In the BMI_Low category (see table 6.8) the average BMI

of the workers stands at 16.6 and the minimum threshold is 12.1. The mean of normal BMI stands at 20.9 which is on the lower side of normal BMI compared to the maximum threshold of 24.9.

The results of the two-sample t test for difference of BMI between two different BMI categories has been presented in tables 6.9 and table 6.10. The results show significant difference between the BMI categories of BMI_Low and BMI_NormalAbove. Similarly, there is significant difference between the BMI categories of BMI_Low and BMI_Normal.

Table 6.8: Mean of Different BMI Categories

Variable	Frequency	Mean	Std. dev.	Min	Max
BMI_Low	322	16.69061	1.330627	12.12458	18.44255
BMI_Normal	550	20.95273	1.761894	18.45917	24.84626
BMI_Above	56	27.14067	2.453013	25.0545	37.49428
BMI_NornalAbove	606	21.52455	2.565285	18.45917	37.49428

Source: Estimated from primary data

Table 6.9: Two-sample t-test with unequal variances

Group	Frequency	Mean	Std. err.	Std. dev.	[95% conf.	interval]
BMI_Low	322	16.69069	0.0741585	1.330727	16.54479	16.83659
BMI_NormalAbove	606	21.52455	0.1042076	2.565285	21.3199	21.7292
Combined	928	19.84728	0.1048819	3.195028	19.64145	20.05312
diff = mean(1) - mean (2)			t = -37.7937			
H0: diff = 0			Satterthwaite's degrees of freedom = 925.552			
Ha: diff < 0	Ha: diff != 0		Ha: diff > 0			
Pr(T < t) = 0.0000	Pr(|T| > |t|) = 0.0000		Pr(T > t) = 1.0000			

Source: Estimated from primary data

Table 6.10: Two-sample t-test with unequal variances

Group	Frequency	Mean	Std. err.	Std. dev.	[95% conf.	interval]
BMI_Low	322	16.69069	0.0741585	1.330727	16.54479	16.83659
BMI_Normal	550	20.95273	0.0751274	1.761894	20.80515	21.1003
Combined	872	19.3789	0.0885984	2.616278	19.20501	19.55279
diff = mean(1) - mean(2)				t = -40.3742		
H0: diff = 0				Satterthwaite's degrees of freedom = 815.66		
Ha: diff < 0	Ha: diff != 0			Ha: diff > 0		
Pr(T < t) = 0.0000	Pr(|T| > |t|) = 0.0000			Pr(T > t) = 1.0000		

Source: Estimated from primary data

6.2.4 Dietary intake of worker population

Dietary intake[16] is an important indicator of nutritional status of an individual, which in turn affects the health status. We discuss dietary diversity at individual level of the tea plantation workers and household expenditure on food consumption by different food items.

The study considers, three measures to understand dietary profile of the workers. (a) Frequency of number of meals taken daily/weekly (b) Number of food groups consumed and (c) 24-hour recall of different food groups consumed. For this analysis, we have considered a sub-sample of 1225 workers. For household expenditure on food consumption, of 723 workers households are considered.

(a) Frequency of Different Types of Food Groups Consumed by the Workers

We have collected data on frequencies of, consumed daily, consumed weekly, consumed occasionally and never consumed. We collected data on an exhaustive list of food items generally consumed in the study districts. Based on the literature we were able to club the items into 12 food groups. Along with the twelve food groups, data on smocking, tobacco and alcohol consumption by the worker was collected as these also affect the health outcomes of the individual. The food groups considered were:

i. Staples (which mainly consist of rice and wheat)
ii. Pulses and beans
iii. Potatoes & Onions
iv. Non-leafy vegetables
v. Green leafy vegetables
vi. Fruits
vii. Milk/dairy products
viii. Egg
ix. Fish
x. Meat
xi. Packaged food
xii. Edible oil
xiii. Beverages (which mainly consist of tea) *not included for calculating dietary diversity score in Table 6.12.*

[16] A note on dietary diversity and dietary diversity score is in *Appendix to Chapter 6, Appendix 6 A.1.*

xiv. Along with the twelve food groups, information on smoking, tobacco and alcohol consumption by the worker was collected as these also affect the health outcomes of the individual *not included for calculating dietary diversity score in Table 6.12.*

Table 6.11 shows the frequency of consumption of twelve food groups along with beverage and smoking/tobacco/alcohol by the workers on daily or weekly (i.e., one to three times a week) basis. For daily basis the consumption of staples (that mainly comprise of rice and in some cases roti), potatoes & onions (96.7 percent) and edible oil is highest. The daily consumption of pules (54.6 percent), dairy products (3.4 percent), egg, fish, meat which are protein rich diet are less. The daily consumption of non-leafy vegetables (61.2 percent) and leafy vegetables is (32.3 percent). For beverage (mainly tea) the daily consumption is 54 percent and for smoke/tobacco/alcohol it is 54.3 percent.

On the right-hand side, the same food groups that are either consumed daily or weekly. When we consider weekly consumption, the percentage of consumption of pulses, egg, fish, meat, non-leafy vegetables, and leafy vegetables have gone up. However, consumption of fruits and dairy products remains relatively low.

The problem of low dietary diversity and excessive intake of carbohydrates was also identified by the health fascinators during the in-depth interview. The main reasons pointed out by the respondents for low dietary diversity was low-income levels and lack of knowledge about the need of dietary diversity for improved nutrition and health outcomes. The workers are heavily dependent on the public distribution system (PDS) which mainly provide rice (*see chapter 7, section 7.3 and 7.4*).

Table 6.11: All Districts Consumption of Different Food Groups Daily and Daily/Weekly by Sample Tea plantation workers

Sl. No.	Food Group	Daily (Frequency)	Daily (%)	Daily/Weekly (Frequency)	Daily/Weekly (%)
1	Staples	1225	100.0	1225	100.0
2	Pulses	669	54.6	1148	93.7
3	Potatoes/Onions	1185	96.7	1219	99.5
4	Non-Leafy Vegetables	750	61.2	999	81.6
5	Leafy Vegetables	396	32.3	1005	82.0

6	Fruits	10	0.8	110	9.0
7	Milk/Dairy Products	42	3.4	68	5.6
8	Egg	23	1.9	727	59.3
9	Fish	51	4.2	957	78.1
10	Meat	53	4.3	928	75.8
11	Packaged Food	545	44.5	749	61.1
12	Edible Oil	1198	97.8	1206	98.4
13	Tea/Coffee	665	54.3	776	63.3
14	Smoke/Tobacco/Alcohol (either of them consumed daily and daily/weekly)	663	54.1	711	58.0

Source: Primary data collected from household survey, September 2021-May 2022

Dietary Diversity Score/Food Groups consumed

Dietary Diversity Score is based on number of food groups consumed on daily basis and on daily/weekly basis by the workers. For example, if a person consumes five food groups out of the 12 daily, then the person has been scored 5 for Daily Dietary Diversity Score. Similarly, if a person consumes seven of the food groups either daily or weekly then the person has been scored 7 for Daily/Weekly Dietary Diversity Score.

Table 6.12 shows the intake of the twelve food products excluding beverage and smoke/tobacco/alcohol on daily basis and daily/weekly basis by the tea plantation workers. The results show (see table 6.12) that when we consider daily diversity score, the modal average is consumption of 4-5 food groups (consumed by 53 percent of the workers). The weekly diversity score has a consumption score of 9-10 food groups (consumed by approximately 50 percent of the workers).

Table 6.12: All Districts Number of Food Groups Consumed by Sample Tea plantation workers

Dietary Diversity Score based on Food Group Consumed	**Number of Food Groups Consumed (Daily)**		**Number of Food Groups Consumed (Weekly)**	
	No. of Workers (Frequency)	**No. of Workers (%)**	**No. of Workers (Frequency)**	**No. of Workers (%)**
1 Food Group Consumed	1	0.1	1	0.1
2 Food Groups Consumed	19	1.6	2	0.2
3 Food Groups Consumed	156	12.7	7	0.6
4 Food Groups Consumed	287	23.4	21	1.7
5 Food Groups Consumed	364	29.7	50	4.1

6 Food Groups Consumed	183	14.9	120	9.8
7 Food Groups Consumed	179	14.6	153	12.5
8 Food Groups Consumed	19	1.6	196	16.0
9 Food Groups Consumed	13	1.1	229	18.7
10 Food Groups Consumed	3	0.2	392	32.0
11 Food Groups Consumed	0	0.0	43	3.5
12 Food Groups Consumed	1	0.1	11	0.9
Total	**1225**	**100**	**1225**	**100**

** Food Groups consumed excludes Tea/Coffee & Smoke/Tobacco/Alcohol
Source: Primary data collected from household survey, September 2021-May 2022

Daily meals frequency

We collected data on number of meals consumed in a day: Breakfast, Morning Snacks, Lunch, Evening Snacks, Dinner. Morning and evening snacks are not complete meals. We observed that these meals usually comprise of tea and light snacks like biscuits. Table 6.13 shows the frequency of meal intake. The maximum range of meal intake of workers are between three meals (66.4 percent) and four meals (23.6 percent). For three meals, the usual combination of meals are breakfast, lunch, and dinner; and for four meals the combination is usually breakfast, lunch, dinner, morning snacks or evening snacks.

Table 6.13: All Districts Frequency of Number of Meals Intake

No. of Meals Taken	Frequency	Percent
2 meals daily	15	1.2
3 meals daily	814	66.4
4 meals daily	289	23.6
5 meals daily	107	8.7
Grand Total	**1225**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

24-hour recall of the different food groups consumed by the workers

Table 6.14 shows the 24-hour recall of the different food groups consumed by the workers. Here we have considered all the food groups consumed by the workers in the last 24 hours, excluding smoke/tobacco/alcohol. Consumption ranges between a minimum of 2 food groups to a maximum of 7 food groups. Only two respondents reported having 8 different food groups. The maximum number of food group intake by the workers are in the range of 3-5 food groups. Highest is for 4 food groups (40.1 percent) followed by 3 food groups (27.8 percent)

and 5 food groups (20.7 percent). The 24-hour recall includes consumption of beverage (tea) within the food groups.

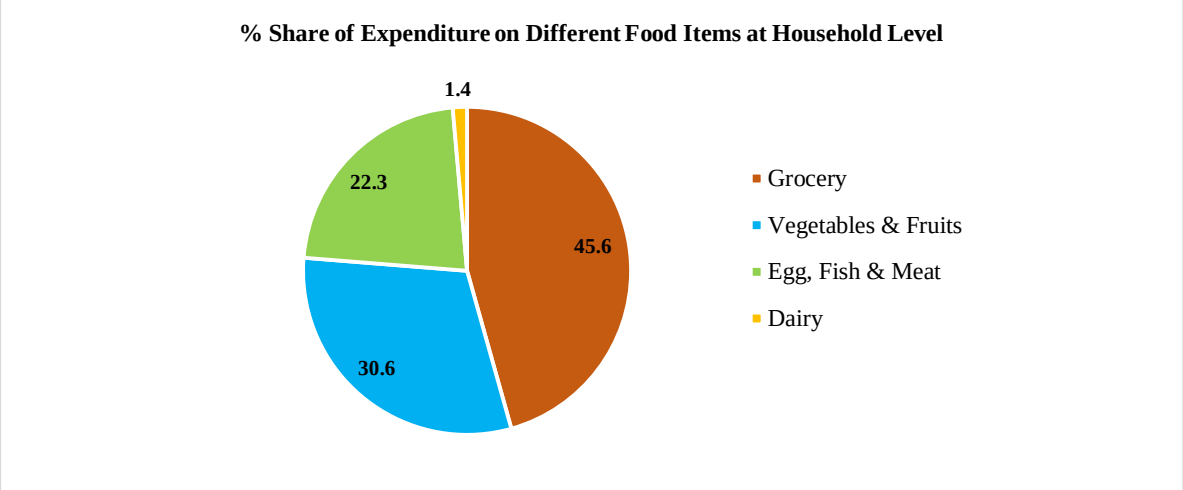
Table 6.14: All Districts Number of Food Groups Consumed by Sample Tea plantation workers (24-hour recall)

Food Groups Consumed	Number of Food Groups Consumed (24-hour recall)	
	No. of Workers (Frequency)	No. of Workers (Percent)
1 Food Group Consumed	2	0.2
2 Food Groups Consumed	37	3.0
3 Food Groups Consumed	340	27.8
4 Food Groups Consumed	491	40.1
5 Food Groups Consumed	254	20.7
6 Food Groups Consumed	79	6.4
7 Food Groups Consumed	20	1.6
8 Food Groups Consumed	2	0.2
Grand Total	**1225**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

6.2.5 Household expenditure on food consumption

Figure 6-2 Percentage share of expenditure on different food items



Source: Primary data collected from household survey, September 2021-May 2022

The average expenditure on food consumption on different food items have been calculated at the household level. The different food items considered were grocery (which includes all the dry ration such as rice, pulses, wheat, dry soya beans etc along with edible oil, salt, and sugar); vegetables and fruits; egg, fish, and meat; and dairy products. The findings

show (see table 6.15 & figure 6-1) that, of the total food expenditure, highest share of the food expenditure is on grocery (45.6 percent) and the lowest is on dairy products (1.4 percent). During the survey, while interviewing the respondent it was seen that, a major part of their income was spent on purchasing grocery items, in which a major share was spent on purchasing edible oil (generally mustard oil) which is expensive compared to other grocery items. The low-income levels of the workers restrict them from purchasing diverse food items. With the low income they mainly try to cover the staple items which are of utmost necessary. This was also reflected while interviewing the health facilitators during the in-depth interview (see *chapter 7 section 7.3*; *Nutrition security and low-income levels*).

Table 6.15: Average and Percentage of Expenditure of Different Food Items at Household Level in Rupees

Items	Overall		Tinsukia		Dibrugarh		Sibsagar		Jorhat	
	Avg. Exp	**%**	**Avg. Exp**	**%**	**Avg. Exp**	**%**	**Avg. Exp**	**%**	**Avg. Exp**	**%**
Grocery	1944	45.6	2176	49.9	1705	42	1939	45.5	1849	42.5
Vegetables & Fruits	1302	30.6	1211	27.8	1329	32.4	1313	30.8	1447	33.3
Egg, Fish & Meat	953	22.3	912	20.9	971	23.6	964	22.6	999	22.9
Dairy	61	1.4	53	1.2	85	2	47	1.1	54	1.2
Total Food Exp	**4260**	**100**	**4352**	**100**	**4089**	**100**	**4262**	**100**	**4350**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

6.2.6 Nature of work carried by workers

Nature of work and the workplace conditions affect the health of an individual. The nature of work by the tea plantation workers are extensively physical labour intensive along with some skill-based activity such as tea plucking. The range of work carried out by the temporary and permanent workers are tea plucking, factory work, pruning, hoeing/weeding, spraying insecticides/pesticides, manuring or spraying fertilizers, drainage and irrigation, water supply for workers in garden, watchman (chowkidar), supervisor (sardar), driver and others (like cook, caretaker etc.).

Table 6.16 shows the frequency of the nature of work the workers are engaged in. A single worker can be engaged in more than one type of work in the tea plantation. The highest frequency of workers is engaged in tea plucking (763), followed by hoeing/weeding (191) and

factory work (188). Tea plucking is usually carried out by the female temporary workers during the peak plucking season.

Table 6.16: All Districts Frequency of Workers Engaged in Different Category of Work in the Sample Tea Plantation

Category of Work	Frequency of Workers
Tea plucking	763
Factory worker	188
Pruning	182
Hoeing/weeding	191
Spraying insecticides/ pesticides	155
Manuring or spreading fertilizers	96
Drainage and irrigation	155
Water supply man for workers in garden	13
Chowkidar	57
Supervisor (sardar)	34
Drivers	10
Other	70

Source: Primary data collected from household survey, September 2021-May 2022

6.2.7 Nature of workplace hazard

There are various agents such as physical, chemical, biological, machines and other humans with whom interaction of an individual takes place in his or her workplace (Park, 2017). Accordingly, Park (2017) has identified five main types of occupational hazards to which any industrial worker may be exposed to: physical hazard, chemical hazard, biological hazard, mechanical hazard, and psychological hazard. For the study mainly five types of hazards were considered. The criteria considered under each type of hazard were specific, mainly in the tea garden and tea garden factory. We observed the following hazards:

i. *Physical hazards*
Heat/sunstroke, dizziness, fainting & dehydration, cough, cold, backache, chest pain, knee pain, neck pain.

ii. *Biological hazards*
Malaria, animal/snake bite, insect sting, fungal infections, parasitic infection from leeches & bugs.

iii. *Mechanical hazards*
Fall in hilly terrains, cuts & injuries, sprains

iv. *Chemical hazards*

Inhalation of harmful chemicals during spraying of insecticides in the tea garden, allergic reaction due to contact with fertilizers, dermatitis, eczema, ulcers

v. *Psychological hazards*
Psychological stress due to low wage or unable to fulfil the daily quota of certain kilograms of tea leaves to be plucked to get the minimum wage etc. and other hazards if any.

Among the workers (see table 6.17), highest reporting is for physical hazard (659 cases) followed by biological hazard (555 cases) and psychological hazard (367 cases). A considerable portion of the worker population also reported chemical hazard (312 cases). It was observed that most of the workers reported multiple workplace hazards. Reporting of physical hazard is very common among the workers, especially during the plucking seasons, due to long working hours in the hot and humid climate in the tea gardens. The long-standing hours with heavy weight are another reason which leads to frequent reporting of physical hazards. These problems affecting the health status of the workers were also pointed out by the health facilitators during the interview (see *chapter 7 section 7.2; Diseases reported due to nature of work, workplace conditions and hours of work).*

Table 6.17: All Districts Frequency of Type of Hazards Faced by the Sample Tea Plantation Workers

Type of Hazard Faced by Workers	Frequency
Physical Hazards	659
Biological Hazards	555
Mechanical Hazards	204
Chemical Hazards	312
Psychological hazards	367
Other hazards (specify)	141

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.18 shows the number of workplace palace hazard faced by the workers by permanent and temporary worker divide. Here there can be multiple reporting of the type of hazard reported by the worker. For example, a worker may report both physical as well as

biological hazard. For permanent worker 22 percent workers did not report any workplace hazard and the rest reported at least one hazard. 32.4 percent worker reported one hazard. For temporary worker 22.8 percent did not report any hazard. For temporary worker 30.9 percent reported at least one hazard.

Table 6.18: All Districts Number of Hazards Reported by Workers in the Sample Tea plantation workers

Number of Hazards Reported	Permanent Worker		Temporary Worker		Total	
	Frequency	%	Frequency	%	Frequency	%
No hazard reported	158	21.9	123	22.9	281	22.3
1 hazard reported	234	32.5	156	29.0	390	31.0
2 hazards reported	110	15.3	85	15.8	195	15.5
3 hazards reported	99	13.7	73	13.6	172	13.7
4 hazards reported	88	12.2	79	14.7	167	13.3
5 hazards reported	32	4.4	22	4.1	54	4.3
Grand Total	**721**	**100**	**538**	**100**	**1259**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

6.3 Population level morbidity status

6.3.1 Reporting of acute and chronic ailment & hospitalization of household members

Primary data of morbidity reporting was collected at household level for all the individuals of the household. Simple “yes” and “no” questions were asked for reporting of acute ailment, chronic ailment, and hospitalization cases. For acute ailment the reference period taken was 30 days. For chronic ailment reported by the individuals, reference period of more than one month was considered. Hospitalisation cases, the reference period considered was one year (or 365 days).

The overall prevalence of acute ailment per 100 stands at 15.5 percent. Reporting of chronic ailment is 18.8 percent and reporting of hospitalization cases is 6 percent (see tables 6.19, 6.20 and 6.21). For hospitalisation percentage of female reporting is more than male in

the last 365 days. For female hospitalization due to childbirth is also included for the reference period of 365 days.

At the district level, reporting of acute, chronic and hospitalization was highest in Dibrugarh district followed by Tinsukia district. The first phase of the survey in Dibrugarh, was carried out immediately after the second wave of covid pandemic in India during September 2021. During this period massive covid vaccination drive were carried out in Assam and in the tea garden areas, therefore there were cases of post covid vaccination fever being reported by the sample population in the reference period of 30 days. This may have affected the reporting of acute ailment cases in Dibrugarh district. But for chronic ailment and hospitalization cases this is not the case. During the survey it was observed that, the tea estates in Dibrugarh district were adjustment to Dibrugarh town, whereas the tea estates in the other districts were far from the main town. This may be one of the reasons of higher reporting in Dibrugarh district. Assam Medical College Hospital (AMCH) is in Dibrugarh town. Most of the time referral service from the tea estate hospital/dispensary is given to AMCH. The access to health care services may have affected the reporting of morbidity in Dibrugarh district.

Table 6.19: Reporting of Acute Ailment by Sample Population

Reporting of Acute Ailment	Yes	No	Grand Total
Tinsukia	148 (11.3%)	1158 (88.7%)	1306
Dibrugarh	308 (31.6%)	666 (68.4%)	974
Sibsagar	56 (7.9%)	654 (92.1%)	710
Jorhat	34 (6.4%)	501 (93.6%)	535
Total	**546 (15.5%)**	**2979 (84.5%)**	**3525**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.20: Reporting of Chronic Ailment by Sample Population

Reporting of Chronic Ailment	Yes	No	Grand Total
Tinsukia	243 (18.6%)	1063 (81.4%)	1306
Dibrugarh	279 (28.6%)	695 (71.4%)	974
Sibsagar	86 (12.3%)	624 (87.8%)	710
Jorhat	56 (10.5%)	479 (89.5%)	535
Total	**664 (18.8%)**	**2861 (81.2%)**	**3525**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.21: Reporting of Hospitalization by Sample Population

Reporting of Hospitalization	Yes	No	Grand Total
Tinsukia	65 (5%)	1241 (95%)	1306
Dibrugarh	99 (10.2%)	875 (89.9%)	974
Sibsagar	31 (4.4%)	679 (95.6%)	710
Jorhat	17 (3.2%)	518 (96.2%)	535
Total	**211 (6%)**	**3314 (94%)**	**3525**

Source: Primary data collected from household survey, September 2021-May 2022

6.3.2 Morbidity at population level by socioeconomic characteristics

Overall reporting of morbidity

Reporting of morbidity is affected by various factors. These *factors* can be ***demographic*** and ***socioeconomic***. The different factors considered under the broad categories have already been discussed in chapter 3. Table 6.22 shows the overall reporting of morbidity by different factors which affect SRM of the sample population in the tea plantations. For this reporting of both acute and chronic ailment together as well as either of acute or chronic ailment anyone by the individuals has been considered. Both the cases have been considered to get the overall reporting of morbidity.

Demographic Characteristics: For ***gende***r females reported more ailment as compared to male (29.6 per hundred for females and 26.3 per hundred for males). Similar findings have been established in literature and the NSSO unit level results for Assam discussed in chapter 5 also shows reporting of morbidity is higher among females. For ***age*** reporting of morbidity is highest in the oldest age group of 65-75 years (60.4 persons per 100) and lowest in the age group of 0-14 years of age. Usually the age group of 15- 25 years report lowest, but this is not the case in the sample population. This may be because in the tea plantation the younger generation starts working from a young age of 15 years. As discussed previously, the workplace

condition and nature of work affects the health of the workers, therefore the reporting has been higher in this age group too. For ***marital status*** reporting was more for others (which includes never married, widowed, and divorced/separated). For religion reporting was higher for others group (which includes Christians, Muslims, and Buddhist).

Socio-economic variables: Educational status which is one of the important determinants of assessing health status of the individuals showed, reporting is highest among the illiterates (39.8 per 100), the finding is similar to NSS unit level results for 71st round in Assam. Nevertheless, studies previously based on Indian population have also shown similar results (Subramanian et.al, 2009). In case of tea plantation workers, reporting is *higher among the least educated as most of the people engaged in the plantation work are illiterates, but at the same time reporting is high as they are dependent on wage employment. Not reporting for work due to illness would mean loss of wage, therefore they tend to report.* Moreover, during the working period they can access the healthcare service at the tea estate hospital/dispensary, although the quality of healthcare facilities at the tea estate hospital/dispensary is not up to the mark. ***Activity status*** of the individuals showed that reporting is higher among employed (34 per 100). By ***occupation status*** reporting is highest for retired tea plantation worker, followed by permanent tea plantation worker. This can be related to the fact that, long exposer to work in the tea estates increase their morbid condition. Moreover, two other factors may also have effect on reporting of morbidity, age and access to healthcare facilities, as permanent workers are entitled to free healthcare facilities in the tea estate hospital/dispensary. Access to ***sanitation*** and awareness of use of sanitation is an important indicator of health outcome. Reporting has been highest in the category of flush toilet category. It can be inferred that people having access to flush toilet are also people with better wealth quintile. Besides, the tea company provides latrine in the quarters of the permeant workers. As reporting is higher among permeant workers, this factor may have also affected in terms of sanitation. Similarly for ***access to water***, reporting

is highest among those using tube well. Most of the households in the tea plantation mainly use water from tube well, but in most cases as evident from the in-depth interview they do not use water filter or boil the water before consuming from the tube well. In terms of household size reporting is highest for households having 1-4 members. Reporting of morbidity separately for acute and chronic ailment were also are carried, however there are not much difference in the results except a few indicators (*see appendix 6A.3, table 6A.3.1*).

Table 6.22: Reporting of Both Acute & Chronic and Either Acute or Chronic Ailment by Sample Population per 100

Variables	Total Sample	Not Reporting	Reporting Both/Either	Per 100 Reporting Both/Either
Gender				
Male	1,705	1,257	448	26.3
Female	1,820	1,281	539	29.6
Age				
0-14	903	759	144	15.9
15-25	904	741	163	18.0
26-35	718	505	213	29.7
36-45	406	231	175	43.1
46-55	299	155	144	48.2
56-65	196	102	94	48.0
65-75	53	21	32	60.4
75 and above	15	7	8	53.3
Marital Status				
Currently Married	1,902	1,487	415	21.8
Others	1,618	1,049	569	35.2
Education				
Not literate	1,032	621	411	39.8
Below primary & Primary	1,751	1,354	397	22.7
Secondary & Higher Secondary	374	276	98	26.2
Graduate and above	34	29	5	14.7
Not Applicable	314	247	67	21.3
Occupation				
Salaried/Pension	84	61	23	27.4
Permanent Tea plantation worker	766	448	318	41.5
Temporary Tea plantation worker	614	425	189	30.8
Retired Tea plantation worker	199	109	90	45.2
Self Employed/Trade	43	26	17	39.5
Dependent	1,619	1,303	316	19.5
Daily wage agri/non agri	192	160	32	16.7
Activity Status				
Employed	1,643	1,084	559	34
Unemployed	1,870	1,445	425	22.7
Religion				
Hindu	3,292	2,373	919	27.9
Others	233	165	68	29.2

Source of Water				
Tube well	2,754	1,915	839	30.5
Pipe Water	598	494	104	17.4
Others	173	129	44	25.4
Sanitation				
Pit Latrine	2,265	1,714	551	24.3
No Facility	381	306	75	19.7
Flush Toilet	761	436	325	42.7
Shared Latrine	118	82	36	30.5
Household Size				
1-4	1,148	782	366	31.9
5-8	2,153	1,571	582	27
8 and above	224	185	39	17.4

Source: Primary data collected from household survey, September 2021-May 2022

6.3.3 Socioeconomic determinants of morbidity at the population level - Binary logistic regression

Reporting of overall morbidity at population level – binary logistic regression

The *estimates of the binary logistic regression* model for self-reported morbidity by individuals for overall reporting of morbidity by different socioeconomic determinants at population level have been presented in table 6.24 along with the standard error and the marginal effect. The estimates of the variables have been presented in terms of odds ratio. The dependent variable taken for the model is "*Reporting of morbidity (acute or chronic either) or both (acute and chronic)*" if yes, the variable takes value 1, or 0 otherwise.

The independent variables considered for the model are discussed in table 6.23

Table 6.23: Description of the Independent Variables considered for Reporting of Morbidity by sample population

Variable Name	Variable Description
Demographic Factors	
Gender	Female =1, Male =0
Age	age has been taken as continuous
Marital Status	Currently Married = 1, 0 Otherwise
Religion	Hindu (base category)
Others	Muslim, Christian and Buddhism
Socio-Economic Factors	
Education	Not literate (base category)
Below Primary & Primary	
Secondary & Higher Secondary	
Graduate & above	
Not applicable	children below 6 years
Sanitation	Pit Latrine (base category)
No facility	

Flush toilet	
Shared latrine	
Drinking water	Tube Well (base category)
Pipe Water	
Others	
Occupation	Salaried/Pension (base category)
Permanent Tea Plantation Worker	
Temporary Tea Plantation Worker	
Retired Tea Plantation Worker	
Dependent	
Daily wage agricultural/non-agricultural	
log_mpce	MPCE has been taken as a continuous variable and the log of MPCE has been considered for the analysis

The *significant socioeconomic determinants* explaining morbidity at population level in the tea plantation is ***age, education status, occupational status, source of water and sanitation***. For age as age increases, higher the ***age*** an individual is more likely to report morbidity (significant at 1% level of significance). The marginal effect shows, higher the age, individuals are 0.7 percent more likely to report morbidity. For socioeconomic variables, ***education level*** of the individual shows that compared to the illiterate group the base category, the higher level of education groups of below primary & primary and secondary & higher secondary is more likely to report, on the other hand graduate and above are less likely to report. The not applicable group which consist of children in the age group of 0-6 years is more likely to report (significant at 1% level of significance). The below primary & primary group is 0.2 percent more likely to report; the secondary & higher secondary group is 1.2 percent more likely to report and the not applicable group is 18.9 percent more likely to report morbidity. For ***source of water***, pipe water is 10.8 percent (significant at 1%) and other sources are 13.2 percent (significant at 1%) more likely to report when compared to the base group of tube well. ***Sanitation:*** compared to the base group of pint latrine, for sanitation, people using flush toilet are 16.4 percent (significant at 5%) and those using shared latrine are 6.8 percent (significant at 10 %) more likely to report, whereas not facility is less likely to report.

Table 6.24: Reporting of Both Acute & Chronic and Either Acute or Chronic Ailment at Population Level - Binary Logistic Regression

Socioeconomic Factors	Odds Ratio	Robust SE	dy/dx
Gender			
Male^			
Female	1.14296	0.10152	0.02318
Age	1.03900*	0.00405	0.00664
Marital Status			
Others^			
Currently Married	1.08926	0.10717	0.01483
Education			
Not Literate^			
Below primary & Primary	1.00951	0.11692	0.00157
Secondary & Higher Secondary	1.07661	0.17900	0.01241
Graduate and above	0.49151	0.24683	-0.10207
Not Applicable	2.69776*	0.59786	0.18797
Occupation			
Salaried/Pension^			
Permanent Tea Garden Worker	1.53410	0.41817	0.07904
Temporary Tea Garden Worker	1.27913	0.35497	0.04410
Retired Tea Garden Worker	0.84061	0.26591	-0.02866
Self Employed/Trade	1.88436	0.77029	0.12065
Dependent	0.90765	0.24851	-0.01625
Daily wage agri/non agri	0.57695***	0.18706	-0.08338
Religion			
Hindu^			
Others	0.89330	0.14158	-0.01957
Source of Water			
Tube well^			
Pipe Water	1.98171*	0.23925	0.10859
Others	2.25062*	0.51811	0.13208
Sanitation			
Pit Latrine^			
No Facility	0.89196	0.13406	-0.01828
Flush Toilet	2.37663*	0.22928	0.16468
Shared Latrine	1.47544***	0.33810	0.06881
log_mpce	1.09300	0.06997	0.01542

Source: Calculated from Primary Data collected in-between September 2021 to April 2022

* p <0.01, ** p< 0.05, *** p< 0.1

Number of observations = 3468; Wald chi-square = 383.92; Probability = 0.0000; Pseudo R2 = 0.1142; Log pseudolikelihood = -1813.0378

^ Reference group

Source: Primary data collected from household survey, September 2021-May 2022

Reporting of Acute and Chronic morbidity – binary logistic regression

To see if there are difference in results in terms of reporting of morbidity separately for acute and chronic ailment logistic regression was carried out for acute ailment and chronic ailment. Here for the first model reporting of acute ailment is taken as the dependent variable and for the second model reporting of chronic ailment is taken as the dependent variable. The *social determinants which were significant for acute ailment (see appendix 6 A.3 table 6A.3.2*) ***age, education, occupation, source of water and sanitation***. For *chronic ailment the significant social determinants* are ***gender, age, education, source of water, sanitation and MPCE***.

In conclusion we can say the social determinants, which significantly affect reporting of morbidity of individuals in tea plantation areas are mainly age, gender, education, occupational status, sanitation, source of drinking water and MPCE.

6.4 Worker level morbidity status and disease profile

6.4.1 Reporting of acute and chronic ailment & hospitalization of plantation workers

Self-reported morbidity (SRM) is an important indicator for assessing the health status of the population. Information on morbidity status for *acute, chronic ailments and hospitalization* were collected for 1269 workers. Tables 25-27 shows the details of self-reported morbidity of tea plantation workers for acute ailment, chronic ailment, and hospitalization cases for a reference period of 30 days, more than 30 days, and 365 days respectively. Out of the 1269 workers 276 workers reported acute ailment i.e., 21.7 percent and 329 workers reported chronic ailment i.e., 25.9 percent within the reference period. 10.3 percent of the workers reported hospitalization. For all the cases reporting, reporting was highest in Dibrugarh district. It should be noted here that, since the Dibrugarh round of the survey was carried out

immediately after the second wave of Covid-19 pandemic; during the time of survey massive vaccination drive of Covid-19 vaccine was going on in the tea garden areas. Many of the respondents reported of post covid vaccination fever after the first dose of vaccination within the reference period especially for acute ailment.

Table 6.25: Reporting of Acute Ailment by Tea plantation workers

Reporting of Acute Ailment	Yes	%	No	%	Grand Total
Tinsukia	77	17.50%	363	82.50%	440
Dibrugarh	134	39.80%	203	60.20%	337
Sibsagar	36	13.50%	230	86.50%	266
Jorhat	29	12.80%	197	87.20%	197
Total	**276**	**21.70%**	**993**	**78.30%**	**1269**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.26: Reporting of Chronic Ailment by Tea plantation workers

Reporting of Chronic Ailment	Yes	%	No	%	Grand Total
Tinsukia	114	25.90%	326	74.10%	440
Dibrugarh	135	40.10%	202	59.90%	337
Sibsagar	44	16.50%	222	83.50%	266
Jorhat	36	15.90%	190	84.10%	226
Total	**329**	**25.90%**	**940**	**74.10%**	**1269**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.27: Reporting of Hospitalization by Tea plantation workers

Reporting of Hospitalization	Yes	%	No	%	Grand Total
Tinsukia	44	10.00%	396	90.00%	440
Dibrugarh	49	14.50%	288	85.50%	337
Sibsagar	21	7.90%	245	92.10%	266
Jorhat	17	7.50%	209	92.50%	226
Total	**131**	**10.30%**	**1138**	**89.70%**	**1269**

Source: Primary data collected from household survey, September 2021-May 2022

6.4.2 Morbidity at worker level by social determinants

Morbidity at worker level is affected by various factors. For the analysis of morbidity reporting of the workers the different social determinants considered are:

I. ***Demographic factors***: gender, age (working age group considered), marital status, and religion

II. ***Socioeconomic factor:*** education, occupation status (permanent and temporary workers), household size and sanitation;

III. ***Nutritional outcome***: BMI of the workers considered. First grouping of BMI (categories considered: low, normal, overweight and obese); second grouping of BMI (low and normal & above)

IV. ***Dietary diversity in food intake***: Number of food groups consumed daily; Consumption of at least four food groups daily; Consumption of pulses daily; Consumption of either of egg/fish/meat daily; Consumption of beverage daily; and Consumption of intoxicant daily.

V. ***Workplace hazard***: Number of workplace hazard reported (from no hazard to maximum of 5 hazards reporting); For the second grouping (not reporting any hazard and reporting at least one hazard).

Overall reporting of morbidity

Overall reporting of morbidity of the workers, reporting of both acute and chronic ailment together as well as either of acute or chronic ailment anyone by the workers has been considered.

Table 6.28 shows the number of workers reporting overall morbidity per hundred of sample tea plantation worker population by various factors. ***Demographic:*** For ***gender*** females reported more as compared to male (39 per hundred for females). ***By age***, reporting is highest in the oldest age group of 55-68 years (52.8 persons per 100), and lowest in the youngest age group of 16-25 years. For the morbidity reporting of workers, the working age group has been considered. For ***marital status*** reporting is higher among currently married. For ***religion*** reporting is slightly higher among others category (37 per 100 person); whereas reporting of overall morbidity for Hindus stands at 36.6 per 100 persons.

For the ***socioeconomic variables*** for ***education*** reporting is highest among not literates (39.6 per 100 person); on the contrary it is lowest among below primary & primary level. This is mainly because a sizeable portion of the workers population are illiterate. In terms of household size reporting is highest for households having 1-4 members. By ***occupation status*** reporting overall morbidity is higher for permanent tea plantation workers. As already discussed in previous section, two factor mainly affect the reporting are permanent workers are entitled to free healthcare services at the tea estate hospital/dispensary and secondly long-time exposer of the permanent workers to harmful work conditions. For **sanitation** reporting is highest for those using flush toilet (57.4 per 100 persons) followed by those using shared latrine (36.6 per 100 person).

For reporting of morbidity of the workers, two different categorizations of ***BMI*** have been considered. In both the categorization reporting is highest for the workers having low BMI. It is evident as already discussed in the descriptive statistic low BMI is predominate among the workers and especially among female workers. Even the in-depth interview with the health fascinators pointed towards undernutrition and underweight being highly prevalent among workers, especially young female workers.

For ***dietary intake***: For number of food groups consumed daily, out of the total cases of morbidity reporting, frequency of reporting is highest for five food groups, followed by four groups. But on the other hand, the prevalence of reporting is higher for workers having higher daily food diversity of six to nine (76.9 per 100 persons for those consuming 9 food groups daily) food groups. For consumption of at least four food groups daily, the prevalence of morbidity is higher for those not consuming four food groups daily.

For ***consumption of Pulses daily*** reporting is higher for those consuming pulses daily. For those consuming ***Egg/Fish/Meat either*** daily the reporting is higher for those consuming

egg/fish/meat daily. It may be inferred that the workers having better access to food diversity are also those having better standard of living in term of income and access to healthcare facilities. Therefore, leading to better reporting among those workers.

For ***beverage consumption*** those not consuming beverages daily reported more. ***Consumption of intoxicants*** (smoke/tobacco/alcohol either) daily, showed higher reporting among those who consumed intoxicants daily. Rampant consumption of alcohol and reporting of various types of diseases (gastric, liver diseases) and symptoms (like swelling of the body) was also responded by the health facilitators in the tea estates. Consumption of alcohol both among male and female worker has been pointed as a major health and social issue among the tea plantation workers by the health facilitators during the in-depth interview (*see chapter 7, section 7.3 Nutrition linkage and reporting of disease-specific morbidity*).

Workplace hazard faced by the workers showed, those reporting at least two hazard reported highest overall morbidity (51.3 per 100 persons).

Appendix table 6 A.3.3, shows the number of persons reporting *acute ailment and chronic ailment* per hundred of sample tea plantation worker population by various background characteristics.

Table 6.28: Reporting of Both Acute & Chronic and Either Acute or Chronic Ailment by Tea plantation worker per 100

Variables	Total Sample	Not Reporting	Reporting Both/Either	Per 100 Reporting Both/Either
Gender				
Male	581	384	197	33.9
Female	688	420	268	39
Age				
16-25	259	188	71	27.4
26-35	461	307	154	33.4
36-45	314	186	128	40.8
46-55	177	94	83	46.9
55-68	53	25	28	52.8
Marital Status				
Others	276	177	99	35.9
Currently Married	989	625	364	36.8
Education				
Not Literate	565	341	224	39.6
Below Primary & Primary	575	385	190	33
Secondary & above	120	75	45	37.5
Occupation				
Permanent	727	434	293	40.3
Temporary	542	370	172	31.7
Sanitation				
Pit Latrine	837	574	263	31.4
No Facility	140	97	43	30.7
Flush Toilet	251	107	144	57.4
Shared Latrine	41	26	15	36.6
Religion				
Hindus	1,188	753	435	36.6
Others	81	51	30	37
HH size				
1-4	511	320	191	37.4
5-8	700	439	261	37.3
8 and above	58	45	13	22.4
BMI Category				
Low	322	180	141	43.9
Normal	550	333	217	39.5
Overweight	49	32	17	34.7
Obese	7	4	3	42.9
BMI Low/Others				
Normal & above	606	369	237	39.1
Low	322	180	141	43.9
Food Groups Consumed Daily				
1 FG Consumed	1	0	1	100.0
2 FG Consumed	19	13	6	31.6
3 FG Consumed	156	93	63	40.4
4 FG Consumed	287	194	93	32.4
5 FG Consumed	364	254	110	30.2
6 FG Consumed	183	103	80	43.7
7 FG Consumed	179	103	76	42.5
8 FG Consumed	19	10	9	47.4
9 FG Consumed	13	3	10	76.9
10 FG Consumed	3	2	1	33.3

11 FG Consumed	1	0	1	100.0
At least four food group consumed				
No	176	106	70	39.8
Yes	1,049	669	380	36.2
Pulses Consumed Daily				
No	556	400	156	28.1
Yes	669	375	294	43.9
Egg/Fish/ Meat either consumed Daily				
No	1,144	735	409	35.8
Yes	81	40	41	50.6
Beverage consumed Daily				
No	560	351	209	37.3
Yes	665	424	241	36.2
Intoxicant (smoke/Tobacco/Alcohol) consumed Daily				
No	562	362	200	35.6
Yes	663	413	250	37.7
Number of Workplace Hazard Reported				
No Hazard Reported	281	169	112	39.9
1 Hazard Reported	390	251	139	35.6
2 Hazard Reported	195	95	100	51.3
3 Hazard Reported	172	102	70	40.7
4 Hazard Reported	167	140	27	16.2
5 Hazard Reported	54	39	15	27.8
Workplace Hazard Reported				
No	281	169	112	39.9
Yes	978	627	351	35.9

Source: Primary data collected from household survey, September 2021-May 2022

6.4.3 Socioeconomic determinants of morbidity at the worker level – Binary logistic regression

The results of binary logistic regression for reporting of morbidity of the workers are presented in Table 6.30. The dependent variable taken for the model is "*Reporting of any ailment (acute or chronic) or both (acute or chronic)*" if yes, the variable takes value 1, or 0 otherwise. The description of the independent variables considered has been explained in table 6.29.

Table 6.29: Description of Independent Variables considered for Reporting of Morbidity by Tea Plantation Workers

Variable Name	Variable Description
Demographic Factors	
Gender	Female =1, Male =0
Age	age has been taken as continuous
Marital Status	Currently Married = 1, 0 Otherwise
Religion	Hindu (base category)
Others	Muslin, Christian and Buddhism
Socio-Economic Factors	
Education	Not literate (base category)
Below Primary & Primary	
Secondary & above	
Sanitation	Pit Latrine (base category)
No facility	
Flush toilet	
Shared latrine	
Occupation	Temporary Tea Plantation Worker =1, Permanent Tea Plantation Worker = 0
log_mpce	MPCE has been taken as a continuous variable and the log of MPCE has been considered for the analysis
Nutritional Outcome	
BMI	BMI low= 1, BMI Normal & above =0
Dietary Diversity	
Pulses Consumption Daily	Pulses Consumption Daily = 1, otherwise =0
Egg/Fish/Meat Daily	Consumption of Egg/Fish/Meat either Daily = 1, otherwise =0
Beverage Consumption Daily	Beverage Consumption Daily = 1, otherwise =0
Intoxicant (Smoke/Tobacco/Alcohol) Daily	Intoxicant (Smoke/Tobacco/Alcohol) Daily = 1, otherwise =0
Workplace Hazard	
Reporting of Workplace Hazard	Reporting at least one Workplace Hazard = 1, otherwise =0

The *significant variables* are ***age, egg/fish/meat consumption, pulses consumption and sanitation***. The older age groups are more likely to report morbidity. Higher the age a worker is 0.7 percent more likely to report overall morbidity (significant at 1% level of significance). Sanitation shows workers using flush toilet (significant at 1% level of significance) and shared latrine are more likely to report morbidity, whereas those having no facility are less likely to report. Daily consumption of pulsed showed that worker who consumed pulses daily are 12.5 percent (significant at 1% level of significance) more likely to report morbidity than those who do not consume pulses daily. Similarly, for daily consumption of egg/fish/meat daily, those consuming egg/fish/meat daily are more likely to report (significant at 5% level of significance). It is seen some of the important determinants such as BMI of the workers,

workplace hazard faced by the worker, gender which affect health outcomes are insignificant in the model. This may be due to some other factor, which may be affecting the results, although workers with low BMI are more likely to report morbidity even though not significant.

Table 6.30: Reporting of Both Acute & Chronic and Either Acute or Chronic Ailment at Worker Level - Binary Logistic Regression

Socioeconomic Factors	Odds Ratio	Robust SE	dy/dx
Gender			
Male^			
Female	1.22780	0.20263	0.04466
Age	1.03681*	0.00861	0.00787
Marital Status			
Others^			
Currently Married	0.90586	0.16352	-0.02152
Education			
Not Literate^			
Below Primary & Primary	1.00635	0.17674	0.00137
Secondary & above	1.33904	0.39309	0.06450
Occupation			
Permanent Worker^			
Temporary Worker	0.99306	0.15417	-0.00152
Sanitation			
Pit Latrine^			
No Facility	0.97211	0.23124	-0.00608
Flush Toilet	2.66562*	0.49268	0.22480
Shared Latrine	1.19586	0.44983	0.03942
Religion			
Hindu^			
Others	0.98102	0.28978	-0.00417
log_mpce	1.00556	0.11417	0.00121
Pulses Consumption Daily			
No^			
Yes	1.78081*	0.28263	0.12559
Egg/Fish/Meat Daily			
No^			
Yes	1.84333**	0.51126	0.13310
Beverage Consumption Daily			
No^			
Yes	0.83921	0.12399	-0.03815
Intoxicant (Smoke/Tobacco/Alcohol) Daily			
No^			

Yes	0.99030	0.15703	-0.00212
BMI			
Normal & above^			
Low	1.16202	0.17578	0.03268
Reporting Work Place Hazards			
No^			
Yes	0.95464	0.17816	-0.01010

Source: Calculated from Primary Data collected in-between September 2021 to April 2022

* p <0.01, ** p< 0.05, *** p< 0.1

Number of observations = 902; Wald chi-square = 77.52; Probability = 0.0000; Pseudo R2 = 0.0753; Log pseudolikelihood = -563.96321

^ Reference group

Source: Primary data collected from household survey, September 2021-May 2022

Reporting Acute and Chronic Workers – Binary logistic regression

Results of binary logistic regression for morbidity reporting separately for acute and chronic ailment (*see appendix 6A.3, table 6A3.4*) of tea plantation works shows similar results as overall morbidity reporting. Here for the first model reporting of acute ailment is taken as the dependent variable and for the second model reporting of chronic ailment is taken as the dependent variable. The *social determinants which are significant for acute ailment* are ***age, pulses consumption and sanitation***. For *chronic ailment reporting the significant variables* are age, egg/fish/meat consumption and sanitation. Overall, for reporting of morbidity among the ***workers is affected by age, food consumption and sanitation***. The type of food consumption shows that individuals who have better income and access to food are more likely to report morbidity.

6.4.4 Disease profile of the workers

Disease profile for acute ailment

Table 6.31 shows district wise *diseases profile for acute ailment reported by the tea plantation workers* under the five broad categories of infectious diseases, NCDs, CVDs, disability, and other diseases. The detail list of diseases under the five broad categories has already been discussed in chapter 3. Of the 276 workers reporting acute ailment in the reference period, the total number of cases of reporting acute ailment is 339 due to multiple diseases

being reported by some of the respondents. The figures in the table are in percentage. The percentage calculated is the number of cases reported for each type of disease (infectious, NCDs, CVDs, disability and other) for acute ailment divided by the total number of cases reported for acute ailment.

Overall, among the five broad classification of diseases the number of cases reported for ***other diseases*** is highest (179 cases, 52.8 percent), followed by disability and infectious diseases. Post covid vaccination fever was listed under other diseases, and as already discussed in the previous section there were high reporting of post covid vaccination fever as massive vaccination drive was being carried out in the tea plantation areas. Among the districts percentage of reporting of ***infectious diseases*** was highest in Tinsukia district (20.2 percent). For ***CVDs*** reporting was highest in Sibsagar district (9.3 percent). ***NCD*** reporting is highest in Tinsukia district (6.7 percent) and disability reporting was highest in Jorhat (35.9 percent). Dibrugarh reported the highest incidence of other diseases (70.6 percent).

The overall, detail diseases profile under the five broad categories has been presented in table 6.32. It discusses the specific disease which contribute majorly to these broad categories. The figures in the table are in percentage. The percentage calculated is the number of cases reported for each type of disease divided by the total number of *cases reported for acute ailment cases*. Highest number of cases were reported under **other diseases** (179 cases, 52.8%). The diseases which are the *highest contributor* in this category are ***all other fever*** (104 cases, 30.7 percent), followed by ***post covid vaccination fever*** (53 cases, 15.6 percent) and ***pain in abdomen: gastric and peptic ulcers*** (14 cases, 4.1 percent).

Under **disability** high number of cases were reported (85, 25.1%). ***Back and body ache*** (26 cases, 7.7 percent) followed by ***weakness in limb muscles*** (18 cases, 5.3 percent) and ***headache*** were highest contributor in this category. This is mainly reported due the nature of

the work that the tea plantation workers do. Under **Infectious disease** number of cases reported (43, 12.7%).

For **NCD** number of cases reported (18, 5.3%). The highest contributor in this category is ***jaundice*** (6 cases, 1.8 percent). **CVD** reporting was lowest (14, 4.1%), under this category for acute ailment the highest contributor was ***hypotension*** (low blood pressure) (7 cases, 2.1 percent).

Table 6.31: District Wise Disease Profile for Acute Ailment of Workers

Type of Diseases Reported for Acute Ailment	Tinsukia		Dibrugarh		Sibsagar		Jorhat		Total	
	No. of Cases Reported	% Disease Reported	No. of Cases Reported	% Disease Reported	No. of Cases Reported	% Disease Reported	No. of Cases Reported	% Disease Reported	No. of Cases Reported	% Disease Reported
Total Infectious Disease	21	20.2	11	7.2	7	16.3	4	10.3	43	12.7
Total CVDs	6	5.8	1	0.7	4	9.3	3	7.7	14	4.1
Total NCDs	7	6.7	7	4.6	2	4.7	2	5.1	18	5.3
Total Disability	30	28.8	26	17	15	34.9	14	35.9	85	25.1
Total Other Diseases	40	38.5	108	70.6	15	34.9	16	41	179	52.8
Total for Acute Ailment	**104**	**100**	**153**	**100**	**43**	**100**	**39**	**100**	**339**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.32: All Districts Diseases Reported for Acute Ailment by Workers

Type of Diseases Reported for Acute Ailment	Number of Cases Reported	% Disease Reported
Infectious Diseases		
Acute upper respiratory infections	3	0.9
Cough with sputum with or without fever not TB	5	1.5
Covid-19	1	0.3
Diarrhoea	3	0.9
Discomfort/pain in the eye with redness or swellings/ boils	1	0.3
Fever due to Diphtheria/Whooping Cough *	20	5.9
Fever with loss of consciousness or altered consciousness	7	2.1
Skin infection (boil/abscess/itching) and other skin disease	2	0.6
Tuberculosis	1	0.3
Total Infectious Disease	**43**	12.7
Cardio Vascular Diseases		
Heart disease: Chest pain/breathlessness	4	1.2
Hypertension	3	0.9
Hypotension (low blood pressure)	7	2.1
Total Cardio Vascular Disease	**14**	4.1
Non-Communicable Diseases		

Anaemia (any cause)	1	0.3
Any difficulty or abnormality in urination	1	0.3
Bleeding disorders	1	0.3
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders and male/female infertility	2	0.6
Cancer	1	0.3
Earache with discharge/bleeding from ear/infections	2	0.6
Jaundice	6	1.8
Piles	2	0.6
Under-nutrition	2	0.6
Total NCDs	**18**	5.3
Disability		
Accidental injury or road traffic accidents and falls	11	3.2
Back or body aches	26	7.7
Decreased hearing or loss of hearing	5	1.5
Decreased vision (chronic) not including where decreased vision is corrected with glasses	1	0.3
Headache	17	5
Joint or bone disease/ pain or swelling in any of the joints or swelling or pus from the bones	5	1.5
Seizures or known epilepsy	2	0.6
Weakness in limb muscles and difficulty in movements	18	5.3
Total Disability	**85**	25.1
Other Diseases		
All other fevers	104	30.7
Childbirth (for both live birth and stillbirth) normal delivery	1	0.3
Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen	14	4.1
Post Covid Vaccination fever	53	15.6
Un-Diagnosed Diseases	7	2.1
Total Other Diseases	**179**	52.8
Grand Total for Acute Ailment	**339**	**100**

Note: * There may be investigator bias as most of the fevers reported in this category are undiagnosed by medical practitioners, to be read with caution
Source: Primary data collected from household survey, September 2021-May 2022

Disease profile for chronic ailment

The percentage of cases of each type of diseases under the broad categories for chronic ailment for tea plantation workers (see table 6.33) is highest for disabilities (143 cases, 31.5 percent), followed by NCDs. Out of the total 329 workers reporting chronic ailment in the reference period the total number of cases of reported for chronic ailment is 454. Among the districts reporting of infectious diseases were highest in Tinsukia district (28 cases, 16.7 percent) followed by Jorhat. For CVDs reporting is highest in Dibrugarh district (39 cases, 22 percent). NCD reporting is highest in Sibsagar (16 cases, 27.6 percent). Reporting of disability is highest in Jorhat and for other diseases reporting is highest in Sibsagar.

Table 6.34 shows the type of diseases reported by the tea plantation workers for chronic ailment. Highest number of cases were reported under **disability** (143 cases, 31.5%). Under disability reporting was high for ***back and body ache*** (54 cases, 11.9 percent) followed by ***weakness in limb muscles*** (22 cases, 4.8 percent) and ***joint and bone disease*** (17 cases, 3.7 percent). This can be attributed to occupational hazard faced and the nature of work carried out by the tea plantation workers.

For **NCD** number of cases reported (102, 22.5%). The highest contributor in this category is ***anaemia*** (21 cases, 4.6 percent) followed by ***under-nutrition*** (20 cases, 4.4 percent); change/irregularity in menstrual cycle or excessive bleeding was also widely reported by female workers (13 cases, 2.9 percent). Apart these chronic diseases like *diabetes and bronchial asthma were also frequently* reported (11 cases in each category, 2.4 percent). These finding corroborates with the findings and the diseases pointed out by health facilitators during the in-depth interview (*see chapter 7, section 7.2 Diseases reported among adults*).

For **CVD** number of cases were reported (87, 19.2%). Under CVD the reporting of ***hypertension*** (59 cases, 13 percent) followed by ***hypotension*** (18 cases, 4 percent) is highest. This is mainly due to the dietary habits of the community. The excessive consumption of salt

with tea is one of the main reasons for hypertension along with workplace hazard of physiological stress, which was widely reported among the workers are some of the root causes of high prevalence of hypertension. Whereas lack of nutrition leads to hypotension.

For **infectious disease** number of cases reported (55, 12.1%). Under this reporting is highest for ***tuberculosis*** (19 cases, 4.2 percent) followed by ***skin infection*** (16 cases, 3.5). The type of diseases reported under *infectious diseases clearly points toward three main causes*. First is *lack of nutrition and balance diet among the workers due to lack of income, secondly the work place conditions and constant exposer to harmful insecticides is another factor and lastly, lack of proper hygienic living conditions in the line quarters and sanitation*.

For **other disease** number of cases reported (67, 14.8%). Under this reporting is highest for ***pain in abdomen gastric and peptic ulcer*** (38 cases, 8.4 percent). The main reasons for frequent reporting of gastric and peptic ulcer as identified by the health facilitators are excessive consumption of alcohol, irregular eating time table and less consumption of water due to long working hours and skipping meals due to long working hours.

It should be noted that for both acute and chronic ailment under the other diseases category we have included the un-diagnosed diseases which includes the diseases which the respondents could not state the exact name of the disease instead they reported the symptoms.

Table 6.33: District Wise Disease Profile for Chronic Ailment by Workers

Type of Diseases Reported for Chronic Ailment	Tinsukia		Dibrugarh		Sibsagar		Jorhat		Total	
	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported
Total Infectious Disease	28	16.7	19	10.7	6	10.3	7	13.7	55	12.1
Total CVDs	29	17.3	39	22	8	13.8	11	21.6	87	19.2
Total NCD	27	16.1	44	24.9	16	27.6	10	19.6	102	22.5
Total Disability	62	36.9	48	27.1	14	24.1	19	37.3	143	31.5
Total Other Diseases	22	13.1	27	15.3	14	24.1	4	7.8	67	14.8
Total for Chronic Ailment	**168**	**100**	**177**	**100**	**58**	**100**	**51**	**100**	**454**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.34: All Districts Diseases Reported for Chronic Ailment by Workers

Type of Diseases Reported for Chronic Ailment	Number of Cases Reported	% Disease Reported
Infectious Diseases		
Acute upper respiratory infections	4	0.9
Cough with sputum with or without fever not TB	3	0.7
Diarrhoea	5	1.1
Discomfort/pain in the eye with redness or swellings/ boils-28	4	0.9
Fever due to Diphtheria/Whooping Cough *	2	0.4
Fever with loss of consciousness or altered consciousness	1	0.2
Skin infection (boil/abscess/itching) and other skin disease	16	3.5
Tuberculosis	19	4.2
Worm infection	1	0.2
Total Infectious Disease	**55**	**12.1**
Cardio Vascular Diseases		
Heart disease: Chest pain/breathlessness	10	2.2
Hypertension	59	13
Hypotension (low blood pressure)	18	4
Total Cardio Vascular Disease	**87**	**19.2**
Non-Communicable Diseases		
Anaemia (any cause)	21	4.6
Any difficulty or abnormality in urination	3	0.7
Bleeding disorders	2	0.4
Bronchial asthma	11	2.4

Cancer	3	0.7
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders and male/female infertility	13	2.9
Diabetes	11	2.4
Earache with discharge/bleeding from ear/infections	1	0.2
Goitre and other diseases of the thyroid	4	0.9
Jaundice	5	1.1
Pain the pelvic region/reproductive tract infection/ Pain in male genital area	3	0.7
Piles	5	1.1
Under-nutrition	20	4.4
Total NCDs	**102**	**22.5**
Disability		
Accidental injury or road traffic accidents and falls	3	0.7
Back or body aches	54	11.9
Burns and corrosions	1	0.2
Decreased hearing or loss of hearing	12	2.6
Decreased vision (chronic) not including where decreased vision is corrected with glasses	6	1.3
Diseases of mouth/teeth/gums	3	0.7
Eye Others (including disorders of eye movements – strabismus/nystagmus/ptosis and adnexa)	1	0.2
Headache	15	3.3
Joint or bone disease/ pain or swelling in any of the joints or swelling or pus from the bones	17	3.7
Mental disorders	1	0.2
Mental retardation	2	0.4
Seizures or known epilepsy	6	1.3
Weakness in limb muscles and difficulty in movements	22	4.8
Total Disability	**143**	**31.5**
Other Diseases		
All other fevers	2	0.4
Could not even state the main symptom- said as piles but not diagnosed by doctor	1	0.2
Gastrointestinal bleeding	1	0.2
Lump or fluid in abdomen or scrotum	3	0.7
Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen	38	8.4
Un-diagnosed diseases**	22	4.8
Total Other Diseases	**67**	**14.8**
Grand Total for Chronic Ailment	**454**	**100**

Note: * There may be investigator bias as most of the fevers reported in this category are undiagnosed by medical practitioners, to be read with caution

** Some of the symptoms reported under un-diagnosed diseases: insomnia, blood in stool but it was not reported by doctor, calcium deficiency, reported of weakness, shivering and weakness, stomach pain and headache, weakness, chest pain

Source: Primary data collected from household survey, September 2021-May 2022

Disease profile for hospitalization cases

Table 6.35 shows district wise reporting of hospitalization by the tea plantation workers. Out of the total 131 workers reporting hospitalization in the reference period the total number of cases of reported for hospitalization is 173. Of the five types of disease classification, reporting of other disease (59 cases, 34.1 percent) is highest followed by disability and NCD. It should be noted here that in the other disease we have considered the child delivery cases both normal and caesarean. Among the districts reporting of infectious diseases were highest in Dibrugarh district (12 cases, 19 percent); for CVDs reporting is highest in Jorhat (18.2 percent); NCD reporting is highest in Tinsukia. Reporting of disability is highest in Jorhat and for other diseases reporting is highest in Dibrugarh.

Table 6.36 shows the type of diseases reported by the tea plantation workers for hospitalization. Highest number of cases were reported under **other diseases** (59 cases, 34.1%). In other diseases ***reporting of childbirth*** (normal delivery) is highest (21 cases, 12.1 percent).

Under **disability** ***weakness in limb muscles*** was highest reported. This is mainly reported due the nature of the work that the tea plantation workers do.

Under **Infectious disease** number of cases reported (21, 12.1%). Highest reporting was for ***Covid 19 cases*** (10 cases, 5.8 percent).

For **NCD** number of cases reported (33, 19.1%) with highest reporting of diabetes cases followed by ***anaemia***. **CVD** cases were lowest reported (18, 10.4%), among CVD ***hypertension*** was reported highest (7 cases, 4 percent).

Table 6.35: District Wise Diseases Profile for Hospitalization by Workers

Type of Diseases Reported for Hospitalization	Tinsukia		Dibrugarh		Sibsagar		Jorhat		Total	
	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported	Number of Cases Reported	% Disease Reported
Total Infectious Disease	8	12.9	12	19	1	3.8	3	13.6	21	12.1
Total CVDs	4	6.5	7	11.1	3	11.5	4	18.2	18	10.4
Total NCDs	13	21	6	9.5	2	7.7	2	9.1	33	19.1
Total Disability	16	25.8	8	12.7	11	42.3	10	45.5	42	24.3
Total Other Diseases	21	33.9	27	42.9	9	34.6	3	13.6	59	34.1
Total for Hospitalization	**62**	**100**	**63**	**100**	**26**	**100**	**22**	**100**	**173**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

Table 6.36: All Districts Diseases Reported for Hospitalization by Workers

Type of Diseases Reported for Hospitalization	Number of Cases Reported	Incidence of Disease Reported
Infectious Diseases		
Acute upper respiratory infections	1	0.6
Cough with sputum with or without fever not TB	1	0.6
Covid 19	10	5.8
Discomfort/pain in the eye with redness or swellings/ boils	1	0.6
Diarrhoea	1	0.6
Fever due to Diphtheria/Whooping Cough*	2	1.2
Fever with loss of consciousness or altered consciousness	1	0.6
Skin infection (boil/abscess/itching) and other skin disease	1	0.6
Tuberculosis	3	1.7
Total Infectious Disease	**21**	**12.1**
Cardio Vascular Diseases		
Heart disease: Chest pain/breathlessness	5	2.9
Hypertension	7	4
Hypotension (low blood pressure)	5	2.9
Stroke/ hemiplegia/ sudden onset weakness or loss of speech in half of body	1	0.6
Total Cardio Vascular Disease	**18**	**10.4**
Non-Communicable Diseases		
Anaemia (any cause)	3	1.7
Bleeding disorders	2	1.2
Bronchial asthma	1	0.6
Cancer	2	1.2

Cataract	3	1.7
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders and male/female infertility	3	1.7
Diabetes	4	2.3
Earache with discharge/bleeding from ear/infections	1	0.6
Goitre and other diseases of the thyroid	1	0.6
Pregnancy with complications before or during labour (abortion/ectopic pregnancy/hypertension/complications during labour)	3	1.7
Jaundice	3	1.7
Joint or bone disease/ pain or swelling in any of the joints or swelling or pus from the bones	3	1.7
Pain the pelvic region/reproductive tract infection/ Pain in male genital area	1	0.6
Under-nutrition	3	1.7
Total Non-Communicable Disease	**33**	**19.1**
Disability		
Accidental injury and road traffic accidents and falls	11	6.4
Back or body aches	9	5.2
Burns and corrosions	1	0.6
Contact with venomous/harm-causing animals and plants	2	1.2
Decreased hearing or loss of hearing	1	0.6
Decreased vision (chronic) not including where decreased vision is corrected with glasses	1	0.6
Headache	2	1.2
Seizures or known epilepsy	2	1.2
Weakness in limb muscles and difficulty in movements	13	7.5
Total Disability	**42**	**24.3**
Other Diseases		
All other fevers	12	6.9
Caesarean Delivery	5	2.9
Childbirth (for both live birth and stillbirth) normal delivery	21	12.1
Gastrointestinal bleeding	1	0.6
Lump or fluid in abdomen or scrotum	2	1.2
Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen	9	5.2
Post Covid Vaccination fever	2	1.2
Symptoms reported for hospitalization**	7	4.0
Total Other Diseases	**59**	**34.1**
Grand Total for Hospitalization	**173**	**100**

Note: * There may be investigator bias as most of the fevers reported in this category are undiagnosed by medical practitioners, to be read with caution
** Some of the symptoms reported: Gallbladder, stomach pain/fever, weakness/fever
Source: Primary data collected from household survey, September 2021-May 2022

6.5 Limitations and Conclusions

There is a dearth of self-reported morbidity study at community level in Assam, focusing on vulnerable population group. NSSO do not provide data at community level. Therefore, there is a need to look at population at more disaggregated level. The primary study makes a beginning by looking at self-reported morbidity status of tea plantation workers in Assam. The study tries to encompass most of the major dimensions that affects the health status of and individual. However, there are further scope for in-depth studies focusing on any particular aspect affecting the health status. In the regression model although, some of the importing determinants like BMI of the workers and workplace hazard is insignificant. But when we look into the descriptive statistic, type of diseases being reported and inputs from the in-depth interviews strongly points towards nutrition and morbidity linkage along with workplace conditions of the tea plantation workers.

Overall, the reporting of chronic morbidity is high compared to acute ailment, both among the sample population and the plantation workers. For acute ailment, less than 20 percent of the workers in Tinsukia, Sibsagar, Dibrugarh and Jorhat constituted together for CVDs and NCDs. Rest of the disease categories constituted close to 80 percent of all the disease categories being reported, reflecting vulnerable or precarious conditions of living. More than a quarter of worker population suffer from occupational health hazard. Close to 40 percent worker population in Tinsukia, Sibsagar, Jorhat suffer from high prevalence of other diseases, which are not life style disease.

Chronic ailment reporting shows, the importance of occupational related disabilities can be seen in the case of chronic ailments ranging from 24 percent in Sibsagar to 37 percent in Jorhat. The prevalence of CVDs and NCDs together is much higher compared to infectious disease. But most of these CVDs and NCDs are related to nutrition and workplace conditions. CVDs in terms of hypertension has been mainly related to excessive salt consumption from

past clinical studies. But what can be probed further is other than excessive salt consumption, there may be other reasons of high reporting of hypertension. The reasons can be either phycological stress which have been extensively reported under one of the workplace hazards. Secondly, there is a need for clinical study or longitudinal study to evaluate if there are intergenerational effect of CVDs, or maternal malnutrition leading to CVDs in later life as established by the larger literature.

Results shows high level of self- reported morbidity. Age, gender, sanitation, and source of water have significant effect on reporting of morbidity. The morbidity status of the population points to low levels of development and indecent workplace conditions with lack of dietary diversity. Other diseases and disability form a sizeable proportion of disease prevalence among plantation workers. Disability related diseases among plantation workers are mostly occupation related. The proportion of infectious disease among plantation workers is sizeable in case of acute ailments. Under chronic ailments, sizeable proportion reporting NCDs and CVDs. Therefore, in terms of prevalence of disease, we see multiple prevalence of diseases: communicable, non-communicable, and occupational hazards. Nutrition outcomes in terms of BMI is significantly low in the plantation worker population. With low food diversity scores and multiple and frequent occupational hazards. There is less consumption of protein as well as fruits and dairy products. This points towards micronutrients deficiency as well as protein deficiency which affects the overall nutrition status of the workers.

At policy implication level, pattern of disease prevalence point to low socioeconomic standards of living in the overall population requiring policy attention at the macro level, particularly social policies of labor market, and public policies on education, health, and social protection. There is a need to distinguish between worker level and population level morbidity status. For e.g., morbidity status of tea plantation workers is compounded due to workplace related hazards that ultimately impact the overall morbidity status of a household/population.

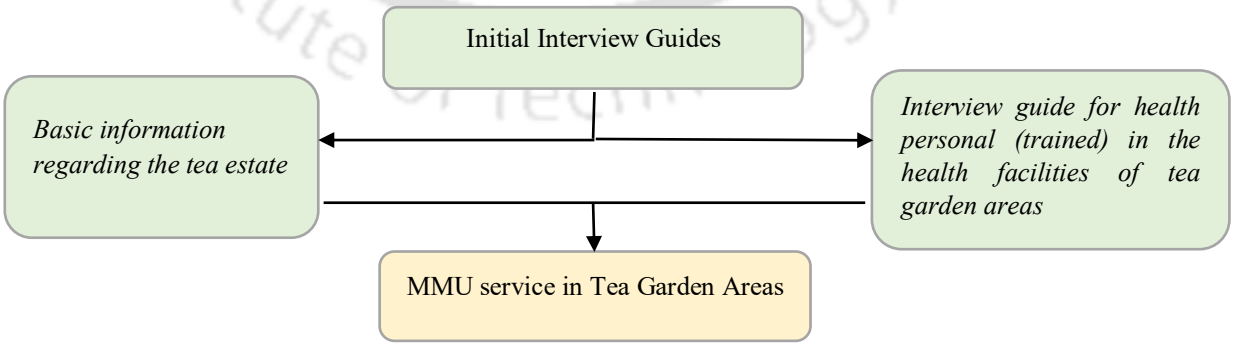
Separate sets of policy frameworks need to be worked out for workers and general population. Low-income levels and access to dietary diversity calls for provision of subsidized sale of protein and fat rich food items like pulses, egg, and oil in the tea plantation areas though PPP (government and tea plantation management) mode other than the regular PDS providing rice.

Chapter 7 Observations on Health and Healthcare Facilities Availed by Tea Plantation Workers

This chapter is an appendage to Chapter 6. It provides evidences of health problems and some of their causes from in-depth interviews with health facilitators working within the tea plantation at the tea garden hospitals/dispensaries. It also tries to capture the different healthcare facilities within the tea plantations. This is an additional information which helps us to understand the overall prevailing morbidity status and various social determinants from the perspective of trained healthcare facilitators.

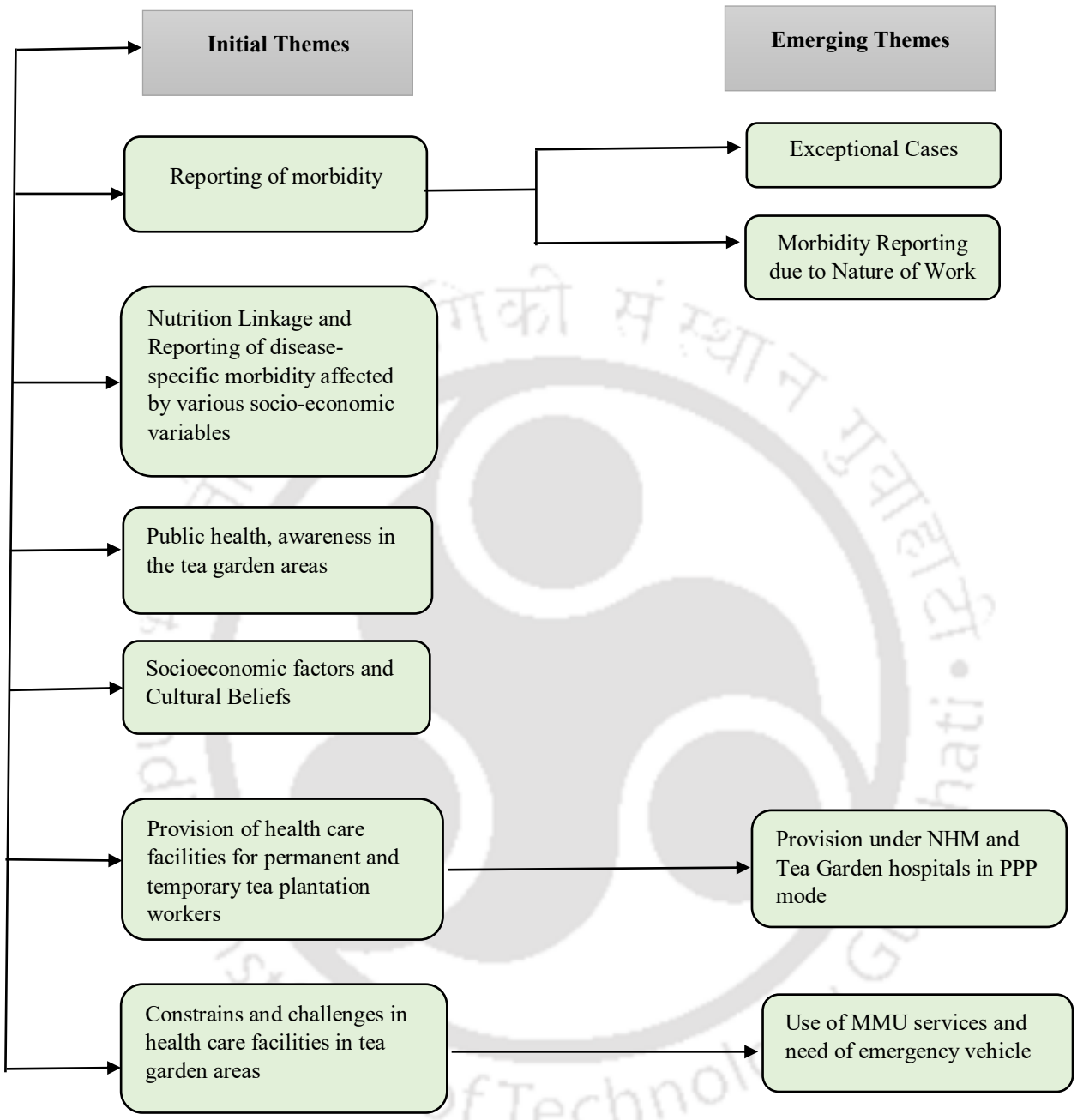
7.1 Basic themes of the qualitative survey

Assessment on disease prevalence and availability of health care facilities with the tea estates were collected from key informants who are health facilitators in the tea garden areas. We initially had two interview guides: one for basic information regarding health facilities within the tea estate and secondly, elaborated interview guide to understand various aspects affecting health status of the tea plantation workers. The initial themes and the emerging themes of the study is shown in figure 7-1.



Source: Author's design

Figure 7-1: Themes for Qualitative Interview Guide



Source: Author's design

Basic information of the key informants

Qualitative data was collected from health facilitators (except in one tea estate) working within the tea estate hospital/dispensary in Tinsukia district. Due to ethical reasons, the tea gardens names have been coded serially from 1 to 10.

Table 7.1: List of Key Informants

Sl No.	TE Code	Line Quarters	HH Surveyed	Person Interviewed
1	TG001	9	35	ASHA
2	TG002	20	63	Pharmacist
3	TG003	6	22	ANM
4	TG004	1	6	ANM
5	TG005	2	16	GNM/ Pharmacist
6	TG006	7	37	Pharmacist/Doctor
7	TG007	3	15	GNM
8	TG008	9	36	GNM
9	TG009	9	30	TE Welfare Officer
10	TG010	4	4	Manager

Source: Primary data collected from field

7.2 Type of diseases and health issues identified by the health facilitators

Table 7.2 summarizes the findings. The health facilitators have identified and both communicable and non-communicable diseases among the tea plantation workers. They also mentioned that certain diseases are seasonal and it is recurrent every season. The most reported cases are common cold and fever. Some of the diseases with recurrent occurrence in all the sample tea gardens as reported by the health facilitators which can broadly divided into infectious, CVDs, NCDs and disabilities. The most common reporting diseases under CVDs is hypertension and hypotension (especially among females), under NCDs anaemia, underweight (especially pregnant women and children) and epilepsy are commonly reported. Infectious diseases reporting showed active TB cases, diarrhoea and skin diseases (specially scabies) are widely reported. Gastric with abdomen pain is frequently reported among the workers. Under disability body and back pain, injuries and fall in workplace and snake bites are common. Apart from this, since the survey was conducted post COVID pandemic they have also identified and

reported the COVID cases reported under their tea estate apart from a few other exception diseases cases in the reference period of last five years. Some of the exceptional cases reported are leprosy case, 1 malaria (2 years prior to survey period), filariasis case, malaria case (2 years prior to survey).

The in-depth interview gave insights into the type of diseases that are specific to population groups (i.e., how it differs among adults, children besides adult females). These interviews also led to emergence of a sub them of morbidity due to nature of work and workplace conditions.

7.2.1 Diseases reported among adults

Frequently reported diseases among adults as identified by the health facilitators are anaemia, headache, backpain, TB, abdomen pain (either gastric, appendicitis, gallbladder, or due to excessive alcohol consumption), hypertension, hypotension, epilepsy, worm infection, jaundice, pneumonia and liver diseases are reported mainly due to excessive consumption of alcohol.

The deficiency diseases which reported both among male and female workers apart from anaemia, are Vitamin A deficiency are reported when patient complaints about not being able to see properly at night. Cases of Vitamin B and C deficiency are reported by women workers mainly they get mouth ulcers. Seasonal disease like fever and cold, cough, diarrhoea, stomach pain, vomiting and eye infection (seasonal, especially during summer season) are widely reported. Among female cases of anaemia (especially during time of pregnancy) and menstrual health problems frequently reported. Among the female complicate cases of pregnancy are sometimes reported mainly due to Cephalopelvic Disproportion (CPD), a condition where the baby has trouble getting through the birth canal because of the size of the baby's head, the baby's position, or the size or shape of the mother's pelvis.

7.2.2 Diseases reported among children

Among the children, reporting of underweight children is frequent. Low birth weight of the children is also frequently reported. Diseases like are fever, cough, skin diseases, asthma, vomiting and diarrhoea (seasonal – more cases in summer usually) are commonly reported. Among children night blindness is sometimes reported due to deficiency of vitamin A.

7.2.3 Diseases reported due to nature of work, workplace conditions and hours of work

Nature of work, workplace conditions and hours of work affect the health of the plantation workers. The nature of work affects the health of the workers, which lead to reporting of body and chest pain. As reported by the health facilitators, fractures and eye injury are reported during work. Reporting of body pain and weakness among the workers is frequent mainly due to the workplace condition and the nature of work the workers do. Skin diseases, allergy (mainly due to workplace condition during plucking season), and cases of deafness are also reported. Heart strokes, vomiting and fainting are reported during the plucking season due to the hot and humid climate, and long-standing hours in the garden with heavy weight. Fractures and cuts at workplace, insect bites, snake bites & animal bites are also reported by the workers. Reporting of gastric is frequent among the workers mainly because of irregular eating time table and less consumption of water due to long working hours. Due to long working hours the workers often skip meals and this leads to reporting of gastric. The health facilitator in a particular garden identified the harmful effects on the health status of the workers engaged in spraying insecticides in the tea gardens. The health facilitator reported,

> *Since spraying of medicines in the garden is a job, which is harmful to the health, and sick persons cannot be given the job of spraying medicines in the garden. Therefore, before spraying medicines, the workers are given medicines and their blood test is done.*

Workplace condition also affects the health of the workers, as reported by another health facilitator

> *Cough and cold are mainly reported due to working continuously in cold and rain. For the children it is frequent, as the children remain unattended as their parents goes to work. For some the mothers take the child along with them to the tea garden when they go to work, in such conditions the child gets affected.*

7.2.4 Observations on child mortality in tea plantation based on responses of key informants

TG001: Severe acute malnourishment (SAM) among two children in 2018 and 2019. Both have recovered now. Details of the SAM babies (1st case- Pre mature delivery male child at 7 months, was kept in hospital for one month; 2nd case- Pre mature delivery male child, this was mainly because of very young age of the mother and lack of food and nutrition during pregnancy).

TG003: One case of low-birth-weight in 2021 and one case of still birth in February 2022. One child mortality case was registered in January 2022 (the child died after 42 days of birth) due to malnourishment.

TG004: Low birth weight registered for 3 babies. One case of still birth (baby boy), was reported in September 2021. Another case of child mortality was reported (girl child) in October 2021, the mother of the child had typhoid and hypertension.

Table 7.2: Types of Diseases Reported by the Tea plantation workers as Reported by the Health Workers in the Tea Garden Areas

Name of the TE	Types of Disease Reported in the TE	Exceptional Cases Reported
TG001	High Blood Pressure, Underweight, Anaemia, Less weight during delivery, Cold & Fever, Diarrhoea, TB, Diabetes, Low Blood Pressure, Skin diseases, Epilepsy, Piles	Covid cases during Covid outbreak; One Leprosy case reported in 2018 (Male, 35 years). The person with Leprosy was mentally disabled too. He is cured fully now. The patient was taken to Makum Civil Hospital where there was treatment available for leprosy. The patient was treated under government treatment for free.
TG002	Seasonal diseases (flue, cough, diarrhoea, dysentery), Hypertension (due to salt water consumption), TB, Anaemia (both male and female), filariasis, epilepsy, diabetes, body pain, burn cases, snake bites (referral given), dog and monkey bites (treatment given in TE hospital), sickle cell disease, skin diseases (due to presence of ring worm), Pneumonia (especially among children), gastric (due to excess alcohol consumption), cataract (eyes), cases of malnutrition (especially of children, when both parents goes to work), Vitamin A deficiency.	Covid cases reported during covid pandemic but no covid deaths
TG003	Diarrhoea, fever and cough, stomach pain, vomiting, gallbladder, TB, Appendicitis, epilepsy, worm infection, skin disease (especially scabies), jaundice, pneumonia, anaemia (especially during time of pregnancy), hypertension, hypotension, piles, eye infection (seasonal, especially during summer season), allergy (mainly due to workplace condition during plucking season, fractures and cuts at workplace, insect bites, snake bites & animal bites (referral given to Digboi civil or Tinsukia civil or Dibrugarh medical hospital).	1 case of brain tumour, Malaria case (last known case 2 years prior to the survey period), Dengue case (last known case 5 years prior to the survey period), 9 cases of Covid reported
TG004	Headache, dysentery, gastric, vomiting, cold & fever, epilepsy, hypertension, scabies (skin disease).	
TG005	Body Pain, Gastric, scabies (skin disease), warm infection, cough and cold, dysentery, vomiting, cut injury (mostly reported), hypertension, diabetes, hypotension, anaemia, epilepsy (presently 2 persons), TB (2 active cases), under nutrition and weakness, Snake bites (referral given), dog bites (treatment done in TE hospital).	Covid cases 70 positive cases in the last one year

TG006	Seasonal viral fever, Vomiting, diarrhoea, Hypertension, Hypotension, Epilepsy, TB, Asthma, Ascites (liver disease), urinary infection, sank bite (referral given), animal bite, Anaemia (especially women), Abdomen pain (worms, food poisoning, gastric, dysentery, piles, liver cirrhosis, kidney stone, gall bladder).	Covid Cases- 8 cases reported during last one year during the time of survey
TG007	Adults- Hypertension (common symptoms are vomiting, head spinning and uneasiness); Body pain; Back pain; Seasonal- Diarrheal, Vomiting, fever, Jaundice); Skin diseases; Deafness; Epilepsy, TB, Arthritis, Anaemia, Vitamin A deficiency (night blindness), Stomach pain Complains (mainly due to gastric, menstrual problem, gallbladder stone, liver enlarge (mainly due to excessive alcohol consumption), Stroke, Burn injury and minor accidents, Snake bites (referral given to Tinsukia civil hospital), animal bites; Children- underweight.	Covid cases during covid outbreak; Leprosy case was detected in the TE (2 years prior to the survey)
TG008	Children- Asthma, cough & cold, diarrhoea, skin disease; Adult Male- Injury (fracture & cuts), epilepsy, Hypertension, Cough & Cold, TB, Skin diseases, Cancer, Liver cirrhosis, Diabetes, Stroke; Adult Female- Anaemia, liver cirrhosis, gynaecological related diseases such as abnormal bleeding during menstruation, Underweight during pregnancy, Histeria, diabetes, Stroke.	Covid cases (2021)- 23 covid cases were reported in the TE, out of which 2 covid patients died (15-year-old Male patient and 35-year-old male patient); Leprosy cases- (2021) last 2 cases of Leprosy in the TE; Filaria -(2019) one filaria case; TB cases- During the time of survey there were 12 active TB patient; Cancer cases - During the time of survey 2 cancer patient were there, both male workers.
TG009	Cough, fever, cold, asthma, TB, snake bites, dog bites, hypertension, hypotension.	
TG010	Fever, Cough, Cold and injury.	

Source: Primary data collected in Tinsukia District, February-March 2022

7.3 Nutrition linkage and reporting of disease-specific morbidity

7.3.1 Type of diseases reported for dietary habits of the workers

The interviews besides focusing on the reporting of various diseases among tea plantation workers, also tried to understand some crucial factors such as nutrition intake and dietary habits which affects health. The main responses which came from almost all the health facilitators which affects health of the plantation workers is the practice of *excessive consumption of salt and alcohol among both male and female workers.* This eventually leads to weakness and swelling of the body. The wide spread of reporting of hypertension among the workers is mainly due to excessive salt consumption. This has been also been established trough clinical studies how high salt diet increased blood pressure among tea plantation workers (Borah et al., 2018). The health facilitators reported that, another reason for weakness is lack of nutrition and food. They do not have a proper balance diet in time. There is *lack of minerals and vitamins in their diet*. They *do not eat pulses and vegetables regularly. Less consumption of egg and milk is observed among the workers*.

In terms of nutrition supply, at the household level, only rice is available. The diet of the workers mainly comprises of carbohydrate rich diet. There is less supply and availability of vegetables, pulses, and fruits. There is less consumption of protein in their diet. As identified by the health facilitators, one of the main reasons is low-income levels.

In terms of nutrition security, the respondents pointed out that, from government nutrition security programmers, they receive only rice but they face difficulty in purchasing other food items. Food and nutrition security at the household level is very fragile. There is availability of food in the household only during the first few days after receiving wage (2-3 days). As their income level is low, and inability to save the rest of the days there is lack of

food availability at the household level. Among the workers there is more consumption of carbohydrates and less consumption of pulses and vegetables, as they are heavily dependent on the rice received from PDS.

7.3.2 Nutrition security and low-income levels

PDS has been helpful for workers. According to a GNM in one of the tea estates, the ration given to the workers by the government is beneficial, as during off-season this ration is used by the temporary workers. The temporary workers face difficulty in buying food items during a certain period especially during non-plucking season. Almost, all the health facilitators have associated the lack of nutrition security and dietary diversity at the household level mainly due to low-income levels. One of the respondents reported,

> *Sometimes even there is non-availability of food at the households. The workers mainly eat whatever is available locally as their incomes are low and difficult to purchase all the food items. With a meagre wage which they receive every 15 days, it becomes difficult for them to run the family for 15 days at a stretch, so they do not have daily supply of balanced diet.*

Another respondent responded,

> *Many of the workers do not have proper access to balance diet, some even do not have daily access to food. This is mainly seen in the households if the family members working are temporary workers none of them are permanent worker. The PDS rice provided is sufficient for the smaller family size. But for larger families, where all the members do not have names in the PDS card they face difficulty. They have to buy the rice from the market. Moreover, many people here, do not have PDS card, so they have to purchase the rice from the market. With low income it becomes difficult for many people to purchase basic food items.*

7.3.3 Lack of knowledge and awareness

An additional feature pointed out by the health facilitators is lack of knowledge and awareness among the population. There is lack of awareness among young parents regarding child nutrition. Undernourished children easily catch infectious diseases such as diarrhoea and cold & fever. A particular health facilitator reported,

Due to lack of awareness and being illiterate, the female workers do not know the need of healthy and better nutritious food during the time of pregnancy, so they are generally undernourished. Also, the excessive laborious work of the female workers affects their health.

According to another respondent,

Food is not prepared and consumed in a hygienic way, which ultimately leads to various diseases. For the children most of the time the children remain unattended when parents go to work. They are left on themselves for consumption of food when the parents go to work. Since the mother goes out for work, there is no proper attendant to the child. In this process the child easily catches infectious diseases in the unhygienic condition, which ultimately leads to undernutrition.

Another respondent reported,

The underweight of the child is most of the time late reported due to unawareness of the mother about the child's condition. One more problem is, when the child is identified as underweight and given referral service to Tinsukia civil hospital, they are hesitant to take the child there. Low birth weight is also reported frequently.

A GNM, in one of the tea estates reported,

TB cases are diagnosed, they are cured immediately by giving the correct medicines and keeping the patients in the hospital. But once they are released and go home, they again start drinking (alcohol) and so they are diagnosed again after two months and they have to come for treatment again. Cases of liver cirrhosis due to drinking are also often reported.

Apart from the above discussed factors *use of tobacco*, in the form of (*Ghutka*) has also been widely reported by the health facilitators among the workers, especially male workers, which is the cause of many diseases.

7.4 Morbidity affected by socio-economic factors and socio-cultural beliefs

7.4.1 Young age of the mothers

Some of the socio-economic factors which affects the health status and reporting of diseases by the health facilitators in the tea garden areas affecting women and child health are early marriage and pregnancies. Mother's age at marriage is very low and weak health during

child delivery. At the same time, there is lack of awareness among young parents regarding child nutrition.

7.4.2 Financial barriers and inability to save

Another factor pointed out by almost all the respondents, which affects the overall health and nutrition status and the reporting of diseases on time is, financial barriers and inability to save for the cost of treatment. As reported by one of the respondents,

> *They usually do not save as their income is low and, they waste parts of their income on alcohol consumption. The workers and even their children are not able to avail education even if they want due to lack of income and at the same time, they are also unaware.*

The respondents identified illiteracy among the workers as another barrier. One of the GNMs responded,

> *Lack of strategic and targeted health education at the household level is seen, there is less use of contraceptives, and this leads to unwanted pregnancy and large family size which eventually led to inability to save, lack of food security and good care of the children. Those who are not educated at all are inclined to all kinds of unhealthy and unhygienic habits.*

It was reported that, the *inability to save* is *mainly seen* among the *temporary workers* mainly during off season, i.e., the non-plucking season. But in recent times with various initiatives and awareness many people have opened bank accounts and they have started to save.

7.4.3 Unawareness about the diseases

Unawareness about the diseases and general awareness among the workers, is one of the reasons of delay in reporting of the diseases for medical treatment. As pointed out by one of the respondents,

> *There is late reporting of morbidities by the workers especially due to lack of awareness. They only come when the disease is severe. Even the reporting and registration of the pregnancy is late.*

Another respondent reported,

> *Reporting of morbidity among the workers are delayed mainly due to lack of income and awareness about the diseases. One of the main reasons is their inability to save, especially for treatment of diseases. At the same time, they are unaware of the diseases and do not report on time, and ultimately, they come for medical treatment only when it becomes sever, which sometime also leads to death of the patient.*

7.4.4 Compromised sanitation and hygiene

Lack of proper sanitation, drinking water and hygienic living conditions in the line quarters affects the health status of the workers. The respondents reported that, hygiene and sanitation is compromised in the line quarters. There is less provision of latrine in the line quarters, only the permanent workers get latrine provided by the company. Some workers only got government latrine; others have no facility. Most of the households have shared latrine. Regarding drinking water, one of the ASHA workers reported,

> *In terms of safe drinking water among the workers, it is seen there is lack of use of filter among the worker households, but they usually boil the water and drink. Since in the households they use tube well water there is excessive iron contain in the water.*

Another ASHA worker reported,

> *In terms of safe drinking water, most of the people rely on tube well for drinking water. Some of the people are aware about the using water filter and boiling the water for the purpose of drinking, but some people are not aware of this and they directly drink the water without filtering or boing it.*

7.4.5 Cultural and superstitious beliefs

One of the frequently faced hurdle by the health workers in the tea garden areas, for smooth and timely treatment of patients is the cultural and superstitious beliefs among the members of the community. They mainly rely on traditional healers, quacks, traditional medicines, and

home remedies. This leads to late reporting of the diseases and delay in treatment. As responded by one of the ASHA workers

> *They initially rely on traditional herbs and only when their condition deteriorates, they approach medical treatment. They also have more preference for traditional healers. They have superstitious belief. They usually go for these practices mainly due to their belief in it and due to lack of money for proper medical treatment*.

Another ASHA worker identified few of the diseases for which the people initially prefer to go to traditional healers, as reported,

> *In terms of cultural beliefs among the workers affecting reporting of morbidity, it is seen there is excessive trust on traditional healers or traditional medicines locally called "jangwali dawai" especially for diarrhoea, snake bites, dog bites, jaundice, injuries (especially if there is a fracture). They initially go for these practices but when they do not recover, they then come for medical treatment.*

There is not only late reporting but also due to these beliefs, the health facilitators face hurdles in timely delivery of treatment.

One of the GNMs reported,

> *They believe a lot in superstitious treatment of the patients. When the history of the patients is taken, we come to know initially they go for traditional healers for treatment, but when not cured they eventually come to the hospital. Superstitious beliefs and less rate of literacy amongst the workers creates problem. They usually insist the hospital staff to let the patient take to traditional healers and sometimes forcefully take the patients from the hospital to the traditional healers.*

Similarly for TB treatment and diagnosis, another GNM reported,

> *In most of the cases they initially so to these traditional healers or quacks and after that when they are not cured, they come for medical treatment. In most of the cases what happens, initially by seeing the symptoms they think it is pneumonia, and when they do not get better, they think it is jaundice. For both the cases they initially go to the traditional healers or these quacks, but when they are not cured finally, they come to the hospital to seek treatment. At the hospital when proper diagnosis takes place it is diagnosed as TB.*

7.5 Healthcare facilities within the tea plantations

7.5.1 Healthcare facilities in PPP mode within the tea estate

Table 7.3 summarizes overall health care facilities in the sample tea gardens. It is seen that basic primary health care facility is provided in the tea garden hospitals within the tea estates. Apart from this especially the tea garden hospitals in Public Private Partnership (PPP) mode with National Health Mission (NHM) have better health care facilities than the stand-alone tea estates hospitals.

7.5.2 In-patient and out-patient facility and health workforce within the tea estate

Table 7.4 shows the findings of detail health care facility at the tea estates. Some of the facilities have inpatient facilities which also carry out normal child delivery cases. They also reported for inpatient facility with beds in some of the cases. However, from the field experience, when visiting theses healthcare centres, except a few cases the conditions of the beds in these healthcare facilities were not in good conditions. Most the tea hospitals have at least one ambulance to cater to the needs of the population living within the tea estate. It was reported that these ambulances are also used for referral service given from the tea garden hospital to the government health centre.

Table 7.5 describes the health workforce available in the sample tea garden hospital. It is observed that the presence of full-time doctor is sparse in the tea garden hospitals. It is mainly the ANM, GNM, Pharmacist and Health assistant who are full time staff at the tea garden hospitals.

7.5.3 Healthcare facilities for permanent workers and temporary workers

Free medical facilities are mainly provided for the permanent workers working in the tea gardens by the tea garden authority and timely reimbursement in done for referral services.

The permanent workers are entitled to free ambulance service; free medicines; reimbursement for referral services outside the tea garden facility. The temporary workers generally get free treatment only during the working season when they are working in the garden. When not working they get free medicines under NHM. They receive reimbursement for referral service only when they are working. They do not receive any reimbursement for referral service when they are not working. But as reported by the respondents, those tea garden hospitals in PPP mode provide free treatment even to temporary tea plantation workers. The details are summarized in table 7.6.

7.5.4 Usefulness of MMU services in the tea plantation areas

Table 7.7 Mobile Medical Unit (MMU) service in selected tea estates of Tinsukia district of Assam. The findings shows that it plays an important role in these interior tea garden areas, especially providing basic free laboratory testing facilities. This saves both time as well as wage days lost by the workers for going for testing facilities to the nearest health care facilities.

In terms of health facilities available and access to health care there is room for further improvement in the plantation areas. During the field survey it was observed that, the health facilities functioning in PPP mode within the tea estate were better performing than stand-alone health facilities under tea company, with a few exceptional cases. The MMU service plays a vital role in the remote tea garden areas. As reported during in-depth interview, post covid times awareness among the people of the community has increased about diseases, hygiene in terms of hand washing after constant awareness programmers and home visits in the line quarters with joint effort of the company management, government, and civil society. The younger generation is being educated and the overall awareness has increased within the community in recent times.

Table 7.3: Overall, Health Care Facilities at the sample Tea Gardens

Name of the TE	Healthcare facilities available in the TE provided by Tea Garden Authority	Any Government Health Care Facility within the TE	If present, what are they?	PPP mode TE Hospital
TG001	Vehicle facility; Weight Machine; Outpatient Health check-up; TB treatment; Normal child delivery, otherwise referred to civil hospital; Referral of C-section delivery to district civil hospital or Medical College hospital in Dibrugarh	Yes	Government Sub-Centre	
TG002	Medicines provided, Ambulance, outpatient care, inpatient care, maternity ward, TB ward, food for inpatient, referral service, normal child delivery	No		The TE Hospital is in PPP mode with NHM (national Health Mission). The PPP mode hospital gets funds from NHM for medicine supply, ambulance fuel, repair of hospital building. Also funds for incentive for the health personal at TE hospital is sent from NHM, but their basic pay is given by the TE Company. The TE Company also provides funds for basic equipment, medicine supply, bedsheets etc. The food provided to inpatients at the hospital is provided by the company. Also since it is a big TE there is one more health centre under the TE company which is TE dispensary
TG003	The TE health facility is only a dispensary not a hospital, no inpatient care only outpatient. Medicines, dressing, saline and injection given.	No	But just adjacent to the TE is the government mini PHC. The PHC has 1 doctor, 3 GNM, 1 ANM, Lab Technician, 2 ward girls and 1 midwife	
TG004	First-aid given for cuts and injuries, Initial preliminary health check-ups, No BP machine (so BP cannot be checked), Dysentery treatment (saline facility available), Most of the cases are given referral to Tinsukia Civil hospital or Nearby Government Model hospital	Yes	1 government SC inside the TE and the Government Model Hospital is adjacent to the TE	
TG005	Both OPD and inpatient available, Vaccination done	No		The TE Hospital is in PPP mode with government under NHM
TG006	OPD general health check-ups, Inpatient, Normal child delivery, Different wards for patients, Anti natal check-ups, Saline given	No		

TG007	First aid (cut injury and stitching done), Emergency medicines are available, Equipment available- Oxygen Cylinder, BP instrument, Oximeter, Thermometer, Baby warmer, Suction machine; Normal Delivery done, prolonged labour cases and critical cases referred to Tinsukia Civil Hospital and Dibrugarh medical hospital; Test Done- Pregnancy test, Sugar test, Haemoglobin test.	No	Nearest is the Model Hospital that is 8km from the TE, but people prefer going to Tinsukia Civil hospital as the TE is not far from the town	
TG008	General OPD, Inpatient, Routine Blood Test	No		Since it is a big TE, it has two healthcare facility. Both are under the TE company and the TE hospital is under PPP mode with NHM. One is the TE hospital and other is TE dispensary (with 1 ANM and 1 Pharmacist)
TG009	Basic Health Check-ups, Distribution of medicines, Referral services, Inpatient and Outpatient facility	No	But the Government SC (Tipuk SC) is just outside the main gate of the TE	
TG010	Only TE dispensary	Yes	Government Dispensary	

Source: Primary data collected in Tinsukia District, February-March 2022

Table 7.4: Detailed Health Care Facilities inside the Tea Gardens as Reported by the Health Workers

Name of TE	Inpatient	Outpatient	X-Ray	Testing Facility	Hospital Beds	Emergency Wards	Ambulance	Institutional Delivery	Any other Facility
TG001	10 bedded hospital, Inpatient facility for TB patients, Covid, Diarrhoea, Normal Child Delivery	General outpatient health check-up, BP check, covid test, TB treatment, Sugar test	NA	Yes (Sugar test and Covid Test)	Yes (10 beds)	NA	Yes (1 ambulance)	Only emergency cases (otherwise referral given)	Food provided for inpatient patients admitted in the hospital
TG002	Normal child delivery cases, TB ward (DOTS medicines given), maternity ward, labour room, food given to inpatients admitted,	BP check, general health check-up, per post and anti-natal check-ups	NA	NA	Yes (20 functional beds)	NA	Yes (2 ambulance)	Yes	Food provided for inpatient patients admitted in the hospital
TG003	No facility	General routine health check-up, Weight check, per natal and anti-natal check-ups,	NA	NA	Yes (6 functional beds available, but not for inpatient, only for services like giving saline or dressing	NA	Yes (1 ambulance)	No	Rented vehicle given to patients during any emergency conditions
TG004	No facility	Only basic general health check-up and measuring weight	NA	NA	NA	NA	Yes (1 ambulance)	NA	NA
TG005	Delivery cases, baby care, TB separate ward, Diarrhoea ward, maternity ward, labour room, food given to inpatient	First aid, Regular Health check-ups, BP check, Pregnancy test, Sugar test, Malaria Test, Covid Test, Pre-natal and post-natal check-ups.	NA	Yes (pregnancy test, Sugar test, Malaria test, Covid test)	Yes (18 functional beds)	NA	Yes (2 ambulance, one company another government)	Yes	3 times food provided to inpatient
TG006	Normal Child Delivery cases done but for C-section referral given; Diarrhoea treatment; fever; TB treatment, initially 6-7 days kept in the hospital and after that they are released from hospital but the treatment continues under DOTs; fracture treatment; Separate Male	General health Check-ups and Anti natal check-ups (Everyday OPD timing 7-11 AM and 2-4 PM)	NA	Yes (pregnancy test, HIV test for pregnant women)	Yes (30 functional beds)	NA	Yes (1ambulance, hired vehicle used as ambulance)	Yes	Food provided for inpatient patients admitted in the hospital

	ward and Female ward, TB ward, Diarrhoea Ward.								
TG007	Isolation ward, Currently TB ward is not functional, Separate Male and Female wards; Maternity Ward & Labor room; Food provided for inpatient.	General health Check-up; BP, Weight and temperature check; Anti natal and post-natal check-ups; Sugar test	NA	Yes (Haemoglobin test, pregnancy test and Sugar test)	Yes (18 functional beds)	NA	Yes (1ambulance)	Yes	Food provided for inpatient patients admitted in the hospital; Reimbursement and Vaccination
TG008	Separate Male and Female Ward; Isolation ward for TB and Diarrhoea; Emergency Room; Maternity and Labor Room; Antenatal Ward; Treatment for Snake and Animal bites; Treatment for cut injuries (dressing done).	General health check-ups, BP check, temperature, weight; Test- Haemoglobin test, blood sugar test	NA	Yes (Routine Blood test, Haemoglobin test, RBC, Urine test)	Yes (30 functional beds)	Yes (1 ward)	Yes (2 ambulance)	Yes	Food for inpatient
TG009	Inpatient facility is available with isolation ward for TB and diarrhoea; Separate male and female wards, maternity ward, saline facility available and give in the hospital, food provided to inpatients.	General health check-ups, Weight check, Per &Post-natal check-ups and Antenatal check-ups, Medicine distribution	NA	NA	Yes (20 functional beds)	NA	Yes (2 ambulance)	NA	
TG010	No facility	General health check-ups and referral service	NA	NA	Yes (2 for emergency purpose)	NA	NA	NA	Na

Source: Primary data collected in Tinsukia District, February-March 2022

Table 7.5: Health Workforce at the sample Tea Gardens

Name of the TE	ASHA	AWW	Doctor	Nurse (Nursing Attendant)	ANM	GNM	Pharmacist	Health Assistant	Midwife (Traditional/Skilled Midwife)	Compounder	Other Staff
TG001	5	4	1	NA	1	1	NA	NA	1	NA	1
TG002	12	7	NA	NA	2	2	2	2	4	NA	2 Ward Girl, 3 Ward Boy, 2 cook
TG003	1	1	NA	NA	1	NA	1	1	1	NA	
TG004	1	1	NA	NA	1	NA	NA	NA	NA	NA	
TG005	1	1	1 (visiting doctor, twice a week)	2	NA	1	1	1	1 (Temporary)	NA	Cook, Night watchman and Ambulance driver
TG006	4	2	1	8	NA	2	1	1	1	NA	Cook-2, Ward boy-1, DOTs provider-1, watchman-1
TG007	3	4	1 (Visiting doctor, 6 days a week)	2	NA	1	1	1	1	1	NA
TG008	6	4	1	NA	1	2	2	1	1	NA	Lab Technician
TG009	5	7	NA	NA	2	NA	1	1	2	NA	Ambulance driver, Attendant
TG010	NA	NA	1 (Visiting doctor, 2 days a week)	NA	NA	NA	NA	NA	NA	NA	NA

Source: Primary data collected in Tinsukia District, February-March 2022

Table 7.6: Medical Facilities provided by Tea Garden Authority

Name of the TE	Permanent Worker	Temporary Worker
TG001	Free medical facility only for the worker and not for other family members; free ambulance service; free medicines; reimbursement for referral services outside the tea garden facility, but latter a part of it is deducted from their salary.	Free ambulance service and Free medicines
TG002	All treatments received	Gets free treatment under TE only when working. When not working they get free medicines under NHM. They receive reimbursement for referral service only when they are working. They do not receive any reimbursement for referral service when they are not working.
TG003	Free medicine and treatment given, also reimbursement done for referral services	Free medicine and treatment given; reimbursement given only during working period
TG004	Free medicine given and reimbursement given	Only free medicine given
TG005	Free treatment and also reimbursement given for referral services	Free treatment given since the hospital comes under PP mode under NHM. No reimbursement given for referral services except for injuries while working in garden/factory.
TG006	Free treatment and also reimbursement given for referral services	Free treatment only during working period. Only TE hospital treatment given
TG007	All facilities given in the TE hospital; reimbursement of referral service is also given by TE company; treatment for the dependent family members of the permanent workers is given.	Only the worker is given treatment in the TE hospital, no reimbursement for referral service
TG008	Free treatment and also reimbursement given for referral services for treatment done outside TE hospital	Free Treatment only for the worker only during time of work
TG009	Free health care facility available for the worker as well as for his or her immediate dependent family members.	Free health facility available only for the temporary worker but his or her family members
TG010	Referral service to government hospital	No temporary worker, as workers work throughout the year

Source: Primary data collected in Tinsukia District, February-March 2022

Table 7.7: Mobile Medical Unit (MMU) Service in selected Tea Estates of Tinsukia District of Assam

Sl No.	*Name of the Tea Estate and Respondent*	*Regularity, availability, and timing of the service*	*Nature of services provided and Workforce in the MMU*	*Coordination of MMU staff with health workers in tea garden area*	*Benefit and people's opinion about the MMU service*
1.	TG006	MMU service started in their tea garden only recently. It started in early 2022. The MMU generally come for 3 days in a month in their tea garden. They usually come on 17th, 18th and 19th of every month. They come continuously for three days and the mobile unit stays from 10 AM to 2 PM. During their visit they station their vehicle and set up the camp, usually for one day near the tea garden dispensary and next two days they station themselves in open space near the line quarters of the workers.	According to the ASHA worker, the main services provided by the MMU in their garden are: Maternal and child health checkups, especial antenatal checkups; laboratory facility of testing of hemoglobin test, especially for pregnant women; blood sugar test; albumin blood test; HIV test; urine test; General health checkup for all people; distribution of free medicines to the patients, especially distribution of iron and folic acid tablets to anemic patients; weight check. The MMU consist of two vehicle, one car and one MMU van. The staff that accompanies the MMU are: 1 doctor, 1 pharmacist, 1 laboratory technician, 3 ANMs.	As reported by the ASHA worker, the coordination between the MMU staff and the health staff in the tea garden takes place though phone calls and WhatsApp messages. The staff of the MMU directly contact them. She reported that the doctor of the MMU text message her 3 or 4 days prior to the camp so that she can inform the people. Once she receives the message, she herself goes in the line quarters and inform the people. The coordination between the MMU and health center at the tea garden takes place over phone calls usually. They also propagate the message of MMU to the people in regular meetings held on VHSND day. To keep a coordination about the health care needs of the people in their tea garden, they have regular meeting at their tea garden health center: the people who attend this meeting are the teachers, line quarter watchman, ASHA, ANM, AWW, other health staff of the tea garden dispensary.	The service provided by the MMU has been very helpful for the people in the tea garden. Especially for the pregnant women, since the laboratory facility is also available without going anywhere, this helps them to keep a track of the hemoglobin level of the pregnant women as most of the women are anemic. They also receive free iron tables from the MMU. The people say they have benefited from the MMU service as without going outside the tea garden they can have free general health checkups, laboratory test and medicines. The service is generally availed by women and old people but apart from this, men also come for general health checkup. The people find the service helpful as the services are available nearby and can come walking.

2.	TG001	The ASHA worker informed that the MMU comes regularly in their tea garden. It came last in the month of October. It comes during the morning hours. It usually stays from 10 AM to 2 PM. It comes for 2-3 days in a month in their tea garden. On different days during their visit, they are stationed in open space near different line quarters so that the people residing in the tea garden can easily access the service.	The services delivered by the MMU are the antenatal checkups, general health checkups of children, other adults and old people (usually blood pressure checkups) and blood and urine test. The ASHA reported that, it is good that the MMU consist of doctor and laboratory testing facilities.	The MMU staff usually contact the pharmacist in the tea garden hospital one or days prior to their visit. Then the pharmacist calls the ASHA and informs the date and time of visit of the MMU in their line quarters. She then informs the people. Sometimes the MMU staff directly call her to inform about their visit. Since the MMU is stationed near the line quarters people can easily avail the services and they usually come walking to the facility.	The ASHA worker reported that all the people of the tea garden avail its services. Apart from the pregnant women, all other people avail the general health checkup and laboratory test facility. They find this service beneficial as they can avail the services without travelling outside the tea garden since their tea garden id remotely located. People do not have to spend on transportation to go and do health checkup outside the tea garden.
3.	TG008	The MMU service in the tea garden is not very regular. It came last in the month of September 2022. When the MMU comes it usually comes for 2 days. They usually station for one day near the tea garden hospital and other day go near the far away line quarter. They usually station in a nearby open field near the line quarters as reported by the GNM. She also said that some of the line quarters are near the tea garden hospital, so when the MMU is stationed there the people from the nearby line quarters comes walking. Some also come by their own motor bikes or scotty or cycle.	The MMU generally provide the laboratory test service, antenatal checkups and general health checkups. All the routine blood test such as hemoglobin test, blood sugar test, albumin blood test, HIV test are done. It very helpful for the people. The MMU consist of 1 doctor, 1 pharmacist, 2 GNM and 1 ANM.	Before coming for the camp, they contact the ASHA worker and she spreads the news of the MMU visit. It usually comes within 10 AM.	The GNM reported that all the people of the garden are interested in the service by the MMU. They have welcome the delivery of the services by the MMU in the tea garden areas.
4.	TG005	The pharmacist at the tea garden hospital reported that very recently the MMU service in their tea garden has closed. He reported that officially no order has come. He was only informed by the MMU staff over phone that their garden name has been removed from the MMU service list.	On enquiry about how the service was doing prior to that, the pharmacist reported that they usually come for 2-3 days in the tea garden in a month. The timings of their visit are usually from 10 AM to 3 PM and sometimes 12 noon to 5 PM. The pharmacist reported for the last three years the MMU service was doing well in their area. When the MMU came it usually stationed near the tea garden	The pharmacist reported that the MMU staff directly messaged him about their visit one or two days prior to the camp. He then tells the line watchman about the MMU visit and then the line quarter watchman informs the people. Also the health staff at the tea garden hospital informs the patients coming to the tea garden hospital about the MMU visit.	The services that were provide by the MMU were antenatal checkups, routine blood test, normal health checkups. The pharmacist reported that the MMU service was very helpful especially for antenatal checkups. The pharmacist reported that MMU service was helpful for them as they could tell the patients to come can visit the MMU and get their health checkup done by doctor, as doctor is part of the MMU staff. The services were good and free of cost. The laboratory service was very helpful.

			hospital, as the tea garden is not that big and have limited population and the line quarters are near the tea garden hospital. People of the garden came waking from their nearly line quarters.		
5	TG003	The ASHA worker reported that the MMU comes to their garden regularly every month. They usually come for 3 days in a month. The MMU service has been functioning in their garden for the last three years. The timing of the MMU is from 11 AM to 2 PM. The ASHA worker said that, since they come from far and to come to their tea garden, they have to cross the jungle they sometimes reach late. As the tea garden is remotely located and the roads are not good there is delay in time in reaching. Even during monsoon when the weather is bad and the road is not in good condition there is delay in time of the MMU reaching the tea garden. The MMU is stationed for one day at the tea garden dispensary and rest two days they are stationed near the line quarters in open space near the school or the church. As the MMU is stationed in places where it is accessible to the people, the people usually come walking to the MMU.	The main services provided by the MMU are the general health checkups, routine blood test (mostly hemoglobin test, hepatitis, blood sugar test, albumin blood test, HIV test) and antenatal checkup and children health checkups. The MMU consist of 1 doctor, 1 pharmacist, 1 laboratory technician and 2 GNMs.	The ASHA worker reported that, prior to coming at the tea garden, the staff of the MMU informs the pharmacist of the tea garden dispensary. The pharmacist informs the ASHA and the ANM of the tea garden. The ANM informs the line watchman of the quarters and he spreads the message among the people in the line quarters. In some areas the ASHA herself informs the people in the line quarters. The ASHA said that during worktime she goes to the *sardar* (supervisor) of the workers and informs him to tell the workers to come for health checkup during the break time.	The people have welcomed the services of the MMU, especially because of free treatment, free medicine and free laboratory service. The ASHA worker reported that, the MMU service is very helpful in their tea garden as their tea garden is very remotely located. Before even to do simple test and health checkup by doctor they had to travel long distance. The services of the MMU are availed by all section of population in the tea garden.
6	TG009	The pharmacist reported that the MMU service started in their tea garden only recently. For the last 2-3 months the services are regular in their tea garden. Before that, the MMU came to the villages outside the tea garden. He reported that last month the MMU came for 3 days. The timing of the MMU is from 9 AM to 2 PM. The MMU is stationed	The services given by the MMU in their tea garden are antenatal checkups, normal health checkups and laboratory service of hemoglobin test, blood sugar test, RBS test, HIV test, ECG and urine test.	The MMU staff directly contact the pharmacist over phone, one or two days prior to their visit. He then informs the ASHA and the line quarter watchman, who spreads the message among the people.	According to the pharmacist, people have benefited from the MMU service. They have benefited as they receive free treatment, free medicine and laboratory service. People of all age both male and female come to avail the service of the MMU.

		for one day at the tea garden dispensary and rest two days near the line quarters. Since the MMU is stationed near the line quarters the people come walking to the MMU.			
7.	TG007	The GNM at the tea garden hospital reported that the MMU service started in their tea garden in July 2017. The last MMU visit to the garden was in October 2022. The GNM do not know the reason why it has not visited in the recent month. She reported that during covid times the MMU service was disrupted, but it was resumed again. The MMU comes for 3 days in a month. The timing of their visit is from 10 AM to 1 PM. The MMU is stationed at the tea garden hospital for one day and two days near the line quarters. The people usually come walking to the MMU as it is stationed nearby within the tea garden.	The GNM said that, the MMU staff consist of 1 doctor, 1 pharmacist, 2 ANMs, 1 laboratory technician, 2 drivers as two vehicles come.	The MMU staff usually directly contacts the ASHA worker through phone one or two days prior to their visit. The ASHA worker spreads the news to the people. She also informs the line quarter watchman about the MMU visit, who also spreads the news among the people.	The GNM reported that, the main services provided by the MMU are, antenatal checkups, routine blood test and urine test, general health checkups and free medicine distribution. The service of the MMU is availed by all section of people of the tea garden. Both male and female avail the service. The GNM reported that the MMU service is useful and helpful for the people. But the MMU visits during the working hours so sometimes it is difficult for the people to avail the service. She also reported that the tea garden hospital also has a visiting doctor on regular basis, so the people avail that service mainly.
8	TG002	The ASHA worker reported that the MMU service in their tea garden has been discontinued since September 2022. The last time the MMU visited their garden was in August 2022. When the ASHA worker called the MMU staff and asked why they are not visiting their tea garden, the MMU staff told that since full time doctor was appointed in the tea garden hospital after August 2022, they were no longer visiting their garden.			She mentioned that, the MMU service was very helpful to them, especially because they could do the test at within their garden without going outside. Now they have to take the patients to the nearest FRU (which is around 5 km from the rea garden). Since it is government facility and people from many nearby places come to the FRU there are long waiting periods. Sometimes even after waiting they cannot do the test, therefore they have to again go for the test next day. The MMU was helpful especially for the pregnant women. She also mentioned that they also have the central medical unit under a bigger tea estate, where certain tests are done, but it is limited. So, they have to go for those tests to the nearest FRU. She mentioned especially the HIV test of the pregnant they have to go to the nearest FRU. It sometimes become difficult to take the pregnant women their and wait.

Source: Primary data collected through telephonic interview for Tinsukia District, November, 2022

7.6 Healthcare Constraints

The basic health care constrains faced in the tea estates hospitals as pointed out by the heath facilitators are: there is lack of full-time doctors and basic modern equipment in the tea estate hospital. Apart from this another constrains faced by the people residing within the tea estates is unavailability of vehicle when referral is given for further treatment from the tea garden hospital to the bigger government health centre. The tea estates are generally remotely located and therefore during time of emergency it becomes very difficult for taking the patients to the nearest healthcare facility outside the tea estate. There is lack of ambulance service in these areas. Usually there is only one ambulance per tea estates. But these tea estates cover a large population. Therefore, a single ambulance is not sufficient to cater to the needs of a large population. As reported by some of the health facilitators, due to lack of ambulance some of the child deliveries are done at home in emergency cases. Usually there is no provision for vehicle for temporary workers to go to the hospital, only sometimes ambulance provided in emergency. Since testing facility not available, so some of the disease investigation not done in the tea estates hospitals. Even some of the simple test cannot be carried out due to absence of facility or even when the equipment are out of order and not functioning. At this point the health facilitators pointed out the need and usefulness of MMU in the remote tea estates and free testing is available under MMU and the people of the tea estates need not travel long distance for simple test which in turn save the workers time and money. The detail findings have been summarized in table 7.8.

Table 7.8: Constrains and Challenges in Health Care facilities in Tea Garden Areas

Name of TE	Health Facility
TG001	i)Since only one ambulance in a big TE, it is not sufficient to cater the needs of all the population in the tea garden. ii) No maternity leave or benefit for temporary workers iii) No provision for vehicle for temporary workers to go to the hospital, only sometimes ambulance provided in emergency iv) Due to lack of ambulance some of the child deliveries are done at home in emergency cases
TG003	i)Since mini PHC is situated just adjacent to the TE, people of the TE most of the time go directly there ii) Covid vaccination was going on during the time of the survey at the TE dispensary. Most of the people were vaccinated after door-to-door awareness was carried out. iii)Normal Delivery cases are mainly done in the adjacent mini PHC or else they are given referral to Digboi, Tinsukia or Margherita Civil hospital iv) The routine immunization is done in the adjacent mini PHC v) There is no testing facility available in the TE dispensary
TG004	i) The TE health centre is only a small dispensary. It does not even have the basic facilities. Only one temporary staff ii) Since the government SC and Model Hospital are within and adjacent to the TE, people in the TE are more dependent on it than the TE dispensary. iii) The TE dispensary is not in PPP mode with NHM, the basic medicines at the dispensary are provide by the tea garden company
TG006	i) The TE hospital is an independent hospital and not in PPP mode with government ii) Since some of the testing facility not available, so some of the disease investigation not done iii) Need to improve and repair the TE hospital iv) Every alternate month NHM medicine supply comes to the hospital and every month the company also supplies medicines.
TG007	i) The quality of food provided to the inpatient can be improved ii) Since no doctor full time, sometimes have to face problem. iii) Recently there has been change in company of the TE, therefore there is delay in supply and shortage of some healthcare facility iv) Repairing of ten TE hospital required v) Recently some facilities were improved in the TE hospital under NHM vi) Frequent change in the TE management create problem and delay in supply of healthcare facilities.
TG008	i) Since the TE hospital is in PPP mode with NHM, apart from people of the TE, patients from nearby villages also come to the hospital for treatment.

Source: Primary data collected in Tinsukia District, February-March 2022

Chapter 8 Summary and Conclusion

This thesis held an inquiry into the state of population health of Assam based on the understanding that health is intrinsically related to economic growth and development. We relied on official statistics collected by the National Sample Survey Organization & primary data on tea plantation workers collected by us as part of a larger project on "A Survey of Morbidity & Mortality among Tea Garden Workers of Assam," funded by the Directorate of Economics & Statistics, Government of Assam. Population health plays a critical role in the overall economic growth and development. Within a conceptual framework of understanding social determinants of health, we studied the status of morbidity of population of Assam.

8.1 Health in terms of social determinants of health framework

We mainly focused on structural determinants under which we focused on gender, education, occupation, and income which contributes to the lager health and wellbeing of an individual. Secondly, we focused on the intermediary determinants focusing mainly on the material circumstances (living and working conditions, food availability), and anthropometric factors which affects health through our primary data findings. The findings show socio-economic characteristics and material conditions of living have a huge bearing on the state of population health. Findings from the primary survey shows, apart from living and working conditions, food availability, behavioural and biological factors affect health status of the plantation workers.

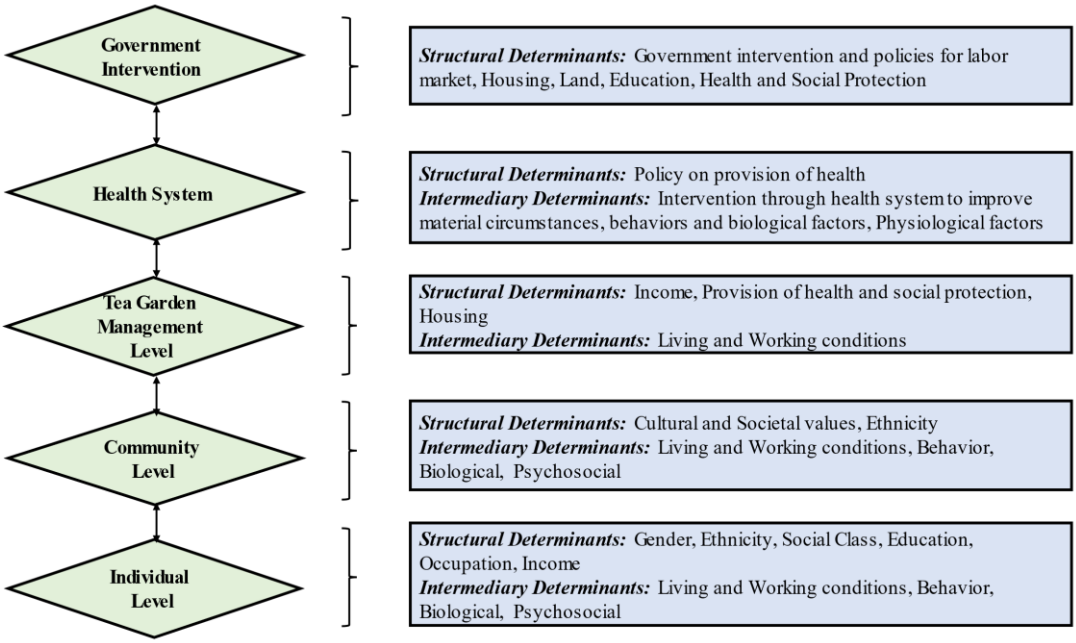
The following flow chart (see figure 8-1) shows how the social determinants and intermediary determinants of the conceptual framework interact at various level in the sample population of the primary study. At the individual level, we see gender (greater percentage of females having lower BMI and affected by anemia as reported by the health facilitators), their low income, occupational status, and low level of education has affected their morbidity status

as well as their diseases profile. The intermediary factors, such as, low living conditions; lack of hygiene & sanitation; workplace hazards; and behavioural & biological conditions such as lack of nutrition and excessive consumption of salt, tobacco & alcohol; and genetic factors such as prenatal conditions of maternal malnutrition that contribute to morbid conditions.

At the community level, there is widespread belief and dependence on traditional medicines and superstitious belief. At the tea garden management level, there is need of intervention, in terms of increased daily wage, provision of better social protection for temporary workers and improvement of workplace conditions. The management can also intervene in terms of generating health awareness.

The public health system plays a vital role for the tea plantation workers, as they are solely dependent on health care provision by tea garden authority and government health care facility. The worker population is excessively dependent on the public health system for quality health care at the primary level and handling both communicable, neonatal, and maternal health as well as non-communicable diseases. At the government level, intervention in the form of policy reforms for plantation labour, separate healthcare programmes for plantation workers, provision of subsidized ration other than rice, especially protein rich diet like legumes, egg, dried soya chunks in fair price shops within the tea estate is required. There is a need for awareness generation at the mass level with, effective intervention to eradicate community practice of consumption of excessive salt and salt with tea.

Figure 8-1: Flow Chart Explaining How Structural Determinants and Intermediary Determinants affecting Tea Plantation Workers at various levels



Source: Authors design

8.2 Reporting of morbidity from NSSO Findings

8.2.1 NSSO surveys

In the first essay, we delved into the details of morbidity surveys conducted by the NSSO since the 1950s. We showed methodological advantages of NSSO surveys over the other large sample surveys. We also showed definitional changes incorporated over time that makes earlier studies incomparable with the surveys done in the 2000s. The 2017 self-reported morbidity covers an exhaustive list of diseases based on the International Classification of Diseases of WHO, thereby making it one of the most reliable data sources on disease specific morbidity in India. We also highlight shortcomings of NSSO surveys for not enabling district level representation of the data unless State sample pool is made available timely. For e.g. for our analysis, we considered going further down from the NSS region level to the district level, however, analysis was restricted due to non-availability of State sample data. Some of the advanced states, such as Kerala, makes State sample data available, making it possible to have

morbidity estimates at the district level. In Assam, although the State sample survey seems to have been carried out, availability of results suffers a huge time lag making it impossible to have district level estimates even after release of Central Sample results.

In terms of morbidity prevalence, between 71st and 75th rounds, reporting of morbidity has declined in India and the States. All previous studies based on NSSO rounds (52nd, 60th and 71st) from 1990s till 2014 however, had shown an increase in morbidity prevalence in India.

An important definitional change that occurred between 60th and 71st rounds is with respect to change in persons counted under the disease group disability. Prior to the 71st round, all persons ailing from disabilities not acquired during the reference period of 365 days were also counted as suffering from ailments. However, from the 71st round the earlier practice was discontinued and only those persons who acquired disabilities during the reference period were counted. The above definitional change may contribute to comparability issues of 75th round with the earlier rounds. The 71st round was a thin round and the change in definition may not have hampered its comparability with the earlier rounds. However, this issue needs to be probed further and can be carried out as future research work.

There are regional differences in morbidity reporting. Morbidity reporting is higher especially in the Southern states and Union Territories. Assam is below national average in terms of reporting morbidity. Assam has lower health outcomes in terms of higher maternal mortality and child mortality compared to all India average. Therefore, low reporting of morbidity in Assam is inconsistent and needs further investigation. There is a need for Assam state sample data to be churned out regularly for more robust analysis. Low reporting does not mean there is absence of health issues in these states. The low reporting states have low health outcomes compared to high reporting states. Self-reported or self-perceived morbidity

is in itself a major social phenomenon, which provides critical information of the relevance of the disease to the individual (Murray & Chen, 1992). The regional imbalance of reporting of morbidity in India points to difference in various socio-economic factors such as health awareness, and access to health care services (Sundararaman & Muraleedharan, 2015).

8.2.2 Disease prevalence in India

Hospitalization due to NCDs and Other diseases are relatively higher in almost all the states except northeastern states where hospitalization due to infectious diseases are at par with NCDs. Hospitalization due to Other diseases is the highest in northeastern states. When we include responses on diseases classification by hospitalization and non-hospitalization cases, a mixed scenario of disease prevalence emerges. Majority of States show higher prevalence of Other diseases and Infectious diseases except the southern and northern states. Southern states show dominance of CVDs and NCDs in both 71st and 75th rounds. In terms of disease proportions, northern states reflect coexistence of CVDs and NCDs along with Infectious and Other diseases. The dominance of Other diseases and Infectious diseases highlight that majority of the Indian population is still afflicted by diseases that are caused by low material conditions of living. For disease-specific morbidity reporting too, there is uneven spread.

8.2.3 Hospitalization

The higher prevalence of Other diseases needs to be probed further, so as we can investigate which diseases are being frequently reported under this category. Some of the developed states like Kerala showed even higher prevalence of CVDs in comparison with infectious diseases. Most of the states in India have also reported significant proportion of disability, which clearly indicates, slow but steady change in the demographic characteristics in terms of aging population.

8.2.4 Spell of ailment

Most of the states showed higher reporting of infectious diseases and other diseases both in the 71st and 75th rounds, except for a few of the developed states, like Kerala and Andhra Pradesh that showed higher reporting of CVDs and NCDs in the 75th round. Self-reported morbidity is mainly influenced by accessibility to health care services, various socio-economic variables like poverty, educational level (especially female education) and working conditions. The difference can also arise due to variation in disease profiles across diverse groups of population (Ghosh and Arokiasamy, 2009; Blacker, 1947; Yadav and Arokiasamy, 2014).

8.2.5 Morbidity in Assam

Assam can be characterized as a state that has very low reporting of overall morbidity. Following the all-India pattern, between 71st and 75th rounds, Assam's reporting has also come down. As has been pointed earlier, definitional changes may contribute to such reporting pattern. However, with the present set of questions that we have, we cannot probe this further.

The NSSO 75th round report also shows that Assam's dependence on the public health sector is very high. In other words, people seeking healthcare in government health facilities is higher. Could access, availability of health facilities and health seeking behavior impact reporting of morbidity? We cannot explore this question with the present dataset.

At the region level, the Western Plains region of Assam seems more likely to report morbidity than the rest. We cannot help drawing attention to the fact that most of the aspirational districts (or poor development indicators districts) under the aspirational districts programme of Government of India are also concentrated in the Western Plains region. However, in this thesis we are not establishing the link with development indicators.

8.2.6 Disease prevalence in Assam

An average person in Assam is more likely to fall sick due to infectious diseases or other diseases. An average person in Assam is also more likely to be hospitalized due to infectious disease, other diseases, and NCDs. Similarly, a person residing in the Western Plains region of Assam is more likely to contract all kinds of diseases than in the other regions.

Socio- economic factors affecting morbidity reporting – Assam

We notice uneven spread of morbidity prevalence across demographic variables, socio-economic characteristics, and geographical areas. Age has been an important factor. J-shaped relation exists between reporting of acute ailment, with reporting being higher in the youngest age group and older age groups. On the other hand, reporting of chronic ailment is higher in the older age group. Reporting of ailment is more for females. As for the wealth quintile, reporting of chronic ailment is higher among the higher wealth quintile. There is a significant rural-urban gap in reporting of morbidity in Assam. This variation also spreads across NSS regions, reporting being higher in the Western Plains and Eastern Plains. These variations clearly signify a difference in access and availability of health care facilities within Assam. It may also be due to the healthcare seeking behavior and availability of the health care services. People may not be aware of these diseases, due to lack of awareness and at the same time due to not availing the health care services.

For disease specific morbidity too, age has been an important factor. J-shaped relation exists for reporting of infectious diseases, with reporting being higher in the youngest age group and older age groups. On the other hand, reporting of CVDs, NCDs and disability are higher in the older age group. Females reporting more morbidities, especially NCDs is evident from the fact that recent studies have shown there has been a rise in NCDs among females in India, especially urban females (Agrawal & Arokiasamy, 2010; Ghosh & Arokiasamy, 2009).

Higher prevalence of both communicable diseases (infectious) and non-communicable diseases (CVDs & NCDs) among the richest wealth quintile in 75th round clearly indicate the dual nature of disease prevalence in the population. We also find prevalence of CVDs and NCDs among the lowest education group in 75th round. Overall, for all types of diseases reporting is higher in urban areas except for infectious diseases in 71st round, but higher prevalence of infectious diseases in urban areas in 75th round which needs to be further investigated. For disease-specific morbidity reporting for spell of ailment, reporting has been higher in the Western Plains region whereas for in-patient of medical institutions, reporting is higher in Eastern Plains for CVDs, NCDs, disability and others. Therefore, we can say that there is prevalence of both communicable and non-communicable diseases in Assam.

8.3 Summary of Morbidity Status of Tea Plantation Workers

From the primary data findings, we see there has been reporting of both acute and chronic morbidity. We find that disability related diseases are quite high among tea garden worker population. Seeking treatment for disability related diseases are also high as it is directly related to their work productivity. There are mainly two reasons for better reporting. Availability of health care facility within the tea garden. The permanent workers are entitled to free health care facility at the tea garden owned healthcare facilities. For temporary workers this facility is only available for the worker only during the plucking season when she/he is working in the tea garden.

Other diseases and disability form a sizeable proportion of disease prevalence among plantation workers. Disability related diseases among plantation workers are mostly occupation related. The proportion of infectious disease among plantation workers is sizeable in case of acute ailments. Under chronic ailments, sizeable proportion reporting NCDs and CVDs.

8.3.1 Reporting of morbidity and health status

NSS unit level data shows, Assam has always shown low reporting of morbidity. Although urban areas have shown relatively higher level of reporting. However, the results of the primary survey of self-reported morbidity of tea plantation workers shows high level of self-reported morbidity. Age, gender, sanitation, better access to food groups like pulses, egg/fish/meat and hygienic source of water have significant effect on reporting of morbidity. Reporting is better for those having better facilities of sanitation and water among the plantation workers.

However, when the overall demographic and socioeconomic condition of the tea plantation workers are assessed, it points to low socioeconomic standard of living which affects the type of diseases prevalence among the survey population. The overall life expectancy is low, with lower level of literacy and low wage levels. The condition is worse for temporary tea plantation workers as they are only seasonally employed. Due to low-income levels, there is lack of nutrition security at household level and inability to access dietary diversity. Apart, from this, the living conditions and housing patterns in the line quarters are congested, without proper drainage and sanitation facility (*see chapter 7, section 7.4*). Therefore, the type of diseases being self-reported by the plantation workers as well as those identified by health workers points towards low socioeconomic conditions and standard of living.

Infectious disease like tuberculosis, diarrhea, all other fevers (comes under other diseases, but most of the time these are viral seasonal fevers), bronchial asthma (NCD) and skin infection are widely prevalent among the workers. Various factors contribute towards the prevalence of infectious diseases such as poor environmental conditions, lack of access to

safe drinking water and sanitation, larger family sizes, poor maternal health due to lack of access to food at household level as well as low dietary diversity.

Another interlinkage that is widely established which is prevalent among the plantation workers is malnutrition-infectious disease cycle along with NCDs like anaemia. Various studies have established the vicious circle of infectious diseases contributing to malnutrition and malnutrition contributing to infection (Tomkins & Watson, 1989; Katona & Katon-Apte, 2007; Bailey et.al, 2015; Fatso & Defo, 2005). Infectious diseases like diarrhoea and tuberculosis contribute towards malnutrition (Cegielski & McMurray, 2004; Schaible & Kaufmann, 2007). The socioeconomic factors which largely contribute towards malnutrition and infectious diseases are mainly poverty, ignorance, lack of education and awareness, adequate knowledge about nutritional value of different food items, poor and compromised sanitary facility (Park, 2017). These factors largely contribute towards the morbidity status of the tea plantation workers.

Poor health in childhood may also have direct and indirect consequences on educational and occupational attainment. Poor health in childhood leads to morbid condition in adulthood and ultimately leads to lack of ample occupational attainment. This affects income and in turn food expenditure of the family. It influences maternal nutrition and nutritional status of the children. Therefore, we see that the family is caught in a vicious cycle of childhood & maternal malnutrition, morbid condition in adulthood and lack of income & food expenditure apart from other exogenous factors such as excess to health services, sanitation, and safe drinking water.

8.3.2 Lack of nutrition significantly impact health

The study tried to link morbidity status with nutritional status. There are two important indicators: BMI and dietary intake of the tea plantation workers. For BMI there is a direct linkage with nutrition deficiency and morbidity. Low BMI population has reported more morbidity. BMI of the workers shows a significant percentage of workers with low BMI, especially female workers. Low BMI indicates towards low height. Bozzoli et.al (2009) has established that early-life burden of under nutrition and disease are not only responsible for mortality in childhood but also leaves a residue of long-term health risks for survivors which is expressed as adult height and in late-life disease.

For dietary intake, the diversity for food groups intakes is low. Dietary intake of the workers shows the average number of food groups consumed is within 3-5 food groups and the diet mainly comprising of carbohydrate diet. Low dietary diversity is associated with nutrient inadequacy (Kennedy et. al, 2011). Global studies point towards and recommend that, adequacy in energy and essential nutrient intake is associated with individual's dietary variation (Ruel, 2003). Therefore, a low dietary diversity of the workers is related to the type of morbidities they report. There is lack of balance diet among the workers with low consumption of protein and minerals/vitamin intake and diet mainly composing of carbohydrates. An ideal recommended balance diet mainly comprises of protein, carbohydrates, and fat (National Institute of Nutrition, 2011).

Most of the diseases self-reported by the workers either infectious, NCDs, CVDs or other disease points toward nutrition linkage. Infectious disease like tuberculosis directly related to malnutrition apart from other factors. The NCDs widely reported by the workers are anemia, jaundice, under-nutrition, and diabetes which are related to nutritional inadequacy or bad eating habits. It is established that, nutritional anemia is mainly caused by malnutrition

which arise due to lower hemoglobin level as a result of deficiency of one or more essential nutrients (WHO,1968). Under CVDs the high reporting of hypertension among the tea plantation workers is widely associate with excessive consumption of salt as side dish and the practice of taking salt with water and tea both at workplace and home. Besides this high consumption of locally prepared alcohol and tobacco are the factors adding to increase in risk of hypertension among the plantation workers (Hazarika et. al, 2002). Various clinical studies have established this phenomenon among tea plantation workers in Assam (Borah et.al, 2018; Mahanta et.al 2013). Besides, studies have also established the links between "early malnutrition war" or nutritional stress in pregnancy and chronic adult diseases through programming has been widely studied after James Neel put forward his original hypothesis in 1962 (cited in Barkar, 1992 and Amuna & Zotor, 2008). Studies have also show that early life health infections have effects on cardiovascular disease, cancer, diabetes, and respiratory disease (Ben-Shlomo & Kuh, 2002). For other diseases, pain in abdomen mainly gastric and peptic ulcer is widely reported. As indicate by the health facilitators it is mainly due to irregular eating time table, less consumption of water due to long working hours and skipping of meals due to long working hours (as discussed in *Chapter 7*). Other than these diseases, the health facilitators widely reported the prevalence of under nutrition, deficiency diseases due to vitamin A vitamin B and vitamin C, iron deficiency, underweight children, and low birth weight. Liver diseases and swelling of the body due to excessive consumption of alcohol were also widely reported.

8.3.3 Workplace hazard and morbidity of plantation workers

For the tea plantation workers, the data shows that disability (back and body pain, cuts and injuries, headache, and weakness in limbs widely self-reported) is contributing more to non-communicable diseases that points to lack of decent work conditions. Besides skin diseases, allergy (mainly due to workplace condition during plucking season), cases of

deafness are reported by workers. Physical, biological hazards as well as chemical and physiological hazards have been widely reported among tea garden workers.

The plantation workers are prone to accidents at the tea factory as well as in hilly and uneven terrain of the tea gardens along with insects and snake bites. With the use of chemical fertilizers and insecticides the workers are exposed to toxic hazard of chemicals in the form of skin diseases as well as other respiratory diseases. Physical hazards like heart strokes, vomiting and fainting are reported during the plucking season due to the hot and humid climate, and long-standing hours in the garden with heavy weight. Besides, those working in the factory are exposed to dust from tea manufacturing which may result in occupational asthma (bronchial asthma have been reported under chronic diseases by the workers) (ILO & WHO, 1962; Park 2017). Occupational epidemiology which is mainly associate with workplace environment and adult predominately male working population (Bonita et.al, 2006). However, in case of tea plantation workers there are a few exceptions. Females too are equally part of the workforce; therefore, it applies to both male and female in the study area. The workplace and working conditions not only affect the workers but the dependent population living within the tea estates. Firstly, all the workers family live within the tea estate and they are dependent on the tea garden management for their basic need like housing, drinking water, sanitation, supply of ration, health care facilities and income. Secondly, they live either adjacent to the tea garden factory and the tea gardens. These gardens are regularly sprayed with insecticides and pesticides, which affects most of the people dwelling around it. Lastly, the tea garden labour workforce working in the tea gardens of Assam are intergenerational. The families in these estates have been working in these gardens over generations, since the time they have been bought as migrant workers from central and eastern India by the colonial British rulers. Therefore, interpretation of occupational epidemiology for tea garden workers will have a few exceptions.

8.3.4 Access to healthcare by the plantation workers

We find that because disability related diseases are quite high among tea garden worker population, seeking treatment is also high as it is directly related to their work productivity. There are mainly two reasons for better health care seeking behavior: availability of health care facility within the tea garden. Secondly, the permanent workers are entitled to free health care facility at the tea garden owned healthcare facilities. For temporary workers this facility is only available for the worker only during the plucking season when she/he is working in the tea garden. Therefore, there is some insurance of provision of social security for the workers.

However, if we look at the supply side; the facilities are not very well taken care of and unavailability of doctors, that also leads to untreated patients which may also show up on their morbidity status. Besides, there are delays in reporting morbidity for medical treatment. Lack of awareness, low literacy level, low-income level for accessing medical treatment and socio-cultural beliefs drive the people of the community toward traditional healers and quacks for seeking treatment.

8.3.5 Disease prevalence among Tea Plantation Workers

The findings show dual nature of disease prevalence among the plantation workers. There is coexistence of both communicable and non-communicable diseases along with occupational related diseases. However, it does not mean that population is close to epidemiological transition. Separate out the effects of communicable and non-communicable diseases, it is observed that most of the disease both communicable and non-communicable disease have linkage to mainly three factors poor socio-economic and living conditions, lack of adequate nutrition and nature of work and workplace conditions. The effect of nutrition on overall demographic and health indicators is well known (Mc Keown 1950-1980; Barker,

1995). Studies (for e.g., Amuna & Zotoro, 2008) have highlighted the role of epidemiological and nutritional transition in overall health transition which is characterized by the change in both disease burden and morbidity patterns. Experience of developing countries has shown that poverty and food insecurity result in morbidity and mortality.

8.4 Policy implication

Pattern of disease prevalence point to low socioeconomic standards of living in the overall population requiring policy attention at the macro level, particularly social policies of labour market, and public policies on education, health, and social protection. From NSS unit level data we find that, prevalence of disease type is dual in nature. From our primary data, we seen apart from dual nature of the disease prevalence the prevalence of workplace disability related disease is of sizeable portion. The morbidity status of the population points to low levels of development and indecent workplace conditions with lack of dietary diversity. In terms of policy attention from our findings; we need to continue to focus on increased income, increased access to better health care facilities, better nutrition access and better workplace conditions. There is a need for policies specially focusing on the plantation workers as their diseases profile and morbidity conditions are affected mainly due to workplace related hazards and nutritional intake apart for their living conditions. These conditions not only affect the workers but also the overall population within the tea estates. Separate sets of policy frameworks need to be worked out for workers and general population. For e.g. SDG goal 8.3 calls for decent job creation and development oriented policies that contribute to workplace conditions. Social policies in the state needs to integrate call for action on sustainable workplace conditions.

8.5 Limitations of the study and scope for future research

Since overall reporting of morbidity has been low in Assam, it would have been fruitful to further look into the district level estimates for further analysis. There are limitations of estimating at the district level with only the central sample data as the sample size at the district level are small. Exploring morbidity estimates with pooled data of central and state samples may possibly give us better results.

The primary study tries to encompass most of the major dimensions that affects the health status of an individual. However, there are further scope for in depth studies focusing on any particular aspect affecting the health status. There is scope for further research in the form of longitudinal study or clinical study to understand the intergenerational effect of certain diseases such as anaemia and hypertension among the plantation workers.

Appendix

Appendix to Chapter 3

Table A 3.1: NSS 71st and 75th Rounds Disease list classified under International Classification of Disease WHO (WHO, 2012)

Sl No.	Disease Name
	Infectious Disease
1	*Fever with loss of consciousness or altered consciousness*
2	*Fever with rash/ eruptive lesions*
3	*Fever due to DIPHTHERIA, WHOOPING COUGH*
4	*TUBERCULOSIS*
5	*Filariasis*
6	*Tetanus*
7	*HIV/AIDS*
8	*Other sexually transmitted diseases*
9	*Diarrheas/ dysentery/ increased frequency of stools with or without blood and mucus in stools*
10	*Worm infestation*
11	*Discomfort/pain in the eye with redness or swellings/ boils*
12	*Acute upper respiratory infections (cold, runny nose, sore throat with cough, allergic colds included)*
13	*Cough with sputum with or without fever and NOT diagnosed as TB*
14	*Skin infection (boil, abscess, itching) and other skin disease*
	Cardio Vascular Diseases (CVD)
15	*Stroke/ hemiplegia/ sudden onset weakness or loss of speech in half of body*
16	*HYPERTENSION*
17	*Heart disease: Chest pain, breathlessness*
	Non-Communicable Diseases (NCD)
18	*Jaundice*
19	*CANCERS (known or suspected by a physician) and occurrence of any growing painless*
20	*Anaemia (any cause)*
21	*Bleeding disorder*
22	*Diabetes*
23	*Under-Nutrition*
24	*Goitre and other diseases of the thyroid*
25	*Others (including obesity)*
26	*Cataract*
27	*GLAUCOMA*
28	*Earache with discharge/bleeding from ear/infections*
29	*Bronchial asthma/ recurrent episode of wheezing and breathlessness with or without cough over long periods or known asthma*
30	*Any difficulty or abnormality in urination*
31	*Pain the pelvic region/reproductive tract infection/ Pain in male genital area*
32	*Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders incl. male/female infertility*
33	*Pregnancy with complications before or during labour (abortion, ectopic pregnancy, abortion, hypertension, complications during labour)*
34	*Complications in mother after birth of child*
35	*Illness in the newborn/ sick newborn*
	Disability Diseases
36	*Mental retardation*
37	*Mental disorders*

38	*Headache*
39	*Seizures or known epilepsy*
40	*Weakness in limb muscles and difficulty in movements*
41	*Others including memory loss, confusion*
42	*Decreased vision (chronic) NOT including where decreased vision is corrected with where decreased vision is corrected with glasses*
43	*Others (including disorders of eye movements – strabismus, nystagmus, ptosis and adnexa)*
44	*Decreased hearing or loss of hearing*
45	*Diseases of mouth/teeth/gums*
46	*Joint or bone disease/ pain or swelling in any of the joints, or swelling or pus from the bones*
47	*Back or body aches*
48	*Accidental injury, road traffic accidents and falls*
49	*Accidental drowning and submersion*
50	*Burns and corrosions*
51	*Poisoning*
52	*Intentional self-harm*
53	*Assault*
	Other Diseases
54	*All other fevers (Includes malaria, typhoid and fevers of unknown origin, all specific fevers that do not have a confirmed diagnosis)*
55	*Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen*
56	*Lump or fluid in abdomen or scrotum*
57	*Gastrointestinal bleeding*
58	*Contact with venomous/harm-causing animals and plants*
59	*Symptom not fitting into any of above categories*
60	*Could not even state the main symptom*

Source: NSSO 71st Round and NSSO 75th Round; (Paul & Singh, 2017)

Table A3.2: NSS Regions of Assam by Districts of Assam 2017-2018

NSS Region	Districts
Eastern Plains	Lakhimpur, Dhemaji, Tinsukia, Dibrugarh, Sibsagar, Jorhat, Golagaht
Western Plains	Kokrajhar, Dhubri, Goalpara, Bongaigaon, Barpeta, Kamrup Rural, Nalbari, Chirang, Baksha, Kamrup Metro.
Cachar Plains	Karbi Anglong, NC Hills, Cachar, Karimganj, Hailakandi
Central Brahmaputra Plains	Darrang, Morigaon, Nagaon, Sonitpur, Udalguri

*Note: Post 2017-2018; Five new districts were formed in Assam. These districts were formed by curving out from older larger districts. The NSS regions they fall under remain same as their previous district they are curved out of. The five new districts formed were; West Karbi Anglong (curved out of Karbi Anglong district), Hojai (curved out of Nagaon district), Bishwanath (curved out of Sonitpur district), Majuli (curved out of Jorhat district), Charaideo (curved out of Sibsagar district), South Salmara (curve out of Dhubri district). (Source: Statistical Handbook Assam, 2022).

* NC Hills have been renamed as Dima Hasao. (Source: Statistical Handbook Assam, 2022)

*However, recently the districts of Hojai and Biswanath have been again reintegrated with their original districts of Nagaon and Sonitpur respectively (Assam state portal https://assam.gov.in/about-us/396)

Appendix to Chapter 4

Table A 4.1: All India State wise, Sample size - 71st and 75th Rounds

States	71st Round (2014-15)	75th Round (2017-18)
	Sample Population	Sample Population
Northern States		
Chandigarh	874	1,565
Delhi	5,424	6,433
Haryana	8,040	16,274
Himachal Pradesh	4,392	10,067
Jammu & Kashmir	6,788	17,155
Punjab	7,797	17,173
Rajasthan	16,655	28,020
Southern States		
Andaman & Nicobar	1,234	2,361
Andhra Pradesh	10,636	17,173
Karnataka	14,727	22,499
Kerala	11,229	19,815
Puducherry	1,117	2,497
Tamil Nadu	16,090	27,865
Telangana	6,582	14,454
Eastern States		
Bihar	17,596	28,125
Jharkhand	8,318	16,121
Odisha	11,576	19,083
West Bengal	22,783	31,046
Western States		
D & N Haveli	641	928
Daman & Diu	537	592
Goa	916	2,037
Gujarat	15,211	21,647
Lakshadweep	836	1,077
Maharashtra	27,124	43,598
North Eastern States		
Assam	11,411	18,463
Arunachal Pradesh	2,994	9,027
Manipur	7,187	13,037
Meghalaya	4,380	6,670
Mizoram	3,864	7,366
Nagaland	2,651	5,830
Sikkim	2,100	3,516
Tripura	5,977	8,421
Central States		
Chhattisgarh	6,026	14,922
Madhya Pradesh	19,131	29,999
Uttarakhand	3,177	8,578
Uttar Pradesh	47,083	61,918
India	**3,33,104**	**5,55,352**

Source: Estimated from unit level data of NSSO 71st and 75th Round

Table A 4.2: All India Reporting of Acute and Chronic Ailment at State level NSS 71st and 75th Round (per 1000 population)

States	71st Round (2014-15)		75th Round (2017-18)	
	Reporting of any other ailment in last 15 days (Acute Ailment)	Reporting of any Chronic Ailment	Reporting of any other ailment in last 15 days (Acute Ailment)	Reporting of any Chronic Ailment
Northern States				
Chandigarh	80	55	25	69
Delhi	33	7	46	14
Haryana	39	24	37	22
Himachal Pradesh	36	43	49	54
Jammu & Kashmir	30	30	48	24
Punjab	90	79	60	53
Rajasthan	34	29	28	21
Southern States				
Andaman & Nicobar	86	98	19	67
Andhra Pradesh	51	123	40	104
Karnataka	49	51	25	18
Kerala	118	208	74	181
Puducherry	99	122	8	15
Tamil Nadu	67	103	24	37
Telangana	44	55	26	30
Eastern States				
Bihar	41	18	19	6
Jharkhand	39	23	53	14
Odisha	74	30	59	35
West Bengal	78	94	49	90
Western States				
D & N Haveli	42	64	61	2
Daman & Diu	49	126	10	23
Goa	80	100	4	56
Gujarat	49	50	34	34
Lakshadweep	108	127	21	85
Maharashtra	45	31	47	41
North Eastern States				
Arunachal Pradesh	75	12	29	1
Assam	25	8	19	6
Manipur	16	3	16	3
Meghalaya	28	2	4	0
Mizoram	20	8	25	9
Nagaland	28	0	7	1
Sikkim	31	9	15	19
Tripura	36	2	28	4
Central States				
Chhattisgarh	31	10	36	13
Madhya Pradesh	38	20	24	15
Uttarakhand	74	12	27	8
Uttar Pradesh	48	25	53	22
India	**52**	**48**	**39**	**37**

Source: Estimated from unit level data of NSSO71st and 75th Round

Table A 4.3 All India State Region wise percentage of Type of Disease Reported out of total Hospitalization Cases Reported (NSS 71st and 75th Rounds)

Sl No.	Disease Name	71st Round								75th Round							
		India	Northern States	Southern States	Eastern States	Western States	North Eastern States	Central States	Assam	India	Northern States	Southern States	Eastern States	Western States	North Eastern States	Central States	Assam
	Infectious Disease																
1	*Fever with loss of consciousness or altered consciousness*	1.06	0.63	0.80	0.68	1.90	3.05	1.23	3.53	1.45	1.36	1.81	1.05	1.71	1.72	1.27	0.61
2	*Fever with rash/ eruptive lesions*	0.36	0.19	0.40	0.17	0.81	0.69	0.24	0.40	1.9	1.70	1.38	1.78	2.47	2.37	2.32	0.74
3	*Fever due to DIPHTHERIA, WHOOPING COUGH*	0.55	0.42	0.74	0.28	1.11	0.80	0.14	0.14	0.44	0.35	0.30	0.29	1.06	1.42	0.32	0.25
4	*TUBERCULOSIS*	0.99	1.20	0.65	1.54	0.61	0.53	1.18	0.38	0.6	0.73	0.28	0.61	0.52	0.59	0.95	0.59
5	*Filariasis*	0.05	0.00	0.03	0.08	0.06	0.00	0.07	0.00	0.06	0.01	0.06	0.09	0.03	0.08	0.08	0.07
6	*Tetanus*	0.04	0.00	0.00	0.05	0.04	0.07	0.09	0.00	0.1	0.02	0.06	0.06	0.07	0.01	0.29	0.00
7	*HIV/AIDS*	0.14	0.03	0.14	0.01	0.11	0.00	0.37	0.00	0.04	0.01	0.00	0.11	0.05	0.01	0.05	0.00
8	*Other sexually transmitted diseases*	0.02	0.01	0.02	0.00	0.05	0.00	0.00	0.00	0.03	0.03	0.00	0.01	0.04	0.02	0.08	0.03
9	*Diarrheas/ dysentery/ increased frequency of stools with or without blood and mucus in stools*	2.43	1.77	1.77	4.57	1.61	4.51	2.11	3.61	2.37	1.58	0.90	5.15	1.68	3.75	2.20	2.62
10	*Worms infestation*	0.13	0.23	0.01	0.10	0.05	0.05	0.34	0.00	0.1	0.12	0.08	0.07	0.07	0.06	0.15	0.00
11	*Discomfort/pain in the eye with redness or swellings/ boils*	0.24	0.10	0.35	0.10	0.39	0.35	0.16	0.45	0.42	1.05	0.59	0.15	0.25	0.21	0.20	0.11
12	*Acute upper respiratory infections (cold, runny nose, sore throat with cough, allergic colds included)*	0.88	0.79	1.04	0.49	1.01	0.49	1.01	0.36	0.71	0.77	0.83	0.64	0.70	0.61	0.61	0.38
13	*Cough with sputum with or without fever and NOT diagnosed as TB*	0.61	0.70	0.63	0.70	0.52	0.68	0.52	0.70	0.39	0.42	0.49	0.37	0.49	0.43	0.22	0.37
14	*Skin infection (boil, abscess, itching) and other skin disease*	0.66	0.53	0.71	0.51	0.54	0.41	0.96	0.18	0.6	0.92	0.63	0.54	0.62	0.49	0.43	0.47
	All infectious diseases	**8.16**	**6.60**	**7.28**	**9.28**	**8.83**	**11.63**	**8.40**	**9.76**	**9.21**	**9.05**	**7.43**	**10.94**	**9.74**	**11.76**	**9.16**	**6.24**
	Cardio Vascular Diseases (CVD)																
15	*Stroke/ hemiplegia/ sudden onset weakness or loss of speech in half of body*	1.35	0.77	1.74	1.63	1.73	0.61	0.61	0.46	1.55	0.96	1.35	1.77	2.11	1.33	1.63	1.66
16	*HYPERTENSION*	2.16	2.52	2.92	2.16	2.33	1.06	0.77	1.01	1.34	1.47	1.69	1.11	1.69	0.91	0.91	0.53
17	*Heart disease: Chest pain, breathlessness*	4.45	4.42	6.16	3.11	4.57	2.76	3.27	2.52	4.77	5.54	6.02	3.81	5.63	3.34	3.42	3.99
	All CVDs	**7.96**	**7.72**	**10.82**	**6.90**	**8.63**	**4.43**	**4.65**	**3.99**	**7.66**	**7.97**	**9.06**	**6.68**	**9.43**	**5.59**	**5.97**	**6.18**
	Non-Communicable Diseases (NCD)																
18	*Jaundice*	1.4	1.93	1.30	1.25	1.44	1.43	1.36	1.52	1.41	1.28	0.85	1.55	1.64	1.78	1.83	2.17
19	*CANCERS (known or suspected by a physician) and occurrence of any growing painless*	1.71	1.51	2.26	1.47	1.28	1.13	1.61	0.90	1.69	2.45	1.72	1.76	1.25	0.61	1.51	0.79
20	*Anaemia (any cause)*	1.05	1.21	0.76	0.98	1.79	0.32	1.00	0.20	1.09	0.92	0.81	1.26	2.34	0.46	0.66	0.45
21	*Bleeding disorder*	0.37	0.35	0.31	0.16	0.38	0.07	0.69	0.00	0.37	0.35	0.31	0.42	0.47	0.25	0.37	0.35
22	*Diabetes*	1.43	1.09	2.35	0.55	1.65	0.80	0.98	0.80	1.35	1.29	2.42	0.78	1.87	1.11	0.41	1.02
23	*Under-Nutrition*	0.11	0.08	0.08	0.04	0.23	0.20	0.17	0.31	0.08	0.02	0.10	0.04	0.05	0.03	0.15	0.02

24	*Goitre and other diseases of the thyroid*	0.34	0.37	0.55	0.17	0.36	0.05	0.19	0.01	0.24	0.14	0.43	0.12	0.14	0.12	0.26	0.04
25	*Others (including obesity)*	0.06	0.03	0.06	0.09	0.08	0.04	0.03	0.06	0.12	0.06	0.10	0.14	0.10	0.05	0.16	0.04
26	*Cataract*	2.46	1.56	2.77	3.02	2.59	0.28	2.16	0.25	1.34	1.20	1.63	1.49	1.67	0.82	0.81	1.29
27	*GLAUCOMA*	0.19	0.13	0.12	0.31	0.40	0.02	0.11	0.01	0.2	0.14	0.21	0.26	0.32	0.04	0.13	0.00
28	*Earache with discharge/bleeding from ear/infections*	0.26	0.09	0.33	0.19	0.35	0.21	0.28	0.18	0.25	0.21	0.26	0.21	0.33	0.21	0.28	0.24
29	*Bronchial asthma/ recurrent episode of wheezing and breathlessness with or without cough over long periods or known asthma*	2.25	2.44	2.68	1.99	2.04	1.51	1.95	1.82	1.73	1.65	1.99	1.88	1.44	0.70	1.61	0.30
30	*Any difficulty or abnormality in urination*	2.48	2.19	3.12	1.73	3.10	0.57	2.15	0.64	1.93	1.59	2.49	1.57	2.23	1.49	1.71	1.57
31	*Pain the pelvic region/reproductive tract infection/ Pain in male genital area*	0.89	0.90	1.17	0.82	0.89	0.49	0.58	0.65	1.01	0.96	1.46	0.97	0.94	0.75	0.64	0.56
32	*Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders incl. male/female infertility*	1.53	1.50	1.87	1.54	1.36	0.72	1.22	0.46	1.00	1.00	1.23	0.84	1.11	0.38	0.90	0.17
33	*Pregnancy with complications before or during labour (abortion, ectopic pregnancy, abortion, hypertension, complications during labour)*	2.91	2.26	1.15	4.15	1.65	1.84	5.83	1.83	1.68	1.68	1.06	2.69	1.07	1.69	1.83	2.05
34	*Complications in mother after birth of child*	0.38	0.24	0.22	0.64	0.14	0.54	0.59	0.34	0.26	0.58	0.11	0.10	0.12	0.32	0.47	0.21
35	*Illness in the new born/ sick new born*	0.68	0.82	0.69	0.68	0.48	0.10	0.79	0.02	0.39	0.29	0.29	0.35	0.30	0.10	0.67	0.05
	All NCDs	**20.5**	**18.70**	**21.79**	**19.78**	**20.21**	**10.32**	**21.69**	**9.99**	**16.14**	**15.82**	**17.47**	**16.42**	**17.39**	**10.92**	**14.38**	**11.34**
	Disability Diseases																
36	*Mental retardation*	0.2	0.21	0.08	0.11	0.28	0.02	0.42	0.01	0.19	0.07	0.22	0.09	0.34	0.03	0.24	0.00
37	*Mental disorders*	0.53	0.81	0.35	0.77	0.33	0.38	0.59	0.58	0.4	0.45	0.37	0.27	0.38	0.09	0.58	0.10
38	*Headache*	0.58	0.56	0.65	0.73	0.39	0.59	0.47	0.41	0.38	0.45	0.44	0.26	0.31	0.57	0.38	0.12
39	*Seizures or known epilepsy*	0.54	0.34	0.69	0.48	0.55	0.00	0.52	0.00	0.34	0.27	0.57	0.31	0.14	0.06	0.29	0.00
40	*Weakness in limb muscles and difficulty in movements*	0.92	0.75	1.00	0.69	1.24	0.77	0.89	0.77	0.78	0.50	0.90	0.85	0.95	0.63	0.65	0.62
41	*Others including memory loss, confusion*	0.24	0.21	0.29	0.23	0.33	0.02	0.14	0.01	0.21	0.20	0.24	0.17	0.26	0.01	0.22	0.01
42	*Decreased vision (chronic) NOT including where decreased vision is corrected with where decreased vision is corrected with glasses*	0.18	0.20	0.24	0.05	0.38	0.04	0.06	0.01	0.26	0.24	0.26	0.10	0.31	0.03	0.43	0.02
43	*Others (including disorders of eye movements – strabismus, nystagmus, ptosis and adnexa)*	0.24	0.30	0.28	0.12	0.25	0.04	0.27	0.03	0.16	0.18	0.17	0.14	0.19	0.09	0.15	0.08
44	*Decreased hearing or loss of hearing*	0.06	0.10	0.10	0.04	0.05	0.06	0.02	0.05	0.05	0.04	0.08	0.02	0.01	0.08	0.07	0.09

45	*Diseases of mouth/teeth/gums*	0.15	0.07	0.20	0.06	0.22	0.05	0.17	0.02	0.19	0.17	0.27	0.11	0.07	0.21	0.26	0.14
46	*Joint or bone disease/ pain or swelling in any of the joints, or swelling or pus from the bones*	2.69	2.35	3.61	2.13	2.56	1.37	2.30	1.08	2.43	2.21	3.38	1.88	2.49	1.47	2.05	1.80
47	*Back or body aches*	0.74	0.71	1.11	0.36	0.68	0.49	0.65	0.34	0.51	0.54	0.89	0.29	0.44	0.61	0.30	0.14
48	*Accidental injury, road traffic accidents and falls*	6.79	6.62	7.39	6.82	6.50	4.16	6.45	4.35	6.61	6.20	7.86	6.77	6.26	4.59	5.71	5.61
49	*Accidental drowning and submersion*	0.06	0.03	0.09	0.02	0.13	0.01	0.05	0.00	0.16	0.11	0.20	0.09	0.37	0.03	0.09	0.03
50	*Burns and corrosions*	0.28	0.10	0.39	0.42	0.12	0.41	0.20	0.28	0.22	0.10	0.12	0.36	0.30	0.21	0.25	0.22
51	*Poisoning*	0.33	0.07	0.31	0.50	0.73	0.12	0.07	0.18	0.21	0.08	0.22	0.37	0.24	0.07	0.12	0.09
52	*Intentional self-harm*	0.1	0.00	0.19	0.11	0.04	0.04	0.03	0.05	0.04	0.00	0.06	0.07	0.01	0.01	0.03	0.02
53	*Assault*	0.14	0.28	0.16	0.17	0.03	0.14	0.08	0.02	0.07	0.08	0.02	0.21	0.00	0.00	0.06	0.00
	All Disability	**14.77**	**13.69**	**17.13**	**13.82**	**14.82**	**8.70**	**13.37**	**8.18**	**13.21**	**11.91**	**16.27**	**12.36**	**13.07**	**8.80**	**11.87**	**9.07**
	Other Diseases																
54	*All other fevers (Includes malaria, typhoid and fevers of unknown origin, all specific fevers that do not have a confirmed diagnosis)*	10.98	11.05	14.45	6.73	12.35	9.75	8.90	4.56	12.52	11.30	19.49	6.76	13.80	9.41	10.19	3.29
55	*Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen*	5.55	5.97	5.41	6.18	5.44	5.95	4.93	5.64	4.96	5.91	4.25	6.08	4.16	7.00	4.42	5.77
56	*Lump or fluid in abdomen or scrotum*	1.71	2.13	1.52	1.80	1.44	0.27	2.05	0.19	1.14	1.33	0.84	1.29	0.62	0.45	1.61	0.40
57	*Gastrointestinal bleeding*	0.52	0.43	0.59	0.45	0.51	0.48	0.54	0.59	0.35	0.22	0.43	0.26	0.47	0.17	0.37	0.05
58	*Contact with venomous/harm-causing animals and plants*	0.38	0.49	0.27	0.85	0.20	0.06	0.19	0.00	0.19	0.10	0.21	0.39	0.15	0.04	0.09	0.01
59	*Symptom not fitting into any of above categories*	2.08	1.47	2.48	2.27	1.56	3.65	1.85	4.62	1.44	1.08	1.90	2.37	0.89	1.06	0.63	0.74
60	*Could not even state the main symptom*	0.13	0.03	0.17	0.08	0.10	0.23	0.17	0.10	0.09	0.04	0.05	0.05	0.04	0.10	0.22	0.00
	All other diseases	**21.35**	**21.57**	**24.90**	**18.36**	**21.60**	**20.40**	**18.64**	**15.70**	**20.69**	**19.96**	**27.17**	**17.21**	**20.13**	**18.23**	**17.53**	**10.25**
	Child Birth																
61	*Childbirth – Caesarean/ normal/ any other (for both live birth and stillbirth)*	**27.29**	**31.71**	**18.09**	**31.85**	**25.91**	**44.51**	**33.26**	**52.38**	**33.08**	**35.29**	**22.60**	**36.39**	**30.24**	**44.71**	**41.10**	**56.92**

Source: Estimated from unit level data of NSS 71st and 75th round

Table A 4.4 All India State Region wise percentage of Type of Disease Reported out of total cases Reported for Spell of Ailment (NSS 71st and 75th Rounds)

Sl No.	Disease Name	71st Round								75th Round							
		India	Northern States	Southern States	Eastern States	Western States	North Eastern States	Central States	Assam	India	Northern States	Southern States	Eastern States	Western States	North Eastern States	Central States	Assam
	Infectious Disease																
1	*Fever with loss of consciousness or altered consciousness*	1.8	2.55	0.91	1.63	4.65	3.42	1.55	4.58	3.12	4.35	1.99	1.60	3.75	7.97	5.04	9.71
2	*Fever with rash/ eruptive lesions*	0.87	0.23	0.56	0.52	3.26	2.24	0.73	2.72	0.84	1.00	0.21	1.18	0.82	0.97	1.28	0.94
3	*Fever due to DIPHTHERIA, WHOOPING COUGH*	2.16	3.54	1.11	1.41	5.04	10.14	2.25	8.83	2.1	4.19	0.60	2.28	3.04	5.45	2.04	4.38
4	*TUBERCULOSIS*	0.71	1.09	0.26	1.00	0.47	0.84	1.28	0.89	0.48	0.25	0.10	0.66	0.49	0.65	0.95	0.50
5	*Filariasis*	0.17	0.00	0.02	0.61	0.07	0.00	0.11	0.00	0.05	0.00	0.02	0.16	0.01	0.00	0.05	0.00
6	*Tetanus*	0.04	0.00	0.07	0.00	0.00	0.01	0.10	0.00	0.02	0.00	0.00	0.08	0.01	0.01	0.01	0.00
7	*HIV/AIDS*	0.1	0.10	0.12	0.08	0.15	0.00	0.05	0.00	0.02	0.07	0.01	0.03	0.00	0.01	0.01	0.00
8	*Other sexually transmitted diseases*	0	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.10	0.00	0.02	0.00
9	*Diarrheas/ dysentery/ increased frequency of stools with or without blood and mucus in stools*	2.38	0.79	0.37	4.87	1.99	4.26	4.63	3.10	1.58	1.44	0.39	2.01	1.25	8.51	2.72	9.58
10	*Worms infestation*	0.14	0.10	0.01	0.25	0.02	0.23	0.42	0.22	0.13	0.07	0.04	0.13	0.07	0.06	0.32	0.00
11	*Discomfort/pain in the eye with redness or swellings/ boils*	0.57	0.62	0.59	0.84	0.16	0.88	0.41	0.43	0.57	0.80	0.41	0.61	0.58	1.44	0.59	1.27
12	*Acute upper respiratory infections (cold, runny nose, sore throat with cough, allergic colds included)*	7.75	8.87	5.85	6.60	13.77	6.08	9.04	6.34	6.08	9.54	3.54	4.48	8.93	7.54	7.51	8.19
13	*Cough with sputum with or without fever and NOT diagnosed as TB*	2.62	3.87	0.95	3.42	3.24	1.36	4.30	0.06	1.52	1.36	0.95	1.86	2.95	1.72	1.02	2.05
14	*Skin infection (boil, abscess, itching) and other skin disease*	2.37	2.40	1.82	2.80	1.72	3.56	3.39	4.99	2.29	3.47	1.14	3.30	1.02	1.81	3.10	1.13
	All infectious diseases	**21.68**	**24.17**	**12.64**	**24.03**	**34.53**	**33.02**	**28.26**	**32.17**	**18.82**	**26.54**	**9.40**	**18.38**	**23.01**	**36.12**	**24.65**	**37.76**
	Cardio Vascular Diseases (CVD)																
15	*Stroke/ hemiplegia/ sudden onset weakness or loss of speech in half of body*	0.51	0.57	0.69	0.29	0.59	0.04	0.33	0.05	0.64	0.50	0.54	0.75	1.02	1.04	0.46	1.40
16	*HYPERTENSION*	9.86	7.10	16.24	5.72	10.18	0.38	3.04	0.09	13.49	9.37	21.25	12.83	17.97	3.76	2.63	3.81
17	*Heart disease: Chest pain, breathlessness*	3.16	2.90	3.68	2.41	3.71	1.68	2.91	1.08	3.24	3.28	4.21	3.06	2.29	3.21	2.71	3.62
	All CVDs	**13.53**	**10.57**	**20.61**	**8.43**	**14.48**	**2.10**	**6.28**	**1.22**	**17.37**	**13.15**	**25.99**	**16.64**	**21.28**	**8.01**	**5.80**	**8.83**
	Non-Communicable Diseases (NCD)																
18	*Jaundice*	0.27	0.15	0.13	0.39	0.41	0.29	0.37	0.01	0.19	0.30	0.03	0.24	0.15	0.21	0.30	0.05
19	*CANCERS (known or suspected by a physician) and occurrence of any growing painless*	0.38	0.49	0.42	0.19	0.31	0.05	0.55	0.03	0.33	0.47	0.39	0.37	0.23	0.71	0.16	0.92
20	*Anaemia (any cause)*	0.74	1.38	0.35	0.82	1.70	0.01	0.52	0.00	0.66	2.20	0.27	0.56	0.55	0.07	0.58	0.10
21	*Bleeding disorder*	0.12	0.11	0.08	0.15	0.06	0.00	0.24	0.00	0.16	0.10	0.19	0.16	0.04	0.03	0.27	0.02
22	*Diabetes*	9.84	7.49	17.05	4.47	8.88	2.14	3.31	2.34	12.61	7.62	21.18	9.32	14.77	5.59	5.56	5.81
23	*Under-Nutrition*	0.08	0.02	0.00	0.27	0.05	0.38	0.01	0.10	0.09	0.03	0.12	0.07	0.03	0.02	0.16	0.00

24	*Goitre and other diseases of the thyroid*	1.64	1.86	2.08	2.13	0.86	0.00	0.46	0.00	1.87	1.13	2.69	2.60	0.91	0.44	1.03	0.42
25	*Others (including obesity)*	0.13	0.01	0.29	0.06	0.03	0.14	0.02	0.04	0.35	0.17	0.49	0.58	0.36	0.00	0.00	0.00
26	*Cataract*	0.3	0.31	0.35	0.23	0.07	0.09	0.47	0.10	0.17	0.05	0.10	0.23	0.04	0.14	0.36	0.03
27	*GLAUCOMA*	0.12	0.03	0.14	0.23	0.05	0.05	0.02	0.00	0.07	0.03	0.16	0.04	0.01	0.00	0.04	0.00
28	*Earache with discharge/bleeding from ear/infections*	0.47	0.50	0.22	0.64	0.43	0.13	0.87	0.00	0.27	0.18	0.35	0.17	0.05	0.37	0.45	0.02
29	*Bronchial asthma/ recurrent episode of wheezing and breathlessness with or without cough over long periods or known asthma*	3.82	4.81	3.61	3.97	2.95	2.92	4.16	3.31	2.72	2.86	2.55	3.07	2.25	2.57	2.86	3.02
30	*Any difficulty or abnormality in urination*	0.92	1.51	0.92	0.79	0.70	0.16	0.94	0.04	0.55	0.95	0.43	0.26	0.29	0.77	0.99	0.60
31	*Pain the pelvic region/reproductive tract infection/ Pain in male genital area*	0.27	0.16	0.37	0.08	0.15	0.00	0.50	0.00	0.23	0.15	0.13	0.48	0.05	0.20	0.26	0.11
32	*Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders incl. male/female infertility*	0.64	0.81	0.74	0.54	0.27	1.42	0.66	1.89	0.46	0.61	0.22	0.30	0.56	0.41	0.81	0.00
33	*Pregnancy with complications before or during labour (abortion, ectopic pregnancy, abortion, hypertension, complications during labour)*	0.17	0.31	0.13	0.15	0.03	0.07	0.29	0.06	0.19	0.20	0.28	0.06	0.25	0.30	0.12	0.00
34	*Complications in mother after birth of child*	0.06	0.03	0.02	0.02	0.02	0.00	0.27	0.00	0.03	0.14	0.01	0.01	0.00	0.03	0.03	0.01
35	*Illness in the new born/ sick new born*	0.07	0.13	0.01	0.08	0.01	0.02	0.22	0.00	0.04	0.08	0.02	0.03	0.06	0.03	0.04	0.04
	All NCDs	**20.04**	**20.10**	**26.90**	**15.23**	**16.98**	**7.85**	**13.87**	**7.92**	**20.99**	**17.26**	**29.60**	**18.54**	**20.62**	**11.88**	**14.04**	**11.16**
	Disability Diseases																
36	*Mental retardation*	0.15	0.12	0.18	0.05	0.25	0.08	0.16	0.12	0.24	0.18	0.19	0.23	0.44	0.00	0.23	0.00
37	*Mental disorders*	0.61	1.16	0.42	0.74	0.35	0.01	0.79	0.02	0.49	0.86	0.42	0.58	0.51	0.10	0.29	0.03
38	*Headache*	2.14	2.36	2.12	2.44	1.62	2.01	2.01	1.03	1.4	2.22	1.44	1.45	0.67	4.52	1.19	4.84
39	*Seizures or known epilepsy*	0.43	0.23	0.39	0.60	0.31	0.64	0.45	0.95	0.24	0.18	0.28	0.27	0.11	0.05	0.29	0.05
40	*Weakness in limb muscles and difficulty in movements*	1.19	0.93	0.79	1.76	1.59	2.03	1.13	2.74	1.08	0.81	0.94	1.95	0.68	1.11	0.75	1.23
41	*Others including memory loss, confusion*	0.13	0.21	0.08	0.13	0.27	0.00	0.08	0.00	0.21	0.22	0.22	0.18	0.24	0.00	0.24	0.00
42	*Decreased vision (chronic) NOT including where decreased vision is corrected with where decreased vision is corrected with glasses*	0.31	0.23	0.27	0.58	0.21	0.77	0.07	1.07	0.12	0.06	0.10	0.17	0.25	0.03	0.02	0.04
43	*Others (including disorders of eye movements – strabismus, nystagmus, ptosis and adnexa)*	0.13	0.05	0.06	0.20	0.02	0.32	0.28	0.47	0.16	0.44	0.10	0.19	0.12	0.06	0.12	0.05
44	*Decreased hearing or loss of hearing*	0.16	0.16	0.17	0.22	0.18	0.44	0.04	0.33	0.13	0.08	0.23	0.19	0.01	0.00	0.05	0.00

45	*Diseases of mouth/teeth/gums*	0.76	1.28	0.62	0.94	0.40	0.24	0.81	0.00	0.43	0.26	0.31	0.39	0.19	1.64	0.86	2.02
46	*Joint or bone disease/ pain or swelling in any of the joints, or swelling or pus from the bones*	7.9	7.62	8.55	8.13	8.61	2.93	6.17	2.80	6.39	6.10	7.93	7.01	4.85	3.21	4.93	3.69
47	*Back or body aches*	3.17	2.33	3.08	3.32	2.18	6.78	4.06	8.68	2.13	2.13	2.92	1.93	1.38	2.01	1.75	1.95
48	*Accidental injury, road traffic accidents and falls*	1.44	0.96	1.14	1.64	1.22	1.23	2.33	1.05	1.04	0.89	0.92	1.15	0.90	2.47	1.19	2.44
49	*Accidental drowning and submersion*	0.03	0.01	0.08	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.01	0.01	0.00	0.12	0.00
50	*Burns and corrosions*	0.06	0.01	0.01	0.06	0.07	0.13	0.16	0.00	0.06	0.04	0.06	0.04	0.08	0.30	0.09	0.41
51	*Poisoning*	0.02	0.02	0.03	0.02	0.01	0.00	0.00	0.00	0.02	0.00	0.02	0.02	0.01	0.07	0.02	0.00
52	*Intentional self-harm*	0.01	0.00	0.01	0.00	0.00	0.14	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	*Assault*	0.03	0.03	0.02	0.01	0.12	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	All Disabilities	**18.67**	**17.69**	**18.03**	**20.85**	**17.40**	**17.76**	**18.54**	**19.26**	**14.17**	**14.50**	**16.07**	**15.76**	**10.43**	**15.57**	**12.16**	**16.76**
	Other Diseases																
54	*All other fevers (Includes malaria, typhoid and fevers of unknown origin, all specific fevers that do not have a confirmed diagnosis)*	17.88	20.65	14.44	20.16	11.72	26.97	24.52	26.10	23.42	23.63	14.37	23.76	21.82	23.48	37.11	21.92
55	*Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen*	4.95	4.17	4.01	7.00	3.10	8.64	5.75	9.52	3.39	3.81	2.49	4.77	1.54	4.07	4.20	3.43
56	*Lump or fluid in abdomen or scrotum*	0.44	0.56	0.20	0.71	0.37	0.01	0.64	0.01	0.35	0.22	0.19	0.52	0.18	0.05	0.61	0.01
57	*Gastrointestinal bleeding*	0.3	0.39	0.22	0.16	0.35	0.02	0.63	0.00	0.13	0.12	0.03	0.36	0.06	0.00	0.10	0.00
58	*Contact with venomous/harm-causing animals and plants*	0.09	0.04	0.11	0.09	0.03	0.21	0.07	0.00	0.04	0.01	0.06	0.00	0.02	0.00	0.07	0.00
59	*Symptom not fitting into any of above categories*	2.18	1.30	2.71	3.10	0.58	2.75	1.25	3.25	1.23	0.65	1.74	1.18	0.99	0.44	1.11	0.08
60	*Could not even state the main symptom*	0.11	0.10	0.04	0.19	0.27	0.41	0.05	0.23	0.02	0.00	0.03	0.02	0.01	0.00	0.01	0.00
	All Other diseases	**25.95**	**27.18**	**21.73**	**31.41**	**16.43**	**39.02**	**32.90**	**39.11**	**28.58**	**28.44**	**18.91**	**30.62**	**24.62**	**28.04**	**43.22**	**25.44**
	Child Birth																
61	*Childbirth – Caesarean/ normal/ any other (for both live birth and stillbirth)*	**0.12**	**0.29**	**0.09**	**0.06**	**0.18**	**0.24**	**0.14**	**0.32**	**0.07**	**0.10**	**0.03**	**0.07**	**0.04**	**0.38**	**0.13**	**0.05**

Source: Estimated from unit level data of NSS 71st and 75th rou

Appendix to Chapter 5

Table A 5.1: Assam Sample size and Percentage by Background Characteristics - 71st and 75th Rounds

	71st Round (2014-15)		75th Round (2017-18)	
Background Characteristics	**Sample Size**	**Percentage**	**Sample Size**	**Percentage**
Gender				
Male	5,997	52.55	9707	52.58
Female	5,414	47.45	8754	47.41
Age				
0 - 14	3,429	30.05	5,246	28.41
15 - 30	3,606	31.60	5,811	31.47
31 - 45	2,332	20.44	3,916	21.21
46 - 59	1,324	11.60	2,436	13.19
60 and above	720	6.31	1,054	5.71
Marital Status				
Currently Married	5,648.00	49.50	9,430	51.08
Others	5,763	50.50	9,033	48.92
Social Group				
ST	1,908	16.72	3089	16.73
SC	1,166	10.22	1727	9.35
OBC	2,513	22.02	5168	27.99
Others	5,824	51.04	8479	45.92
Religion				
Hindu	7,888	69.13	12,362	66.96
Muslim	3,294	28.87	5,486	29.71
Others	229	2.01	615	3.33
Wealth Quintile				
Poorest	2,859	25.05	4,783	25.91
Poor	2,409	21.11	4,744	25.69
Medium	2,270	19.89	2,671	14.47
Rich	2,014	17.65	3,244	17.57
Richest	1,859	16.29	3,021	16.36
Education				
Illiterate	2,760	24.19	3,865	20.93
Below Primary & Primary	5,879	51.52	8,904	48.23
Secondary & Higher Secondary	2,228	19.53	4,522	24.49
Graduate & above	544	4.77	1,172	6.35
Type of Latrine Used				
Pit Latrine	5,514	48.32	8,945	48.45
No facility	112	0.98	646	3.5
Flush/Septic Tank	4,932	43.22	8,686	47.05
Others	853	7.48	186	1.01
Drinking water				
Piped/Tap	1,466	12.85	2,378	12.88
Tube well/Pacca well	8,622	75.56	14,707	79.66
Open Source	909	7.97	1,069	5.79
Others	414	3.63	309	1.67
Household Size				

1-4 members	3,578	31.36	6,117	33.13
5-7 members	5,293	46.39	8,947	48.46
8 or more members	2,540	22.26	3,399	18.41
Usual Activity Status				
Employed	NA	NA	5,373	29.10
Unemployed	NA	NA	10,628	57.56
Others	NA	NA	942	5.10
Not in workforce	NA	NA	1,520	8.23
Health Insurance				
Covered	376	3.30	842	4.56
Not Covered	11,035	96.70	17,621	95.44
Area				
Rural	8,757	76.74	13,746	74.45
Urban	2,654	23.26	4,717	25.55
NSS Region				
Eastern Plains	3,183	27.89	4,651	25.19
Western Plains	4,075	35.71	6,639	35.96
Cachar Plains	1,846	16.18	2,999	16.24
Central Brahmaputra Plains	2,307	20.22	4,174	22.61

Source: From unit level data of NSSO 71st and 75th Round

Table A 5.2 Reporting of Morbidity by socioeconomic factors in Assam (per 1000 person) - 71st and 75th Round (per 1000 person)

Socioeconomic Factors	71st Round (2014-15)		75th Round (2017-18)	
	Any Ailment in last 15 days (Acute Ailment)	Chronic Ailment	Any Ailment in last 15 days (Acute Ailment)	Chronic Ailment
Gender				
Male	17	9	15	6
Female	35	8	23	6
Age				
0 - 14	29	2	36	0
15 - 30	18	2	12	2
31 - 45	19	13	6	4
46 - 59	39	16	19	13
60 and above	37	30	33	41
Marital Status				
Currently Married	17	12	12	8
Others	33	4	26	4
Social Group				
ST	12	6	17	4
SC	18	1	23	6
OBC	30	11	18	7
Others	28	8	19	5
Religion				
Hindu	23	8	18	6
Muslim	30	8	20	4
Others	2	6	28	17
Wealth Quintile				

Poorest	29	6	13	4
Poor	32	7	21	8
Medium	22	6	20	4
Rich	12	12	19	5
Richest	29	15	27	11
Education				
Illiterate	44	14	24	16
Below Primary & Primary	22	7	21	4
Secondary & Higher Secondary	18	1	10	4
Graduate & above	3	17	25	7
Type of Latrine Used				
Pit Latrine	25	7	15	5
No facility	3	0	40	13
Flush/Septic Tank	28	9	22	7
Others	18	12	16	0
Drinking water				
Piped/Tap	33	7	32	3
Tube well/Pacca well	27	9	18	7
Open Source	1	1	11	1
Others	24	11	0	0
Household Size				
1-4 members	19	8	23	7
5-7 members	29	8	18	4
8 or more members	32	6	13	12
Usual Activity Status				
Employed	NA	NA	10	9
Unemployed	NA	NA	22	5
Others	NA	NA	14	3
Not in workforce	NA	NA	46	0
Health Insurance				
Covered	25	8	18	8
Not Covered	25	8	19	6
Area				
Rural	25	6	17	5
Urban	25	22	30	13
NSS Region				
Eastern Plains	19	5	16	2
Western Plains	20	14	35	14
Cachar Plains	2	0	9	3
Central Brahmaputra Plains	54	6	6	0

Source: Calculated from unit level data of NSSO 71st and 75th Round

Table A 5.3 Assam 71st Round Reporting of Morbidity Binary Logistic Regression

Background Characteristics	Acute Ailment			Chronic Ailment		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender						
Male^						
Female	0.96951	0.13598	-0.00056	1.18855	0.26123	0.00149
Age						
60 and above^						
46-59	0.96728	0.24872	-0.00112	0.39748*	0.10002	-0.02797
31-45	0.64011	0.17442	-0.01256	0.21241*	0.06507	-0.03742
15-30	0.26892*	0.07875	-0.02607	0.06509*	0.02744	-0.04532
0-14	0.41341*	0.10757	-0.02074	0.01820*	0.00928	-0.04792
Marital Status						
Others^						
Currently Married	0.69837***	0.13698	-0.00653	0.75089	0.19324	-0.00247
Education						
Illiterate^						
Below Primary & Primary	0.62612**	0.10333	-0.00961	0.52607*	0.12166	-0.00710
Secondary & Higher Secondary	0.49651***	0.13113	-0.01301	0.22762*	0.09606	-0.01191
Graduate & above	0.39189***	0.20334	-0.01579	0.26617**	0.14491	-0.01127
Type of Latrine Used						
Pit Latrine^						
No facility	0.42887	0.44902	-0.01040			
Flush/Septic Tank	0.97711	0.16764	-0.00041	0.39472*	0.09439	-0.00826
Others	1.59799***	0.42098	0.01047	0.97778	0.37267	-0.00029
Drinking water						
Piped/Tap^						
Tube well/Pacca well	1.40924	0.41658	0.00578	1.71244	0.78358	0.00379
Open Source	0.19821**	0.15107	-0.01167	5.23761*	3.03880	0.02010
Others	1.52879	0.65988	0.00745	1.89708	1.17125	0.00474
Religion						
Hindu^						
Muslim	1.43152***	0.30539	0.00708	1.59664	0.49273	0.00440
Others	0.28675	0.29060	-0.01212	1.38708	1.11363	0.00289
Social Group						
Others^						
ST	1.10695	0.28374	0.00170	1.44478	0.55714	0.00312
SC	0.90318	0.27977	-0.00155	1.44642	0.61450	0.00313
OBC	1.72225*	0.35529	0.01130	1.97989**	0.59982	0.00668
Area of Residence						
Urban^						
Rural	0.80206	0.16383	-0.00401	0.69566	0.23485	-0.00313
NSS Region						
Western Plains^						
Eastern Plains	1.32148	0.29234	0.00410	0.39174*	0.10401	-0.01093
Cachar Plains	0.97103	0.32337	-0.00037	0.02545*	0.01169	-0.01845
Central Brahmaputra Plains	2.69755*	0.50798	0.02106	0.43176*	0.13085	-0.01016
Covered Under Health Insurance						
Covered^						
Not Covered	0.62670	0.22347	-0.00850	1.93713	1.40554	0.00571
Household Size	0.99404	0.03684	-0.00011	1.05499	0.04990	0.00046
log_mpce	0.94800	0.16146	-0.00097	5.02242*	1.39897	0.01394

Source: Calculated from unit level data of NSSO 71st Round

* p <0.01, ** p< 0.05, *** p< 0.1

71st Round Acute: Number of Observation = 11,411; Wald chi-square = 135.20; Probability = 0.0000; pseudo *R2 = 0.0707;* log pseudo likelihood = - 991.47927

71st Round Chronic: Number of Observation = 11,299; Wald chi-square = 385.72; Probability = 0.0000; pseudo *R2 = 0.2290;* log pseudo likelihood = -459.31835

^ Reference group or base category

Table A 5.4 Assam 75th Round Reporting of Morbidity Binary Logistic Regression

Socioeconomic Factors	Acute Ailment			Chronic Ailment		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender						
Male^						
Female	1.19061	0.18434	0.00223	1.00487	0.22810	0.00005
Age						
60 and above^						
46-59	0.45518*	0.11656	-0.01868	0.40821*	0.08105	-0.02982
31-45	0.21593*	0.06327	-0.02732	0.10192*	0.02933	-0.04722
15-30	0.21146*	0.05565	-0.02748	0.05171*	0.01618	-0.05023
0-14	0.42466*	0.11566	-0.01977	0.01161*	0.00713	-0.05267
Marital Status						
Others^						
Currently Married	0.67353**	0.12846	-0.00504	1.07173	0.20778	0.00066
Education						
Illiterate^						
Below Primary & Primary	0.93155	0.20802	-0.00092	0.93241	0.19760	-0.00074
Secondary & Higher Secondary	0.86043	0.23414	-0.00188	0.66352	0.18207	-0.00376
Graduate & above	1.08336	0.38094	0.00111	0.67961	0.23238	-0.00357
Type of Latrine Used						
Pit Latrine^						
No facility	2.23128*	0.59054	0.01435	0.53972	0.32128	-0.00418
Flush/Septic Tank	1.04377	0.16333	0.00053	1.20659	0.25180	0.00178
Others	0.48352	0.49045	-0.00630			
Drinking water						
Piped/Tap^						
Tube well/Pacca well	0.83943	0.18878	-0.00233	2.04934*	0.56896	0.00549
Open Source	1.44903	0.60506	0.00637	2.12758	1.12093	0.00588
Others				3.81526**	2.20735	0.01375
Religion						
Hindu						
Muslim	1.20839	0.22010	0.00243	1.03217	0.21562	0.00030
Others	2.50286*	0.73651	0.01692	2.03488	1.02480	0.00893
Social Group						
Others^						
ST	1.20671	0.26678	0.00232	0.52725**	0.16554	-0.00520
SC	1.91732*	0.42000	0.01011	1.01412	0.28189	0.00015
OBC	1.13747	0.20327	0.00155	0.82852	0.19592	-0.00184
Area of Residence						
Urban^						
Rural	0.88670	0.17829	-0.00153	0.60411**	0.12602	-0.00479
NSS Region						
Western Plains^						
Eastern Plains	0.34629*	0.06391	-0.01635	0.11678*	0.04258	-0.01751
Cachar Plains	0.24668*	0.06924	-0.01893	0.43122*	0.11624	-0.01090
Central Brahmaputra Plains	0.13497*	0.03798	-0.02184	0.04685*	0.02745	-0.01905
Health Insurance						
Covered^						
Not Covered	1.14437	0.40593	0.00172	0.65571	0.21575	-0.00401
Activity Status						
Employed^						
Unemployed	0.83299	0.17631	-0.00237	1.23083	0.30889	0.00185
Others	0.71077	0.27039	-0.00413	2.20841**	0.76006	0.00918
Not in workforce	1.13569	0.43147	0.00191			
Household Size	0.94796	0.03106	-0.00068	0.98648	0.04216	-0.00013
log_mpce	1.40185***	0.27559	0.00431	1.69144**	0.40670	0.00499

Source: Calculated from unit level data of NSSO 75th Round

* p <0.01, ** p< 0.05, *** p< 0.1

75th Round Acute: Number of Observation = 18.154; Wald chi-square = 247.71; Probability = 0.0000; pseudo *R2 = 0.0907;* log pseudo likelihood = - 1156.9959

75th Round Chronic: Number of Observation = 16,771; Wald chi-square = 462.99; Probability = 0.0000; pseudo *R2 = 0.2665;* log pseudo likelihood = -713.38836

^ Reference group or base category

Appendix to Chapter 6

Appendix 6 A.1: Note on Dietary Diversity

"Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals" (Kennedy et al 2011; FAO, 2011). It is widely documented that household dietary diversity score (HDDS) reflects the economic ability of a household to access different food groups in their diet. Increase in socioeconomic status and food security at household level is associated with an increased dietary diversity at household level (Hoddinot and Yohannes, 2002; Hatløy et al., 2000). At the individual level too, individual dietary diversity scores (IDDS) are calculated. Its main aim is to reflect the nutrient adequacy of the individual (FAO & FHI, 2016; Swindale & Bilinsky, 2006). Studies have shown nutrient adequacy of the diet of an individual is associated with an increase in individual dietary diversity score for different age groups (FAO, 2011; Foote et al., 2004; Arimond et al., 2010).

Most of the global studies, point towards and recommend that, adequacy in energy and essential nutrient intake is associated with individual's dietary variation. Ruel, 2003 suggest that, micronutrient deficiency is mostly associated with population whose diet consists of starchy staples. The most common method put forward for accessing the dietary diversity of such population at household or individual level is simply accessing different variety of food groups consumed in a specific recall period (Ruel, 2003).

The Food and Agriculture Organisation (FAO) and U.S. Agency for International Development (USAID, 2006) guidelines on dietary diversity score suggest, most often 12 food groups are considered for HDDS and 8 or 9 food groups for IDDS. Dietary diversity score is most often determined by counting the number of selected food groups consumed by a household or individuals over a reference period (Krebs-Smith, 1987; Lo¨wik,1999) which usually ranging from 1-3 days, and in some cases extends to 7 days or even to 15 days (Drewnowski et.al, 1997). The guideline indicates, the food groups are selected from a given array of recommended food groups, which can be 9, 10 or 12 or other than these. The basis of the classification of foodstuffs in different groups lies on the variability of nutrient density. It considers the number of groups in a daily diet of the individual or the household consumes (Swindale & Bilinsky, 2006; FAO 2011).

Individual Dietary Diversity along with age and sex can be used as a proxy measure for macro and micronutrient adequacy of diet. Also, if assessment of the nutrient adequacy of the diet is of primary concern it is best to collect information at the level of individual (FAO, 2011; FAO & FHI, 2016). Undernutrition and malnutrition also include condition of micronutrient deficiencies such as iron, calcium, vitamin A, vitamin D, magnesium, iodine, vitamin B12. Therefore, it is important to collect individual dietary diversity to understand nutrition and morbidity linkage.

Appendix 6 A.2 Health Care Seeking Behaviour of the Tea Plantation Workers

The health care seeking behaviour of the tea plantation workers and the corresponding demand for health care depends on various factors. The difference in self-reported morbidity reflects various dimensions. The basic dimension is that it reflects demand for healthcare or the health seeking behaviour (Akthar et.al, 2020). Fist one of the basic reasons that can be inferred is that, the plantation workers are wage labourers are entirely dependent on the wage they receive on daily basis for their work. Missing work means losing their wage, therefore there is a tendency to report their morbid condition as and when necessary, especially in the health care facility available within the tea estate. Secondly, the permanent workers and the temporary workers (only during the period when they are working in the plantation) are entitled to free healthcare at the healthcare facility within the tea estate. But at the same time, there are delays in reporting the diseases due to unawareness about the diseases, cultural and social beliefs (superstitious beliefs and initially depending on traditional healers and quacks) and the clash of timings of opening of healthcare facility and working hours, as pointed out during the in-depth interviews by the health facilitators. The real challenge on the part of the workers is accessing health care is when referral service is given to health facilities (especially government facility) outside the tea estate. The main hurdle faced is lack of vehicle to take the patient to the referral facility in terms of availability of vehicle and cost. Usually, the tea estates are remotely located from the district headquarters which pose challenge in accessing better facility. As discussed in chapter 7, most of the time referral service is given from the tea estate dispensary/hospital due to lack of doctors and basic testing facilities and equipment. This shows only accessing the available healthcare facility is not sufficient, but the quality of healthcare provided and the ability to access quality healthcare facility is more important. Therefore, demand for health care for any

ailment reported is based on various factors like nature of the ailment, availability of health care services and access to and ability to afford health care services.

Seeking of medical treatment

Table 6 A.2.1 shows, at the tea plantation workers level, out of 276 cases of acute ailment reported, 81.2 percent sought for medical treatment for acute ailment. For 329 cases of chronic ailment reported 83.6 percent sought for medical treatment. This shows a very high percentage of workers seeking for medical treatment, and the health care seeking behaviour of the plantation workers.

Table 6 A.2.1: Whether Ailment Treated on Medical Advice (Acute & Chronic Ailment) for Workers

Response	Acute Ailment		Chronic Ailment	
	Frequency	Percent	Frequency	Percent
No	52	18.8	54	16.4
Yes	244	81.2	275	83.6
Grand Total	**276**	**100**	**329**	**100**

Source: Primary data collected from household survey, September 2021-May 2022

Source of treatment availed

Looking at the source of treatment availed for reporting of acute and chronic ailment, shows they are mostly dependent on tea estate dispensary/hospital. For acute ailment the highest source of treatment is tea estate owned dispensary/hospital (153 cases, 55.4 percent) which is more than half of the acute ailment cases (see table 6.A.2.2). The percentage goes down when other source of treatment is sought. The overall reliance on government facility contributes a major portion. The total sum of source of treatment on government facility sums up to 18.1 percent. The percentage of private source of treatment is quite negligible. Similarly for chronic ailment (see table 6.A.2.3) the reliance on tea estate dispensary/hospital is highest (148 cases, 45 percent). However, for chronic ailment the reliance on government source of treatment (30.7 percent) is more compared to acute ailment as most of the time for chronic ailment referral is given to the nearest government healthcare facility.

Table 6 A.2.2: Source of Treatment availed for Reporting of Acute Ailment by Tea Plantation Workers

Source of Treatment	Frequency	Percent
Govt./public hospital (incl. HSC/PHC/CHC etc.)	14	5.1
Govt./public hospital (incl. HSC/PHC/CHC etc.), Tea Garden/Company own Dispensary/Hospital	20	7.2
Govt./public hospital (incl. HSC/PHC/CHC etc.), Tea Garden/Company own Dispensary/Hospital, Private	16	5.8
Tea Garden/Company own Dispensary/Hospital	153	55.4
Private	21	7.6
Other**	12	4.3
No medical treatment	40	14.5
Grand Total	**276**	**100**

Note: Private source of treatment includes: Pharmacy, Private Hospital, Private doctor/clinic

** Others include: mainly seeking treatment through superstitious beliefs and quack

Source: Primary data collected from household survey, September 2021-May 2022

Table 6 A.2.3: Source of Treatment availed for Reporting of Chronic Ailment by Tea Plantation Workers

Source of Treatment	Frequency	Percent
Govt./public hospital (incl. HSC/PHC/CHC etc.)	22	6.7
Govt./public hospital (incl. HSC/PHC/CHC etc.), Tea Garden/Company own Dispensary/Hospital	49	14.9
Govt./public hospital (incl. HSC/PHC/CHC etc.), Tea Garden/Company own Dispensary/Hospital, Private	30	9.1
Tea Garden/Company own Clinic/Hospital	148	45.0
Private	26	7.9
Other**	16	4.9
No medical treatment	38	11.6
Grand Total	**329**	**100.0**

Note: Private source of treatment includes: Pharmacy, Private Hospital, Private doctor/clinic

** Others include: mainly seeking treatment through superstitious beliefs and quack

Source: Primary data collected from household survey, September 2021-May 2022

Nearest healthcare facility outside tea estate

To understand what affects the healthcare seeking behaviour of the tea plantation workers in terms of availability of healthcare services other than the tea estate dispensary/hospital, data on nearest healthcare facility outside the tea estate was collected (see table 6 A.2.4). The data showed the highest percentage of other source of treatment mainly comprise of private facility which is most of the time is a private pharmacy (out of 352 responses for private facility, 327 were pharmacy) followed by government facility (34.7 percent).

Overall, it is observed that the health care seeking behaviour of the tea plantation workers depends mainly on the healthcare facility available within the tea estate.

Table 6 A.2.4: Nearest Healthcare Facility Outside the Tea Estate of the Sample Household

Type of Facility Available	Frequency	Percent
Govt./public hospital (incl. HSC/PHC/CHC etc.)	242	34.7
Govt./public hospital (incl. HSC/PHC/CHC etc.); Private	90	12.9
Private	352	50.4
No Facility	12	1.7
Others (Mobile medical unit)	2	0.3
Total	**698**	100.0

Note: Private source of treatment includes: Pharmacy, Private Hospital, Private doctor/clinic
*Out of 352 responses for private facility, 327 were Pharmacy
Out of 723 households, 25 responses were blank
Source: Primary data collected from household survey, September 2021-May 2022

Appendix 6 A.3: Chapter 6 appendix table

Table 6 A.3.1 Reporting of Acute and Chronic Ailment by Sample Population per 100

Variable	Total Sample	Reporting Acute Ailment	Per 100 Reporting of Acute Ailment	Reporting Chronic Ailment	Per 100 Reporting of Chronic Ailment
Gender					
Male	1,705	248	14.5	286	16.8
Female	1,820	298	16.4	378	20.8
Age					
0-14	903	106	11.7	51	5.6
15-25	904	97	10.7	93	10.3
26-35	718	127	17.7	138	19.2
36-45	406	97	23.9	129	31.8
46-55	299	62	20.7	122	40.8
56-65	196	37	18.9	82	41.8
65-75	53	15	28.3	29	54.7
75 and above	15	2	13.3	7	46.7
Marital Status					
Currently Married	1,902	237	12.5	252	13.2
Others	1,618	307	19	410	25.3
Education					
Not literate	1,032	185	17.9	338	32.8
Below primary & Primary	1,751	246	14	238	13.6
Secondary & Higher Secondary	374	51	13.6	63	16.8
Graduate and above	34	5	14.7	1	2.9
Not Applicable	314	56	17.8	17	5.4
Occupation					
Dependent	1,619	180	11.1	183	11.3
Permanent Tea plantation worker	766	183	23.9	229	29.9
Temporary Tea plantation worker	614	116	18.9	118	19.2
Retired Tea plantation worker	199	31	15.6	84	42.2
Self Employed/Trade	43	8	18.6	10	23.3

Salaried/Pension	84	13	15.5	15	17.9
Daily wage Agri/non Agri	192	13	6.8	24	12.5
Activity Status					
Employed	1,643	323	19.7	381	23.2
Unemployed	1,870	222	11.9	280	15
Religion					
Hindu	3,292	513	15.6	616	18.7
Others	233	33	14.2	48	20.6
Source of Water					
Tube well	2,754	472	17.1	567	20.6
Pipe Water	598	50	8.4	70	11.7
Others	173	24	13.9	27	15.6
Sanitation					
Pit Latrine	2,265	287	12.7	377	16.6
No Facility	381	47	12.3	52	13.6
Flush Toilet	761	192	25.2	216	28.4
Shared Latrine	118	20	16.9	19	16.1
Household Size					
1-4	1,148	215	18.7	242	21.1
5-8	2,153	316	14.7	393	18.3
8 and above	224	15	6.7	29	12.9

Source: Calculated from survey primary data

Table 6 A.3.2 Reporting of Acute and Chronic Ailment at Population Level - Binary Logistic Regression

Socioeconomic Factors	Acute Ailment			Chronic Ailment		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender						
Male^						
Female	1.17904	0.12452	0.02023	1.22913***	0.12993	0.02632
Age	1.01927*	0.00459	0.00234	1.04720*	0.00457	0.00588
Marital Status						
Others^						
Currently Married	1.12200	0.13562	0.01414	1.15005	0.12653	0.01783
Education						
Not Literate^						
Below primary & Primary	1.30792***	0.18313	0.03045	0.82547	0.10903	-0.02478
Secondary & Higher Secondary	1.17059	0.23618	0.01725	0.93822	0.18046	-0.00849
Graduate and above	1.39539	0.69653	0.03856	0.13465***	0.13836	-0.15915
Not Applicable	3.83790*	0.97201	0.20380	1.06869	0.34930	0.00911
Occupation						
Salaried/Pension^						
Permanent Tea Garden Worker	1.63078	0.53171	0.07075	1.37640	0.42410	0.04280
Temporary Tea Garden Worker	1.39544	0.46297	0.04607	1.07528	0.33997	0.00916
Retired Tea Garden Worker	0.70506	0.27354	-0.03890	0.91935	0.32155	-0.01020
Self Employed/Trade	1.26671	0.64269	0.03175	1.52400	0.71321	0.05778
Dependent	0.71593	0.23656	-0.03739	0.94479	0.29649	-0.00694
Daily wage agri/non agri	0.42086**	0.17957	-0.08097	0.72535	0.26691	-0.03661
Religion						
Hindu^						
Others	0.76592	0.15663	-0.03276	0.94974	0.17676	-0.00658
Source of Water						
Tube well^						

Pipe Water	2.16358*	0.34758	0.07992	1.88405*	0.27088	0.07257
Others	2.21145*	0.61552	0.08282	2.04921*	0.56843	0.08403
Sanitation						
Pit Latrine^						
No Facility	1.09154	0.18844	0.00968	0.95727*	0.16981	-0.00511
Flush Toilet	2.24638*	0.25025	0.11245	2.07154	0.22885	0.10258
Shared Latrine	1.38155	0.37565	0.03863	1.09174	0.31164	0.01063
log_mpce	0.98914	0.07182	-0.00134	1.16332**	0.08833	0.01930

Source: Calculated from Primary Data collected in-between September 2021 to April 2022

* p <0.01, ** p< 0.05, *** p< 0.1

Acute Ailment: Number of observations = 3468; Wald chi-square = 187.81; Probability = 0.0000; Pseudo R2 = 0.0702; Log pseudolikelihood = -1391.3738

Chronic Ailment: Number of observations = 3468; Wald chi-square = 405.38; Probability = 0.0000; Pseudo R2 = 0.1522; Log pseudolikelihood = -1409.7863

^ Reference group

Table 6 A.3.3

Reporting of Acute and Chronic Ailment per 100 persons for Tea plantation workers by Background Characteristics

Variable	Total Sample	Reporting Acute Ailment	Per 100 Reporting of Acute Ailment	Reporting Chronic Ailment	Per 100 Reporting of Chronic Ailment
Gender					
Male	581	118	20.3	133	22.9
Female	688	158	23	196	28.5
Age					
16-25	259	39	15.1	46	17.8
26-35	461	96	20.8	101	21.9
36-45	314	77	24.5	94	29.9
46-55	177	49	27.7	66	37.3
55-68	53	14	26.4	21	39.6
Marital Status					
Others	276	62	22.5	66	23.9
Currently Married	989	213	21.5	262	26.5
Education					
Not Literate	565	131	23.2	169	29.9
Below Primary & Primary	575	116	20.2	126	21.9
Secondary and above	120	27	22.5	30	25
Occupation					
Permanent	727	176	24.2	210	28.9
Temporary	542	100	18.5	119	22
Sanitation					
Pit Latrine	837	146	17.4	186	22.2
No Facility	140	29	20.7	33	23.6
Flush Toilet	251	91	36.3	102	40.6
Shared Latrine	41	10	24.4	8	19.5
Religion					
Hindu	1,188	262	22.1	304	25.6
Others	81	14	17.3	25	30.9
HH Size					
1-4	511	123	24.1	126	24.7

5-8	700	145	20.7	195	27.9
8 and above	58	8	13.8	8	13.8
BMI Category					
Low	322	84	26.2	100	31.2
Normal	550	135	24.5	149	27.1
Overweight	49	11	22.4	13	26.5
Obese	7	1	14.3	3	42.9
BMI Low/Others					
Normal and above	606	147	24.3	165	27.2
Low	322	84	26.2	100	31.2
Food Groups Consumed (Daily)					
1 Food Group Consumed	1	0	0.0	1	100.0
2 Food Groups Consumed	19	4	21.1	4	21.1
3 Food Groups Consumed	156	32	20.5	45	28.8
4 Food Groups Consumed	287	51	17.8	68	23.7
5 Food Groups Consumed	364	73	20.1	80	22.0
6 Food Groups Consumed	183	49	26.8	49	26.8
7 Food Groups Consumed	179	45	25.1	56	31.3
8 Food Groups Consumed	19	5	26.3	7	36.8
9 Food Groups Consumed	13	6	46.2	7	53.8
10 Food Groups Consumed	3	0	0.0	1	33.3
11 Food Groups Consumed	1	1	100.0	1	100.0
At Least Four Food Groups Consumed daily					
No	176	36	20.5	50	28.4
Yes	1,049	230	21.9	269	25.6
Pulses Consumed Daily					
No	556	92	16.5	116	20.9
Yes	669	174	26	203	30.3
Egg/Fish/Meat either consumed Daily					
No	1,144	245	21.4	286	25
Yes	81	21	25.9	33	40.7
Beverage consumed Daily					
No	560	116	20.7	149	26.6
Yes	665	150	22.6	170	25.6
Intoxicant (Smoke/Tobacco/Alcohol) Daily					
No	562	122	21.7	138	24.6
Yes	663	144	21.7	181	27.3
Number of Workplace Hazard Reported					
No Hazard Reported	281	60	21.4	79	28.1
1 Hazard Report	390	92	23.6	84	21.5
2 Hazards Reported	195	56	28.7	79	40.5
3 Hazards Reported	172	34	19.8	54	31.4
4 Hazards Reported	167	20	12	22	13.2
5 Hazards Reported	54	14	25.9	9	16.7
Workplace Hazard Reported					
No Hazard Reported	281	60	21.4	79	28.1
At least One Hazard Report	978	216	22.1	248	25.4

Source: Calculated from survey primary data

Table 6 A.3.4 Reporting of Acute and Chronic Ailment at Workers Level - Binary Logistic Regression

Socioeconomic Factors	Acute Ailment			Chronic Ailment		
	Odds Ratio	Robust SE	dy/dx	Odds Ratio	Robust SE	dy/dx
Gender						
Male^						
Female	1.19905	0.21964	0.03200	1.30084	0.23576	0.04915
Age	1.02173**	0.00869	0.00379	1.03841*	0.00893	0.00704
Marital Status						
Others^						
Currently Married	0.77554	0.15063	-0.04482	1.13308	0.22135	0.02335
Education						
Not Literate^						
Below Primary & Primary	1.07961	0.21199	0.01344	0.86715	0.16856	-0.02645
Secondary & above	1.18218	0.36834	0.02996	1.15680	0.36889	0.02847
Occupation						
Permanent Worker^						
Temporary Worker	0.95272	0.16588	-0.00854	0.95748	0.16075	-0.00812
Sanitation						
Pit Latrine^						
No Facility	1.17395	0.32065	0.02685	1.14093	0.29214	0.02375
Flush Toilet	2.27720*	0.43334	0.16008	2.39897*	0.44893	0.17942
Shared Latrine	1.67884	0.69229	0.09467	0.72717	0.33953	-0.05159
Religion						
Hindu^						
Others	0.72452	0.24702	-0.05681	1.37952	0.42353	0.06012
log_mpce	1.05907	0.13164	0.01012	0.98747	0.12667	-0.00236
Pulses Consumption Daily						
No^						
Yes	1.78757*	0.33024	0.10241	1.27987	0.22086	0.04611
Egg/Fish/Meat Daily						
No^						
Yes	1.23939	0.37316	0.03784	2.28514*	0.62127	0.15443
Beverage Consumption Daily						
No^						
Yes	0.98795	0.15968	-0.00214	0.91904	0.14557	-0.01578
Intoxicant (Smoke/Tobacco/Alcohol) Daily						
No^						
Yes	0.84243	0.14727	-0.03023	1.13838	0.19403	0.02422
BMI						
Normal & above^						
Low	1.04394	0.17644	0.00758	1.15342	0.18726	0.02667
Reporting Work Place Hazards						
No^						
Yes	1.36361	0.28899	0.05468	0.85437	0.16883	-0.02941

Source: Calculated from Primary Data collected in-between September 2021 to April 2022

* p <0.01, ** p< 0.05, *** p< 0.1

Acute Ailment: Number of observations = 902; Wald chi-square = 52.61; Probability = 0.0000; Pseudo R2 = 0.0502; Log pseudolikelihood = -481.22294

Chronic Ailment: Number of observations = 902; Wald chi-square = 70.6; Probability = 0.0000; Pseudo R2 = 0.0702; Log pseudolikelihood = -501.99991

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Survey Schedule for the Primary Survey

Survey of Morbidity & Mortality Rates Among Tea Garden Workers of Assam

Indian Institute of Technology Guwahati, Assam; India

Household No.						
Date						
Investigator name						
Start Time						

TABLE 1: IDENTIFICATION			
Name of the Household Head		**Phone number (if available)**	
District		**Mother tongue of the respondent**	
Block		**Religion**	

Where do you reside? (Location/address)		**Social Group/Jati (Specify name)**	
Are you residing in the tea garden quarter?		**How many members in your family are tea garden workers?**	
Name of the tea garden where you are working?			
Gram Panchayat/Revenue Village			

Table 2: Demographic Details of Household Members

Member ID	Name	Relationship with Head	sex	Age		Marital Status	Age at Marriage	General Education	Occupation Status	Activity Status	Whether suffering from any chronic ailment	Whether suffering from any ailment in last 30 days other than chronic ailment	Whether hospitalized in the last 365 days	Whether covered under any Health Insurance
				Years	Months									
1.														
2.														
3.														
4.														
5.														

		Self=0, Spouse-1, Child – 2, Spouse of Married Child – 3, Parent – 4, Grand-parent – 5, Grand-child -6, Brother/Sister – 7, In-laws-8, Other relatives – 9, Servant/Employee -10, Others -11	Male – 1 Female – 2 Transgender- 3	Age in completed years; Up to the nearest month in case of children below 5 years of age	Never married -1 Currently married- 2 Widowed- 3 Separated/Divorced- 4 Other (specify)- 5		not literate -01, literate without any schooling -02, literate without formal schooling: through NFEC -03, literate through TLC/ AEC -04, others -05; literate with formal schooling: below primary -06, primary -07, upper primary/middle -08, secondary -10, higher secondary -11, diploma /certificate course (upto secondary)-12, diploma/certificate course (higher secondary)-13, diploma/certificate course(graduation & above) -14, graduate -15, post graduate and above -16 not applicable-17	Agriculture & Allied-1, Agricultural labourer-2, permanent tea garden worker-3, temporary tea garden worker-4, daily wage non-agricultural worker-5, homemaker-6, petty business/self-employed-7, trade/business-8, salaried service (reg)-9, salaried but casual-10, student-11, pensioner-12, not applicable-13,retired tea-garden worker-14	Currently employed full time-1, currently employed part time-2 not working but seeking or available for work-3, not available for work-4, household work/child care-5	Yes- 1 No- 2	Yes- 1 No- 2	Yes- 1 No- 2	Yes- 1 No- 2

Table 3: Self - Reported Morbidity of the Workers			
Item		**Tea Garden Worker 1**	**Tea Garden Worker 2**
Member ID			
1.	Whether suffered from any ailment in the last 30 days	Yes- 1 No- 2	Yes- 1 No- 2
2.	Whether suffering from chronic ailment	Yes- 1 No- 2	Yes- 1 No- 2
3.	Whether hospitalized in the last 365 days	Yes- 1 No- 2	Yes- 1 No- 2
4.	Whether tested positive for Covid-19 last 365 days	Yes- 1 No- 2	Yes- 1 No- 2

Table 4: Nature of Ailment Reported by Workers						
Items	**Tea Garden Worker 1**			**Tea Garden Worker 2**		
Member ID						
Nature of Ailment	**Any ailment in the last 30 days**	**Chronic Ailment**	**Hospitalized in the last 365 days**	**Any ailment in the last 30 days**	**Chronic Ailment**	**Hospitalized in the last 365 days**
INFECTION Fever with loss of consciousness or altered consciousness- 1 Malaria- 2 Fever due to DIPHTHERIA, WHOOPING COUGH -3 All other fevers (Includes typhoid, Fever with rash/ eruptive lesions and fevers of unknown origin, all specific fevers that do not have a confirmed diagnosis)- 4						

TUBERCULOSIS- 5 Filariasis-6 Tetanus- 7 HIV/AIDS -8 Other sexually transmitted diseases- 9 Jaundice- 10 Diarrheas/ dysentery/ increased frequency of stools with or without blood and mucus in stools-11 Worms' infestation-12 Covid-19-13 CANCERS Cancer (known or suspected by a physician) and occurrence of any growing painless lump in the body-14 BLOOD DISEASES Anaemia (any cause)-15 Bleeding disorders-16 ENDOCRINE, METABOLIC, NUTRITIONAL Diabetes-17 Under-nutrition-18 Goitre and other diseases of the thyroid-19 Others (including obesity)-20 PSYCHIATRIC & NEUROLOGICAL Mental retardation-21 Mental disorders-22 Headache-23 Seizures or known epilepsy-24 Weakness in limb muscles and difficulty in movements-25 Stroke/ hemiplegia/ sudden onset weakness or loss of speech in half of body-26 Others including memory loss, confusion-27 EYE Discomfort/pain in the eye with redness or swellings/ boils-28 Cataract-29 Glaucoma-30 Decreased vision (chronic) NOT including where decreased vision is corrected with glasses-31						

Others (including disorders of eye movements – strabismus, nystagmus, ptosis and adnexa)-32 EAR Earache with discharge/bleeding from ear/infections - 33 Decreased hearing or loss of hearing-34 CARDIO-VASCULAR Hypertension-35 Heart disease: Chest pain, breathlessness-36 RESPIRATORY Acute upper respiratory infections (cold, runny nose, sore throat with cough, allergic colds included)-37 Cough with sputum with or without fever and NOT diagnosed as TB-38 Bronchial asthma/ recurrent episode of wheezing and breathlessness with or without cough over long periods or known asthma)-39 GASTRO-INTESTINAL Diseases of mouth/teeth/gums-40 Pain in abdomen: Gastric and peptic ulcers/ acid reflux/ acute abdomen-41 Lump or fluid in abdomen or scrotum-42 Gastrointestinal bleeding-43 SKIN Skin infection (boil, abscess, itching) and other skin disease-44 MUSCULO-SKELETAL Joint or bone disease/ pain or swelling in any of the joints, or swelling or pus from the bones-45 Back or body aches-46 GENITO-URINARY INJURIES Any difficulty or abnormality in urination-47 Pain the pelvic region/reproductive tract infection/ Pain in male genital area-48 Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders incl. male/female infertility-49 OBSTETRIC						

Pregnancy with complications before or during labour (abortion, ectopic pregnancy, hypertension, complications during labour)-50 Complications in mother after birth of child-51 Illness in the new-born/ sick new-born-52 INJURIES Accidental injury, road traffic accidents and falls-53 Accidental drowning and submersion-54 Burns and corrosions-55 Poisoning-56 Intentional self-harm-57 Assault-58 Contact with venomous/harm-causing animals and plants-59 Symptom not fitting into any of above categories-60 Could not even state the main symptom-61 Childbirth (for both live birth and stillbirth) normal delivery-62 Caesarean-63 other types of delivery-64 Post-covid vaccination fever-65 Hypotension (low pressure)-66 Undiagnosed diseases-67 Piles-68						

Table 5: Healthcare seeking behaviour, healthcare expenditure and insurance coverage for any ailment and chronic ailment					
Items		**Tea Garden Worker 1**		**Tea Garden Worker 2**	
Member ID					
1.	How often do you visit health care facility or consult any healthcare personnel?	Visit to Doctor: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Hospital Outpatient: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Emergency service: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Company or Industry Clinic: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Call doctor at home: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Consult doctor over phone: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Consult AWW, ASHA or ANM: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Visit health camp: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7		Visit to Doctor: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Hospital Outpatient: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Emergency service: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Company or Industry Clinic: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Call doctor at home: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Consult doctor over phone: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Consult AWW, ASHA or ANM: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7 Visit health camp: Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7	
Reporting of Self-Reported Morbidity		**Any ailment in the last 30 days**	**Chronic Ailment**	**Any ailment in the last 30 days**	**Chronic Ailment**

2.	Current Status of the ailment	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4
3.	Whether Ailment is treated or not on medical advice?	Yes -1, No- 2	Yes -1, No- 2	Yes -1, No- 2	Yes -1, No- 2
4.	If not treated, why?	No medical facility available in the neighbourhood- 1 Facility too expensive- 2 Cannot afford to wait long due to domestic/economic engagement- 3 Ailment not considered serious enough- 4 Familial/religious belief- 5 Others- 6	No medical facility available in the neighbourhood- 1 Facility too expensive- 2 Cannot afford to wait long due to domestic/economic engagement- 3 Ailment not considered serious enough- 4 Familial/religious belief- 5 Others- 6	No medical facility available in the neighbourhood- 1 Facility too expensive- 2 Cannot afford to wait long due to domestic/economic engagement- 3 Ailment not considered serious enough- 4 Familial/religious belief- 5 Others- 6	No medical facility available in the neighbourhood- 1 Facility too expensive- 2 Cannot afford to wait long due to domestic/economic engagement- 3 Ailment not considered serious enough- 4 Familial/religious belief- 5 Others- 6

5.	If not treated, then whom consulted?	self / other household member/ friend – 1 medicine shop – 2 others - 9	self / other household member/ friend – 1 medicine shop – 2 others - 9	self / other household member/ friend – 1 medicine shop – 2 others - 9	self / other household member/ friend – 1 medicine shop – 2 others - 9
6.	Whether the ailment prevented the individual from doing his normal work?	Yes -1, No- 2	Yes -1, No- 2	Yes -1, No- 2	Yes -1, No- 2
7.	If so, for how many days?				
8.	No. of wage days works lost due to illness				
9.	Source of Treatment	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital- 3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital- 3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital- 3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital- 3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)
10.	Reason for not availing government	required specific services not available- 1 No nearby facility- 2 Facility timing not convenient- 3	required specific services not available- 1 No nearby facility- 2	required specific services not available- 1 No nearby facility- 2	required specific services not available- 1 No nearby facility- 2

	source of treatment	Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9, others- 10	Facility timing not convenient- 3 Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9 others- 10	Facility timing not convenient- 3 Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9 others- 10	Facility timing not convenient- 3 Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9 others- 10
11.	System of Medicine	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5
12. .	Whether any medical service provided free (fully/partially) by	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5

13.	Medical Expenditure for treatment (in Rs)	Doctor's fee …………………………… Medicine ……………………………... Diagnostic Test …………………….. Other medical expenditure if any……………………..	Doctor's fee …………………………… Medicine ……………………………... Diagnostic Test …………………….. Other medical expenditure if any……………………..	Doctor's fee …………………………… Medicine ……………………………... Diagnostic Test …………………….. Other medical expenditure if any……………………..	Doctor's fee …………………………… Medicine ……………………………... Diagnostic Test …………………….. Other medical expenditure if any……………………..
14.	Other non-medical expenditure for treatment (in Rs)	Transportation …………………….. Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……………………………………… …	Transportation …………………….. Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……………………………………… …	Transportation …………………….. Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……………………………………… …	Transportation …………………….. Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……………………………………… …
15.	Whether covered under any health care insurance?	EMPLOYEES STATE INSURANCE SCHEME (ESIS)……….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2 STATE HEALTH INSURANCE SCHEME…………………….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)………….4 AYUSHMAN BHARAT…………………….5 ATAL AMRIT ABHIYAN………………….6	EMPLOYEES STATE INSURANCE SCHEME (ESIS)……….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2 STATE HEALTH INSURANCE SCHEME…………………….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)………….4 AYUSHMAN BHARAT…………………….5 ATAL AMRIT ABHIYAN………………….6	EMPLOYEES STATE INSURANCE SCHEME (ESIS)……….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2 STATE HEALTH INSURANCE SCHEME…………………….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)………….4 AYUSHMAN BHARAT…………………….5 ATAL AMRIT ABHIYAN………………….6	EMPLOYEES STATE INSURANCE SCHEME (ESIS)……….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2 STATE HEALTH INSURANCE SCHEME…………………….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)………….4 AYUSHMAN BHARAT…………………….5 ATAL AMRIT ABHIYAN………………….6

		COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER………..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE……………….10 OTHER……………….11	COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER………..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE……………….10 OTHER……………….11	COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER………..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE……………….10 OTHER……………….11	COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER………..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE……………….10 OTHER……………….11
16.	Have you availed insurance in last one year? (Yes-1, No-2)				
17.	Total amount received as reimbursement under health insurance				
18.	Major source of finance for treatment	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5

Table 6: Healthcare seeking behaviour and healthcare expenditure for hospitalization in the last 365 days			
Items		**Tea Garden Worker 1**	**Tea Garden Worker 2**
Member ID			
1.	Current Status of the ailment	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4	Started before the reference period and still continuing -1 Started before the reference period and has ended -2 Started within the reference period and continuing -3 Started within the reference period and has ended -4
2.	When admitted to the hospital?	during last 15 days – 1 16 days to 365 days ago – 2 more than 365 days ago - 3	during last 15 days – 1 16 days to 365 days ago – 2 more than 365 days ago - 3
3.	Number of cases of Hospitalization last 365 days?		
4.	When discharged from hospital?	not yet -1 during last 15 days -2 16 days to 365 days ago -3	not yet -1 during last 15 days -2 16 days to 365 days ago -3
5.	Duration of stay at hospital (no. of days)		
6.	Whether the ailment prevented the individual from doing his normal work?	Yes -1, No- 2	Yes -1, No- 2
7.	If so, for how many days?		

8.	No. of wage days works lost due to illness		
9.	Source of Treatment	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital-3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Tea Garden/Company own Clinic/Hospital-3 private hospital -4 private doctor/clinic -5 informal health care provider -6 Pharmacy – 7 Health Camp- 8 Other- 9 (specify)
10.	Reason for not availing government source of treatment	Required specific services not available- 1 No nearby facility- 2 Facility timing not convenient- 3 Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9 others- 10	Required specific services not available- 1 No nearby facility- 2 Facility timing not convenient- 3 Health personnel often absent- 4 available but quality not satisfactory- 5 quality satisfactory but facility too far- 6 quality satisfactory but involves long waiting- 7 financial constraint- 8 preference for a trusted doctor/hospital- 9 others- 10
11.	System of Medicine	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5	Allopathy- 1 Indian system of medicine- 2 (desi dawai: ayurveda, unani or siddha) Homoeopathy- 3 Yoga & Naturopathy- 4 Other- 5

12.	Whether any treatment received before hospitalization?	Yes- 1, No- 2	Yes- 1, No- 2
13.	Whether treatment continued after discharged from hospital?	Yes- 1, No- 2	Yes- 1, No- 2
14.	Whether any medical service provided free (fully/partially) by	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5	Government/Public ……1 Private (NGO, Charitable trust etc)…2 Both (1) & (2)……..3 Tea Garden Company Provided…..4 Others…..5
15.	Medical Expenditure for treatment (in Rs)	Doctor's fee ……1 Surgery fee……2 Bed/Cabin fee……3 Medicine ……...4 Diagnostic Test ……5 Other medical expenditure if any……6	Doctor's fee ……1 Surgery fee……2 Bed/Cabin fee……3 Medicine ……...4 Diagnostic Test ……5 Other medical expenditure if any……6
16.	Other non-medical expenditure for treatment (in Rs)	Transportation ……1 Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……2	Transportation ……1 Other Expenditures (registration fee, food, expenditure of the person accompanying the patient etc.) ……2
17.	Whether covered under any health care insurance?	EMPLOYEES STATE INSURANCE SCHEME (ESIS)…….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2	EMPLOYEES STATE INSURANCE SCHEME (ESIS)…….1 CENTRAL GOVERNMENT HEALTHSCHEME (CGHS)……2

		STATE HEALTH INSURANCE SCHEME…….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)……..4 AYUSHMAN BHARAT……..5 ATAL AMRIT ABHIYAN…….6 COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER……..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE…….10 OTHER……..11	STATE HEALTH INSURANCE SCHEME…….3 RASHTRIYA SWASTHYA BIMA YOJANA(RSBY)……..4 AYUSHMAN BHARAT……..5 ATAL AMRIT ABHIYAN…….6 COMMUNITY HEALTH INSURANCE PROGRAMME…… 7 OTHER HEALTH INSURANCE THROUGH EMPLOYER……8 MEDICAL REIMBURSEMENT FROM EMPLOYER……..9 PRIVATELY PURCHASED COMMERCIAL HEALTH INSURANCE…….10 OTHER……..11
18.	Have you availed insurance in last one year? (Yes-1, No-2)		
19.	Total amount received as reimbursement under health insurance		
20.	Major source of finance for treatment	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5	household income/ savings- 1 borrowings- 2 sale of physical assets- 3 contribution from friends and relatives- 4 other sources- 5

Table 7: Household Income			
Table 7.1: Income from Agriculture and Allied Activities			
Crop 1	**Output**	**Input**	**Sale**
Crop 2			
Crop3			
Tea Plantation			
Livestock and Fishery			

Table 7.2 Household Income from Wages, Salaries, Remittances, Earnings, Scholarships, Pensions		
Member ID	**Source of earning**	**Net earnings**

Table 8: Household Consumption-Expenditure (in last one month in Rs)											
8.1 Household Expenditure on Food items											
Grocery	**Vegetables & Fruits**	**Egg, fish & meat**	**Milk**	**Do you feel you had less food in the last one year (during the pandemic)? (Yes-1, No-2)**							
8.2 Household Expenditure on Non-Food items											
Medical Expenses (outpatient)	**Medical Expenses (in-patient)**	**Medical Expenses on medicines**	**Amount covered under health Insurance**	**Education**	**Household Electricity**	**Cooking Fuel**	**House Rent**	**Mobile/TV/Newspaper recharge**	**Transportation**	**Repayment of any loans**	**Any other**

Table 9: ANTHROPOMETRIC DETAILS			
Item		**Tea Garden Worker 1**	**Tea Garden Worker 2**
Member ID			
1.	Height (cm)		
2.	Weight (kg)		

Table 10: Consumption of different food items, smoking, tobacco and alcohol by the workers											
Items		**Tea Garden Worker 1**					**Tea Garden Worker 2**				
Member ID											
Which are the following meals that you take per day? (tick the meals)		**Breakfast**	**Snacks**	**Lunch**	**Snacks**	**Dinner**	**Breakfast**	**Snacks**	**Lunch**	**Snacks**	**Dinner**
How often do you yourself eat the following food items: daily, weekly, occasionally, or never?		**Daily**	**Weekly**	**Occasionally**		**Never**	**Daily**	**Weekly**		**Occasionally**	**Never**
1.	Staples (rice, wheat, millets etc.)										
2.	Pulses and Beans (different types of dal, soybean, kidney beans, chickpeas etc.)										
3.	Potatoes & Onions										
4.	Non-leafy vegetables										
5.	Green leafy vegetables										
6.	Fruits										
7.	Milk & Dairy Products (eg. butter, curd, cheese, paneer etc.)										
8.	Egg										
9.	Fish										
10.	Meat										
11.	Packaged Food (eg. chips, biscuits, sweets etc.)										

12.	Processed Food (eg. processed meat, fish etc.)								
13.	Edible Oil								
14.	Beverages (eg. coffee, tea)								
15.	Cigarette, bidi, any other tobacco								
16.	Alcohol								
17.	What did you have for food in last 24 hours?								

TABLE 11: Worker's detail of workplace conditions and facilities available for workers			
Items		**Tea Garden Worker 1**	**Tea Garden Worker 2**
Member ID			
1.	Whether Permanent Worker or Non- Permanent Worker at the tea garden	Permanent……1 Non- Permanent……..2 (if 2, for female, fill up time use table 18)	Permanent……1 Non- Permanent……..2 (if 2, for female, fill up time use table 18)
2.	Category of worker	Tea plucking- 1 Factory worker-2 Pruning-3 Hoeing/weeding- 4 Spraying insecticides/ pesticides- 5 Manuring or spreading fertilizers- 6 Drainage and irrigation- 7 Water supply man for workers in garden- 8 Chowkidar - 9 Supervisor (*sardar*)- 10	Tea plucking- 1 Factory worker-2 Pruning-3 Hoeing/weeding- 4 Spraying insecticides/ pesticides- 5 Manuring or spreading fertilizers- 6 Drainage and irrigation- 7 Water supply man for workers in garden- 8 Chowkidar - 9

		Drivers- 11 Other (specify)- 12	Supervisor (*sardar*)- 10 Drivers- 11 Other (specify)- 12
3.	If Permanent worker	Wage Rate/day or Salary (in Rs.) …… Frequency of Wage: Daily----1, Weekly-----2, Bi-weekly----3 Monthly-------4 Any wage received in kinds? Yes----1, No----2	Wage Rate/day or Salary (in Rs.) …… Frequency of Wage: Daily----1, Weekly-----2, Bi-weekly------3, Monthly-------4 Any wage received in kinds? Yes----1, No----2
4.	If Temporary worker	Wage Rate/day or Salary (in Rs.) …… Frequency of Wage: Daily----1, Weekly-----2, Bi-weekly------3, Monthly-------4 Any wage received in kinds? Yes----1, No----2	Wage Rate/day or Salary (in Rs.) …… Frequency of Wage: Daily----1, Weekly-----2, Bi-weekly-3,Monthly-------4 Any wage received in kinds? Yes----1, No----2
5.	Do you usually work throughout the year, or do you work seasonally, or only once in a while?	Throughout the year . . . . . 1 Seasonally/ part of the year . . . . 2 Once in a While 3	Throughout the year . . . . . 1 Seasonally/ part of the year . . . . 2 Once in a While 3
6.	If option 2 or 3, what are the other sources of income?		
7.	Are you paid in cash or kind for the work, or are you not paid at all?	Cash only . . . . . .……1 Cash and Kind . . . . . .…..2 In Kind only . . . . . .…..3 Not Paid . . . . . .….4	Cash only . . . . . .……1 Cash and Kind . . . . . .2 In Kind only . . . . . .3 Not Paid 4

8.	Items received in Kind	**Yearly:** Mosquito net-----1 Tarpaulin----2 Umbrella----3 Sandal-----4 Blanket----5 **Monthly:** Rice----1 wheat---2 Tea leaves---3 Firewood----4	**Yearly:** Mosquito net-----1 Tarpaulin----2 Umbrella----3 Sandal-----4 Blanket----5 **Monthly:** Rice----1 wheat---2 Tea leaves---3 Firewood----4
9.	Other facilities/entitlements received by the worker from the tea garden authority	Housing-----1 Electricity----2 Water----------3 Ration----------4 Medical Facilities------5 Others (specify)---------6	Housing-----1 Electricity----2 Water----------3 Ration----------4 Medical Facilities------5 Others (specify)---------6
10.	Workplace hazards faced	Physical Hazards-Heat/sun stroke, dizziness, fainting & dehydration, cough, cold, backache, chest pain, knee pain, neck pain……1 Biological Hazards- malaria, animal/snake bite, insect sting, fungal infections, parasitic infection from leeches & bugs …..2 Mechanical Hazards-fall in hilly terrains, cuts & injuries, sprains……3 Chemical Hazards- inhalation injury during spraying, allergic reaction due to contact with fertilizers, dermatitis, eczema, ulcers……4 Psychological hazards- stress.....5	Physical Hazards-Heat/sun stroke, dizziness, fainting & dehydration, cough, cold, backache, chest pain, knee pain, neck pain……1 Biological Hazards- malaria, animal/snake bite, insect sting, fungal infections, parasitic infection from leeches & bugs …..2 Mechanical Hazards-fall in hilly terrains, cuts & injuries, sprains……3 Chemical Hazards- inhalation injury during spraying, allergic reaction due to contact with fertilizers, dermatitis, eczema, ulcers……4

		Other hazards (specify) …….6	Psychological hazards- stress.....5 Other hazards (specify) …….6
11.	Whether first aid is available at the workplace?	Yes- 1, No- 2	Yes- 1, No- 2
12.	Whether reimbursement or free medical facility provided to the workers in case of workplace hazard injury?	Yes- 1, No- 2	Yes- 1, No- 2
13.	Any provision of maternity leave or benefit for the permanent female workers	Yes- 1, No- 2	Yes- 1, No- 2
14.	Any provision of maternity leave or benefit for the temporary female workers	Yes- 1, No- 2	Yes- 1, No- 2
15.	Duration of maternity leave (if availed)		
16.	Received any bonus, benefit or compensation from the tea garden authority in the last one year?	Yes- 1, No- 2	Yes- 1, No- 2
17.	Amount received as bonus, benefit or compensation in the one year?		

18.	If currently unemployed, mention duration of unemployment (in years or months)		
19.	If currently unemployed, make a note of the reasons and circumstances of unemployment.		

Table 12: Nearest Health care facilities and Health Care facilities within the tea garden		
1.	Availability of healthcare facilities within the tea garden	Tea garden own Dispensary/Clinic/Hospital -----1 Government Dispensary/SC/PHC--------2 Private doctor/pharmacist available ------3 Others --------4
2.	Nearest healthcare facility available outside the tea garden	Govt./public hospital (incl. HSC/PHC/CHC etc.) -1 Charitable/Trust/NGO run hospital -2 Private hospital -3 Private doctor/clinic -4 Informal health care provider -5 Pharmacy – 6 Other- 7 (specify)
3.	Distance of the nearest healthcare facility outside the tea garden from the workers home	

4.	Availability of Means of communication to this facility	Tea garden provide vehicle----1 Government ambulance --------2 Public transport ----------3 Private ambulance service ------4 Private rented vehicle ----------5 Own vehicle ----------6 Others ----------7
5.	Availability of Anganwadi Centre within or outside the tea garden	Yes- 1, No- 2
6.	Whether home visits done by AWW, ASHA, ANM, tea garden hospital/dispensary staff	Yes- 1, No- 2
7.	How often does these home visit takes place	Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7
8.	Organisation of Village Health, Nutrition and Sanitation Day (last one year)	Once a week-1, Once in 15 days-2, Once a month- 3, Only when need arise-4, Rarely-5, Once a year- 6, Never- 7
9.	Any other health camp held (last one year)	Yes- 1, No- 2

Table 13: Details of mortality at household level of the workers for a reference period of 5 years			
1.	Name of the Deceased Member		
2.	Gender (Male—1, Female—2)		
3.	Age at death		

4.	Cause of Death		
5.	Whether medical treatment received before death (Yes-1, No-2)		
6.	Whether hospitalised at least once before death (Yes-1, No-2)		
7.	If hospitalized what was the nature of ailment?		
8.	Nature of ailment for death		
9.	Health care expenditure of the deceased member		
10.	Has there been any still birth of a child?		

Table 14: Covered under any Government Scheme and Benefits Received		
1.	Households covered under any government scheme both central & state govt. (Ujjawala, PMAY, etc)	
2.	What are the government schemes that you have benefitted from?	
3.	Any direct cash transfer benefit received	
4.	Any direct cash transfer as maternity benefit or for institutional delivery	

TABLE 15 SOURCE OF WATER FOR DOMESTIC USE					
Source of water	Ownership	Distance from house	Purpose for which used	Who brings water	Cost/payment

TABLE 16 HOUSING												
No.	Owned/rented/Line Colony/ Own house in tea garden company land	Veranda	Separated kitchen	No. of rooms	Main material used for roof	Main material Used for wall	Main material used for floor	Latrine	Electricity	Cooking fuel	Place of cooking	Type of stove

Time	Adult Female Temporary Worker's Primary Activity	Location
04:00 - 05:00		
05:00 - 06:00		
06:00 - 07:00		
07:00 - 08:00		
08:00 - 09:00		
09:00 - 10:00		
10:00 - 11:00		
11:00 - 12:00		
12:00 - 13:00		

13:00 - 14:00		
14:00 - 15:00		
15:00 - 16:00		
16:00 - 17:00		
17:00 - 18:00		
18:00 - 19:00		
19:00 - 20:00		
20:00 - 21:00		
21:00 - 22:00		
22:00 - 23:00		
23:00 - 00:00		

TABLE 19: INVESTIGATOR'S COMMENTS	
(In bullet points the investigator can write her/his comments on any relevant information and observation about the household)	