Disease Burden and Healthcare Utilization in the North Eastern Region of India

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Abstract: The Burden of diseases are changing its course throughout the globe and so does the utilisation of healthcare by the population. The paper focuses on the North-Eastern region of India its disease burden and the pattern of utilisation of healthcare facilities despite the challenging terrain and ongoing development. Based on the 75th round of National Sample Survey, Household Social consumption: Health, bivariate and multivariate analyses is used for the study. The North-Eastern region of India still faces the undeniable burden of infectious diseases (29 per 1000) followed by Non-communicable. Alongside the disease burden the healthcare utilisation of the population mostly incline towards the private healthcare over the public healthcare. The region also faces ¼ of its population not seeking any medical treatment mostly due to believing that the morbidities were not serious enough to seek treatment. In contrast to the urban population, there was a higher share of untreated morbidities among the rural population, with the majority of untreated disabilities and injuries. Government focusing on the needs as per the region is highly recommended to reduce untreated morbidities, health inequalities as well as to better the public health utilisation.

Keywords: Diseases, Untreated, Healthcare utilization, Outpatient, North-East India.

Introduction

Globally, as indicated by the epidemiologic transition, the burden of non-communicable diseases (NCDs) has increased over the years, with the largest share among the diseases, i.e. more than 60 percent, followed by communicable, maternal, neonatal and nutritional diseases, and injuries (IHEM, 2018). The recent study on global burden of various diseases in 204 countries stated that global health has stabilised in the past 30 years mostly in the age group less than 50 years but yet disability becomes an increasingly large component of disease burden and a larger component of health expenditure. Whereas for children younger than 10 years in 2019, lower respiratory and diarrhoeal diseases remains the top cause of disability adjusted life years (DALYs) (Vos et al., 2020). In case of India, a similar morbidity and mortality pattern is being experienced over the years. The Million Death Studies (MDS; 2010-13) highlighted that the main causes of death in most of the states of India were cardiovascular diseases (CVDs), ill-defined/all other symptoms, respiratory diseases, malignant and other neoplasms, and perinatal conditions. Also, in the eight large and socioeconomically backward states, referred to as the Empowered Action Group (EAG) states (viz., Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttaranchal and Uttar Pradesh), and Assam a similar pattern observed, including diarrhoeal diseases.

The Indian Health of the Nation's state Report (2017) clearly indicated that India faces dual challenge of diseases with infectious and neonatal disorders being reduced, but remaining high and the increasing burden of non-communicable diseases. The epidemiological transition has moved from communicable disease in 1990s to non-communicable diseases, with states

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like Kerala, Goa, and Tamil Nadu in the advanced stage of epidemiological transition. In the case of the North East (NE) region, Assam and Meghalaya are still considering to be at the lowest level of epidemiological transition while other states Arunachal Pradesh, Mizoram, Nagaland, Tripura, Sikkim and Manipur are at a lower-middle stage of epidemiological transition, but with quite different disease burden rates from specific leading diseases.

Even with the changing burden of diseases India allocates the least amount of its resources and expenditure on the health sector compared to many other developing countries. According to the National Health Accounts Report (NHA) of India (2019.), the total health expenditure of India during 2016-17 is only 3.84 percent of the GDP (from which the government expenditure constitutes 30.6 percent of the total health expenditure). The World Bank and WHO (2017) stated, half of the population in the globe does not have access to essential healthcare services. As a result, the households pay for healthcare from out-of-pocket (OOP) that prompts almost 100 million households into extreme poverty.

According to WHO (2010), the key components that help in making the health system people's centred are meeting the population's needs and expectations, viz., improving the health status of every member of the society, defending the people from health threats, financial protection against ill-health, equitable access (universal coverage), and decision making in the health system. Along with them, it is also necessary to have proper monitoring and evaluation of the health system that can help to identify the strengths and weaknesses of the sector for the betterment of the population (Hossain, 2015). To achieve equitable access to health it is necessary to have adequate health resources like infrastructure, better medical practitioners, and medical supply with a proper understanding of the health outcomes, diseases, socioeconomic factors, and geography (Baru et al., 2010; Kiadaliri et al., 2011; Aremu et al., 2011; WHO, 2019). Studies also suggested that in the past few decades, prevalence of untreated morbidities havealso been increasing, especially among the rural population of India. A large share of the population going undiagnosed, unreported, and undertreated among the illiterate and financially weaker section of the society could be due to a rise in the price of medicine and cost associated with treatment (Ghosh and Arokiasamy, 2010; Ghosh, 2014a; Pandey et al., 2017; Anushree and Madheswaran, 2018).

The Rural Health Statistics Report (2018-19) stated that the primary (PHC) and community health centres (CHCs) lag behind in health facilities and human resource in the tribal areas. As the 8 states of NE Region are mostly populated by tribes, the shortfall of a human resource is more prominent and one of the reasons for rural women and men to go for private healthcare and ended up spending more. The North Eastern Council (NEC) has identified some of the crucial setbacks in the health sector of NE region. It sums up the inadequate communication facilities, shortage of trained human resources, infrastructure, improved quality of health services, and full-utilization of existing facilities even by the population in the far and remote areas. Although there is development in the healthcare services with trained health personnel, it still needs to undergo many changes, especially in the case of affordable services for women and children, with quality healthcare services in public hospitals of the region.

Half of the population in rural areas of Northeast India opt for public healthcare services, while in the urban area it is mainly the private healthcare sector. Most of the public, trust-run, and private hospitals are in the urban areas, so people in the rural sector tend to utilize the primary healthcare facilities with limited, undertrained, and underequipped facilities (Hossain, 2015; Ngangbam and Roy, 2019). Studies highlighted the fact that decision for

healthcare services is not only influenced by the necessity and severity of diseases but also the sociodemographic background of individuals and the capacity to pay (Roy and Chaudhuri, 2008; Prinja et al., 2012).

The North-East Region (NER) of India is characterised by diversity in its geography, terrain, social and ethnic structures. Over the years, the region has experienced an increase in all-round development in socio-economic and healthcare, but also heavily burdened by both communicable and non-communicable diseases (NCDs), particularly for their treatments. This study aims to understand the changing burden in morbidity/disease pattern and the choice of healthcare services for treatment in the rural and urban sectors in this region. The NE region of India has limited healthcare facilities and human resources, particularly in public healthcare. Secondly, the study also attempts to understand the reasons for neglecting (not treating) the ailments/morbidities, as well as choice for a health sector for treatments. Thirdly, using suitable statistical methods, we identify the socio-demographic, neighbourhood, and health factors associated with the diseases, and reasons for untreated morbidities in the region.

Methodology

Data source
The main data source used in the study is the National Sample Survey (NSS), 2017-18, the 75th round on Social Consumption: Health. The NSS is a nationally representative survey, which used a multi-stage stratified sampling. The first stage units were the census village in the rural sector and Urban Frame survey (UFS) blocks in the urban sector. The second stage units are the households for both the sectors. The data include information on demographic and economic factors at the household and individual levels along with health factors like the nature of ailments, inpatient and outpatient, type of providers, medical expenditure, childbirth, mortality, and on aged population, etc. The survey collects data on 5,55,115 individuals from 1,13,823 households from rural and urban areas on male, female, and transgender. The study is based and restricted to 72,334 persons from 15,122 households in the North East region of India, comprising of 8 states. However, specific analyses are based on the 1,390 subpopulations, among those who reported spells of ailments in the last 15 days (excludes childbirth) prior to the survey and sought treatment for various morbidities.

Statistical Analysis:
Bivariate analysis was used to understand the distribution of the diseases, choice of healthcare, and reason for seeking and not seeking medical advice. The logit regression (LR) analysis is also applied to understand the association of the individual, neighbourhood, and health factors over the untreated morbidities and private healthcare facilities for the self-reported spell of ailments in the last 15 days. The utility of the LR model is to understand the relationship of outcome variables with the levels of predictor variables but by adjusting the covariates or cofounders. The covariates could be dichotomous like sector (rural and urban) or more than two levels like the level of education or sometimes continuous like birth-order. The LR model allows us to include multiple covariates in a single model that simultaneously adjusts for all of the covariates (Alexopoulos, 2010; Wiest et al., 2015; Boateng and Abaye, 2019) The model represents the predicted odds, which is derived from the probability P(Y), as given below:

$$l = (P) = ln\ ln\left(\frac{P(Y)}{1-P(Y)}\right) \ ....(1)$$

where, the ratio $\frac{P(Y)}{1-P(Y)}$ is the odds and the logit is the log odds;

$$ln\ ln\ \left[\frac{P(Y)}{1-P(Y)}\right]\ =\ \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots\cdots\cdots + \beta_k X_k \ \text{....................(2)}$$

and,
$$\left[\frac{P(Y)}{1-P(Y)}\right]\ =\ e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots\cdots + \beta_k X_k} \ \text{...(3)}$$

Where, $ln\ ln\ \left[\frac{P(Y)}{1-P(Y)}\right]$ is the log (odds) of the outcomes, Y is the outcome variable; X_1, X_2,….., X_k are the cofounder or independent variables, β_0, β_1, β_2,…,β_k are the regression coefficients (odds ratio in this study) and β_0 is the intercept. Logit regression is a regression analysis of logit (P) on the predictors where the dependent variable is logit (P) and derived from the dichotomous variable assuming the values of 0 and 1. It predicts the values of the Odds of each independent variable keeping the effect of other independent variables constant.

Variables used for analysis:
Dependent variables
The Multivariate Logit Regression (MLR) model is used to examine the association between the dependent and the independent variables. Model 1 considers the untreated morbidities (choice for not seeking medical advice/treatment) for spells of ailments reported during the last 15 days before the survey. The choice of treatment: (i) Seeking health advice = 0; and (ii). Not seeking health advice = 1.

The second model examines how different factors influence the individual's decision to seek treatment from a private or public healthcare providers in the event of spells of ailment reported during the last 15 days before the survey. The options are: (i) Public hospital, includes HSC/PHC/CHC, etc., = 0; and (ii) Private hospital which includes charitable/trust/NGO run hospital, private hospital, private doctor/clinic, and informal health care provider = 1.

Independent variables
The independent variables are categorized into three parts: (a). Socio-demographic factors (b) Neighbourhood factors, and (c). Health factors.

Socio-Demographic variables: The factors which are most probable to influence the decision to not treat morbidities and choice of healthcare are: age (coded as 0-14 years, 15-64 years, and 65 and above years.); sex (male and female); education (illiterate, up to the primary, up to secondary, and graduate+); social group (tribe and non-tribe); and household consumer expenditure, considered as a proxy for income (poorest, poor, middle, rich, and richest).

Neighbourhood variables: The neighbourhood factors considered are state (Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam) and residence/sector (Rural and Urban areas).

Health variables: The status of morbidity and well-being among the residents are the information that can mediate the choice of seeking treatment and facility for treatment. Therefore, the health factors are the type of ailments/morbidity (reclassified into broad groups (as per ICD 10) as Infectious, Non-communicable diseases (NCDs), Disabilities and Injuries, and Other diseases); duration of the illness/morbidity (a week, up to 15 days, and more than 15 days); and duration of activity restricted (less than 3 days, up to a week, and up to 15 or more days).

Other variables are reasons for not availing government/public healthcare sector (not available, not satisfactory, too far or long waiting time, preference for trusted or different doctor/hospital and others); and reason for not seeking medical advice (unavailable in the neighbourhood/ expensive, long wait, an ailment not serious enough, familial or religious belief/others).

The reported ailments have been divided into four broad categories, and details of reclassification presented in Table 1.

Table 1: Reclassification of diseases/ailments into four broad categories from NSS, 2017-18 (ICD 10)

Infectious Diseases	
Fever with loss of consciousness or altered consciousness	Diarrhoea/dysentery/increased frequency of stools…
Fever due to diphtheria, whooping cough.	Worms infections
Tuberculosis	Discomfort/pain in the eye…
Filariasis	Acute upper respiratory infections….
Tetanus	Cough with sputum with/without fever…..
HIV/AIDS	Skin Infections….
Other Sexually Transmitted diseases	

Non-Communicable Diseases	
Jaundice	Pregnancy with complication…..
Cancers	Complication in mother after birth…..
Anaemia	Illness of new-born….
Bleeding Disorders	Hypertension
Diabetes	Heart diseases: chest pain, breathlessness.
Under-nutrition	Stroke/hemiplegia/loss of speech half body
Goitre and other Diseases of Thyroid	Glaucoma
Others(includes obesity)	Cataract
Any difficulty/abnormality in urination	Earache with bleeding…..
Pain the pelvic region/RTI/ male genital area	Bronchial asthma/recurrent of wheezing…..
Change/irregularity in menstrual cycle…	

Disabilities and Injuries	
Mental Retardation	Disease of mount/teeth/gums
Mental Disorders	Join or bone diseases
Headache	Back or body ache
Seizures or known epilepsy	Accidental injury, road traffic accidents and falls
Weakness in Limb muscles and difficulty in movements	Accidental drowning and submersion
memory loss, confusion	Burns and corrosions
Decrease vision (not includes better with glasses)	Poisoning
Disorders of eye movements…	Intension self-harm
Decrease hearing/ loss	Assault

All others	
Malaria	Gastrointestinal bleeding
All other fevers (typhoid, fever with rash…..)	Contact with venomous/harm causing animals and plants.
Pain in abdomen: gastric and peptic…	Symptoms not fitting
Lump or fluid in abdomen or scrotum	Could not state the main symptom

Note: reclassified by authors as per ICD-10.

Results and Findings

Disease burden in the region

The burden of ailments, as depicted by the broad groups of diseases, within the NER is shown in Table 2. Overall, in NE region the reported prevalence (suffering) of any ailment is 65 per 1000 population in the past 15 days prior to the survey. However, in the region, the state which is more likely to have more persons suffering from any ailment is Sikkim and Mizoram (94/1000), followed by Tripura (84/1000), and Arunachal Pradesh (80/1000). Interestingly, Meghalaya has reported the least proportion suffering from any ailment (10/1000).

In case of the burden of diseases in the region, the prevalence of infectious diseases is highest with 23/1000 population, followed by Other ailments (19/1000) and NCDs (13/1000). Similarly, among the states the burden varies with the highest prevalence of infectious disease reported in Arunachal Pradesh with 43 per 1000 population; NCDs highest in Sikkim (39/1000); disabilities and Injuries in Mizoram and Sikkim (17/1000 each); and for others morbidities in Tripura (39/1000) respectively. Among the states, Meghalaya is the 'healthiest' state, as it is the only state that reported the least prevalence for all groups of diseases, and the very least for NCDs (0.3/1000).

In the NE region, the leading group of diseases is the infectious diseases or more popularly known as 'communicable diseases', which still affects substantial proportion of the populations. However, in the recent years, besides the infectious diseases, NCDs have been observed to be gradually expanding in the region. The findings also indicate that in the NE region Sikkim and Mizoram has substantial population suffering from the NCDs, followed by Tripura, and Assam. As NCD is the emerging disease across the region, each state needs to take up precautionary measures at the earliest.

Table 2: Prevalence of infectious, NCDs, disabilities and injuries, other morbidities and any ailment (per 1000 population) by state in NE Region, India, 2017-18

States	Infectious	NCDs	Disabilities and Injuries	Others	Any ailment
Sikkim	15.7	39.0	17.0	21.9	93.6
Arunachal Pradesh	43.2	5.9	8.4	22.2	79.6
Nagaland	5.5	6.8	5.6	4.8	22.7
Manipur	15.4	8.0	6.9	21.7	52.0
Mizoram	27.7	24.8	17.0	24.5	94.1
Tripura	22.0	17.5	5.7	39.1	84.2
Meghalaya	4.6	0.3	3.1	1.7	9.8
Assam	25.6	13.7	11.6	18.3	69.2
Total	**22.9**	**12.8**	**10.2**	**18.9**	**64.8**

Source: Calculation by authors from NSS data, 2017-18.

To understand better the burden of individual diseases, top 10 reported diseases (in past 15 days) along with their share in the total diseases and region is presented in Table 3. The first ranking ailment reported and for which treatment has been sought is for 'All other fever' (24%), which includes typhoid, fever with rash/eruptive lesion, and fever with unknown origin), followed by diarrhoea/dysentery (9%), fever with loss consciousness, and acute respiratory infection (8% each). Diabetes is about 6 percent, and the least share is by 'joint or bone disease' with 3 percent. Overall, the top 5 diseases account for over 50 percent of all diseases in the region. However, their prevalence and share vary widely when segregated by rural-urban

sector. It is observed that in the urban areas diseases such as 'All other fever' accounts for 22 percent, followed by 'fever with loss of conscious' (16%), diabetes (11%), hypertension (9%), and acute upper respiratory infection (6%) take the largest shares and the least share is with 'stroke' (2%). Similarly, in the rural areas also, the diseases more likely to be prevalent are 'All other fever' (24%), diarrhoea (10%), acute upper respiratory (8%), and headache, Fever due to diphtheria, and fever with loss of consciousness (each with 6%). The least ailment in the top 10 for rural areas is 'heart disease', which accounts for nearly 4 percent. In both the urban and rural areas, the top 3 or 4 diseases account for more than 50 percent of the total share of diseases in each sector.

Table 3: Top 10 diseases/ailments in NE region of India by Urban and Rural sectors, NSS 2017-18

NE Region (Total)		Urban		Rural	
Ailments	Percent	Ailments	Percent	Ailments	Percent
1. All other fevers	23.65	1.All other fevers	21.52	All other fevers	24.29
2. Diarrhoea/dysentery	8.56	2. Fever with loss of consciousness	15.72	Diarrhoea/dysentery	10.17
3. Fever with loss of consciousness	8.01	3. Diabetes	10.53	Acute upper respiratory infection	7.95
4. Acute upper respiratory infection	7.59	4. Hypertension	8.76	Headache	5.88
5. Diabetes	5.61	5. Acute upper respiratory infection	6.39	Fever due to diphtheria	5.79
6. Fever due to diphtheria…	5.47	6. Fever due to diphtheria…	4.41	Fever with loss of consciousness	5.71
7. Headache	4.56	7. Pain in abdomen	4.21	Diabetes	4.15
8. Pain in abdomen	4.07	8. Weakness in limb	3.58	Pain in abdomen	4.02
9. Hypertension	3.79	9. Diarrhoea/dysentery	3.18	Joint or bone disease	3.76
10. Joint or bone disease	3.23	10. Stroke	2.93	Heart disease	3.62

Healthcare utilization: treatment

Treated morbidities

Interestingly, in the NE Region only about three-fourths (74%) who suffered from any of the four broad morbidities reported seeking treatment in a healthcare facility (Table 4). Overall, among the broad diseases, seeking healthcare is highest for NCDs (95%), followed by infectious disease (72%), Other disease (70%) and the least with 62 percent for treatment of Disabilities and Injuries.

The proportion seeking healthcare for various ailments varies drastically by sector; 70% in rural areas against 89% in urban areas. Table 4 also exhibits the distribution of treatments by broad morbidities and rural-urban sector. In the urban areas, the share of treatment for all four broad morbidities is very high, ranging from 86 percent for Other ailments to 97 percent for Disabilities and Injuries, followed by Infectious diseases (89%). Whereas in the rural areas the lowest share of treated disease is for Disabilities and Injuries (58%) and highest for NCDs (99%), which is followed by Infectious diseases (67%).

Table 4: Percentage of treated and untreated ailments in Rural and Urban sectors of NE Region, India, 2017-18

Ailments	Treated		Untreated		Treated	Untreated
	Rural	Urban	Rural	Urban	Total	
Infectious	66.9	88.9	33.1	11.1	71.9	28.1
Non-Communicable	98.5	88.5	1.53	11.54	94.9	5.1
Disabilities and						
Injuries	57.9	96.5	42.14	3.5	62.1	37.9
Others	65.6	86.4	34.36	13.6	70.0	30.0
Total	**70.1**	**88.7**	**29.89**	**11.34**	**74.4**	**25.6**

Source: Calculation by authors from NSS data, 2017-18.

Choice of healthcare for treatment - Public Vs Private sector

The choice for treatment of diseases across the NE region differ widely by healthcare facility as well as by urban-rural sector (Table 5). More than half of diseased persons (54%) chose private facility, compared to public facility (47%). Diseases more likely to be treated in private healthcare facility are Other ailments (60%), followed by disabilities and injuries (56%), infectious (54%), and least for NCDs (45%). On the other hand, treatment in the public healthcare facility is for NCDs (55%), followed by infectious (46%), disabilities and injuries (44%), and least for Others (40%). The results suggest that choice for treatment in private sector is higher, but people also go for treatment, even for NCDs, in public healthcare facility.

A sharp contrast in the choice of facility become much more evident when comparing the treatments by urban-rural sector (residence): the urban-rural differential is huge and revealing. For instance, in rural areas the choice for treatments is greater in public healthcare facility (53%), compared to private facility (47%). The most revealing fact is that in rural areas the highest proportion of disease treated at public healthcare (71%) is NCDs, followed by infectious diseases (55%). Treatment of the same diseases in rural areas, in the private facility is only 29 percent for NCDs, and less than half for infectious diseases (45%).

In the urban areas, choice and treatment pattern is completely different between public and private healthcare facilities. For instance, urban residents prefer private facility for almost all treatments, ranging from 45 percent for disabilities and injuries to 78 percent for NCDs. The public facilities in urban areas are much less utilised, particularly for NCDs (22%) and infectious diseases (25%), and the diseases most likely to be treated are disabilities and injuries – preferred by 55 percent. Choice of facilities for treatment of diseases indicates that in urban areas private sector is the most preferred facility for most ailments, barring disabilities and injuries, and the public facilities cater mostly to non-infectious or a less serious ailment such as disabilities and injuries.

Table 5: Percentage distribution of choice of healthcare facilities by ailments in Rural and Urban sectors of NE Region, India, 2017-18

Ailments	Rural		Urban		Total	
	Public	Private	Public	Private	Public	Private
Infectious	55.2	44.8	24.6	75.4	46.29	53.71
Non-Communicable	70.9	29.1	22.3	77.7	54.69	45.31
Disabilities and						
Injuries	41.7	58.3	54.6	45.4	43.94	56.06
Others	40.6	59.4	38.8	61.2	40.1	59.9
Total	**53.0**	**47.0**	**30.0**	**70.0**	**46.53**	**53.47**

Source: Calculation by authors from NSS data, 2017-18

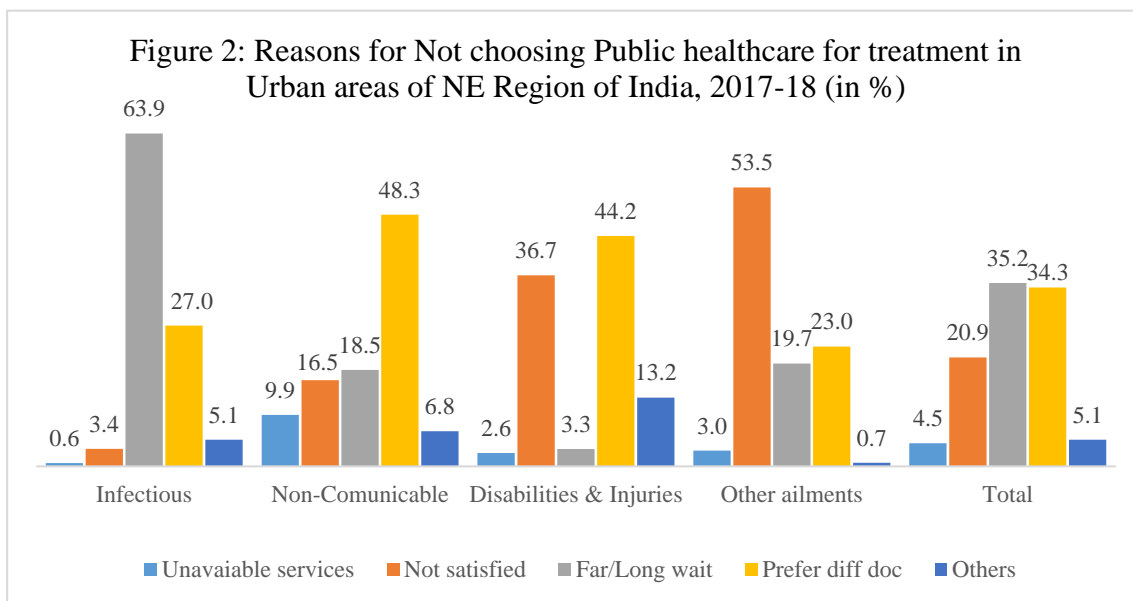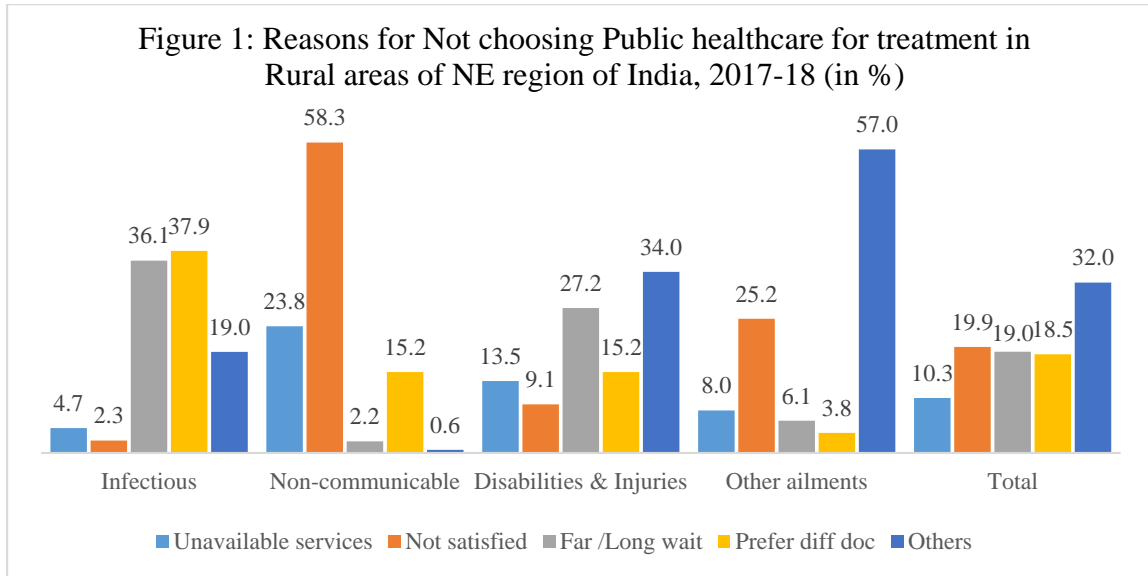### Reasons for not opting a public healthcare for treatment

As indicated earlier, in general, in the NE region more people use private healthcare (54%), compared to public healthcare facility (47%). The choice of facility become more evident when analysing by the ailments for which treatment has been sought. This is despite the fact that in most states, public healthcare is the main provider. Clearly, there is a huge rural-urban differential in terms of preferred facility for treatment, and people gave different reasons for the choice based on the ailments. The many reasons cited by people in the region for not opting public healthcare for treatment of ailments have been regrouped as (a) Unavailable services, (b) Not satisfied with the service, (c) Facility far away/Long waiting time, (d) Prefer different doctor, facility, etc., and (e) for Other reasons. These reasons have been analysed by diseases for better understanding of the perceptions people have about the capability, expectation, and quality of public healthcare for treatment of specific as well as life threatening diseases/ ailments.

In rural areas

As presented in Figure1, overall, nearly one-third (32%) of the diseased persons do not prefer public healthcare facility due to 'some other' reasons, followed by 'not satisfied' with the facility (20%), distance (far away) or long wait and prefer different doctors/facility (19% each), and unavailable services (10%). People cites specific reasons for not opting public healthcare for treatment of different diseases/ailments. For instance, in case of infectious diseases, most people would not choose a public healthcare due to perceived poorer services, such as preference for different doctor/facility (38%), followed by facility far away/long wait at facility (36%), etc. Similarly, for NCDs, the main reasons cited were not satisfied (58%), unavailable services (24%), and prefer different doctors, etc., (15%). For disabilities and injuries, people mainly cited other reasons (34%), distance (far away) or long wait (27%), prefer different doctors (15%), and unavailable services (14%). In case of Other ailments, the main reasons mostly given are due to others (57%), not satisfied (25%), and unavailable services (8%).

In urban areas

Results show that in urban areas, private healthcare facilities are more commonly used for treatment of most ailments. As shown in Fig.2, three main reasons given for not treating ailments/diseases in public healthcare in urban areas of NE region of India are – distance and time (35%), followed by prefer different doctor/facility (34%), and not satisfied with the services (21%). Diseased persons in urban areas would not like to treat infectious diseases in public healthcare facility for two main reasons, viz., far away/long wait (64%), and prefer different doctor/facility (27%). In case of NCDs, nearly half of the people (48%) would avoid public healthcare as they prefer different doctor/facility, far away/long waiting time (19%), and not satisfied with the facility (17%). Similar reasons were cited in case of treating disabilities and injuries, viz., prefer different doctors/facility (44%), and not satisfied with the facility (37%).

Figure 1: Reasons for Not choosing Public healthcare for treatment in Rural areas of NE region of India, 2017-18 (in %)

Figure 2: Reasons for Not choosing Public healthcare for treatment in Urban areas of NE Region of India, 2017-18 (in %)

Associative factors for utilisation of private healthcare: the odds

In the NE region, the private healthcare facility has emerged as the popular service providers for treatment of different diseases. An attempted is made to identify the associative factors that determine the utilization of private healthcare services through three broad groups of factors (demographic, neighbourhood, and health characteristics) of the people who had treated their ailments. As shown in Table 6(a), over half of treatment of ailments (54%) were done in private healthcare facility, but actual utilization varies widely by characteristics of the people. Overall, cutting across the different characteristics, utilization of private healthcare services for treatment is found higher in the richest households (75%), graduates (74%), urban areas (70%), Tripura (69%), Assam (57%), for Other ailments, females (60% each), <3 days of activity restricted (58%), those with upto 15 days of illness and age 15-64 age group (57% each), and non-tribe (56%). Among the states, Arunachal Pradesh shows the lowest utilisation of private healthcare services (9%).

The levels of utilisation of private healthcare show wide variation across the associative factors and characteristics of the people. The results of regression (MLR) indicate that, among the factors, the odds for utilizing private healthcare has been significant with both the covariates of neighbourhood factors (state and place of residence) than other factors (Table 6.a). Among the states, in reference to Sikkim, the odds in favour of private healthcare facility is much higher in Tripura (12 times), and Assam (7 times) (p<0.001), and less likely in Arunachal Pradesh by 75 percent (p<0.01). Similarly, urban residents are 3 times more likely (p<0.001) to use private healthcare facility for treatment of diseases than their rural counterparts. The only other socio-demographic variable showing significant association is the household economic status (household expenditure). The richest households are nearly 4 times more likely than the poorest households to choose or use private healthcare facilities (p<0.001).

Untreated morbidities: levels and reasons

The results also show (Table 4) that not all ailments have been treated in NE region – at least a quarter of them (26%), which is much higher in rural areas (30%) compared to the urban areas (11%). Among the morbidities, the highest share of untreated ailments is seen with those suffering from disabilities and injuries (38%), followed by others (30%). Also, in the rural areas, the untreated morbidities are higher for disabilities and injuries (42%), others (34%), and infectious diseases (33%). In contrast, in the urban areas the share of untreated ailments is much lower, ranging from 4 percent for disabilities and injuries to 14 percent for others.

Table 6(b) presents the share of untreated ailments across the NE region by the characteristics of the diseased persons. According to the demographic characteristics, the older the diseased persons are, the most unlikely they are to treat their ailments. The proportion is the highest with the oldest group age 65 years and above (35%) compared with children age 0-14 years (25%). Education also indicates an inverse relation with non-treatment of ailments, i.e. lesser the education, higher is level of untreated ailments as among illiterate (30%) against those with graduate degree and above (18%). Similar pattern is seen by social group also, in which untreated ailments much lesser among the non-tribes (21%) as compared with the tribes (39%). Among the states in NE region, the untreated morbidities is as high as 67 percent in Nagaland, followed by Mizoram (37%), and Manipur (29%). But it is much lower in Arunachal Pradesh (12%) and Sikkim (14%). When considering the morbidities, the proportion untreated is highest for disabilities and injuries (38%), and lowest for NCDs (5%). In case of the health factors, the untreated share is found highest among those who suffered for at least a week (33%) and < 3 days of activity restricted (32%). This indicates that the shorter the duration of illness or activity restriction, higher is the untreated ailments, and vice versa. An interesting and unexpected pattern found is that there is an inverse association with wealth quintiles. Contrary to the expectation, the proportion of untreated ailments is much lower, by twice, among the poorest households (13%) as compared with the richest households (26%). One plausible reason for the contrast could be due to higher untreated morbidities (particularly of NCDs) in the urban areas than the rural areas (Table 4), which also reflects the socio-economic classes.

In Figure 3, is presented the various reasons cited for not seeking medical advice/treatment for the morbidities in rural and urban areas in the NE Region. The main reason cited by majority of the people is that they do not consider their ailments to be serious enough (or unaware) to seek medical attention (not serious; 80%), which is as high as 83 percent in urban areas and 79 percent in rural areas. This perception of non-seriousness about ailments is followed by other reasons in urban areas (17%), and unavailability of services in rural areas

(13%). Reasons related to quality of facility such as unavailable services, others and long wait appear as less important compare to the perceived seriousness of the morbidities in both rural and urban areas.

Figure 3: reasons for not treating morbidities by rural-urban sectors in NE region, india, 2017-18 (in %)
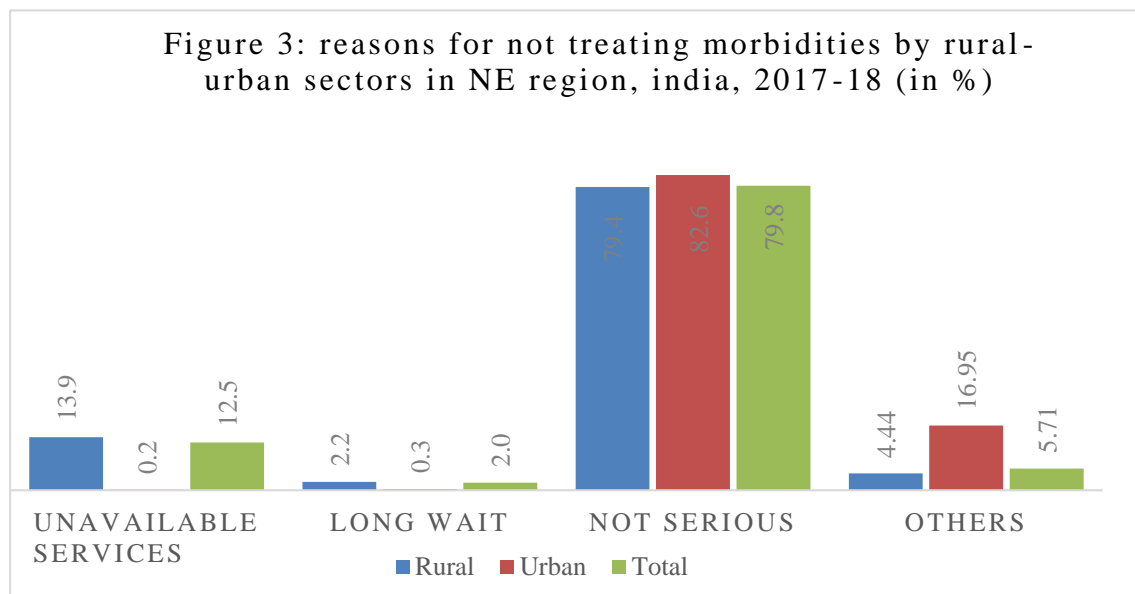
Associative determinants of untreated morbidities: the odds
The percentage of untreated morbidities by the demographic, neighbourhood and health determinants is shown in Table 6 (b), which also shows the results of the regression (MLR). From the logit regression it is clear indicated that age, education, and household expenditure (demographic variables) do not have any significant association with not seeking formal medical advice (non-treatment) for the morbidities. Whereas, females and non-tribe population are 35% and 40% less likely (p<0.05) to not seek formal medical advice respectively compared with their counterparts. On the other hand, the neighbourhood determinants (state and place of residence) show highly significant association. For instance, untreated or non-seeking of medical advice for ailments is highly more likely in Nagaland (15 times), Mizoram (9 times), Manipur (nearly 8 times), and Assam (7 times) with reference to Sikkim (p<0.001). Similarly, the urban residents are less likely (by 43%) to not seek medical advice for ailments than the rural population (p<0.01). Even among the different broad morbidities, people with NCDs are less likely to not seek treatment compare to infectious diseases (p<0.05). Also, people who are suffering from ailment for more than 15 days (by 78%; p<0.001), those restricted from activities for a week (by 77%; p<0.001), and more than 15 days (76%, p<0.01) are less likely to not seek medical advice than those suffering for shorter duration of illness or activity restricted.

Table 6 (a): Percentage treated in private healthcare facility and the odds for treatment by associative factors (demographic, neighbourhood, and health); and (b): Percent of Untreated ailments and the odds by selected associative factors in NE region, India 2017-18

	Characteristics	(a). Treated in Private facility	Odds ratios	(b). Untreated ailments	Odds ratios
D e m o g r a p h i c f a c t o r s	**Age group**				
	0-14 years ®	51.9	1	24.6	1
	15-64 years	57.3	0.79	24.5	1.27
	65+ years	37.2	0.59	34.7	1.71
	Sex				
	Male ®	46.2	1	25.6	1
	Female	60.3	1.22	25.6	0.65*
	Education				
	Illiterate ®	46.4	1	29.8	1
	Up to primary	60.2	0.67	22.8	1.34
	Up to secondary	45.5	0.82	27.1	1.13
	Graduate +	73.7	1.69	18.0	1.49
	Social group				
	Tribe ®	43.5	1	38.6	1
	Non-Tribe	55.8	1.21	21.4	0.59*
	Household expenditure				
	Poorest ®	62.2	1	12.8	1
	Poor	36.6	1.06	28.4	1.01
	Middle	43.1	1.22	34.2	0.78
	Rich	52.5	1.38	24.0	1.06
	Richest	75.2	3.78***	25.6	1.04
N e i g h b o u r h o o d	**State**				
	Sikkim ®	48.1	1	14.1	1
	Arunachal Pradesh	9.1	0.25**	11.5	0.77
	Nagaland	50.8	0.33	66.7	15.26***
	Manipur	17.4	0.66	28.8	7.54***
	Mizoram	32.4	1.10	36.5	8.76***
	Tripura	68.7	12.18***	17.0	3.02*
	Meghalaya	46.4	2.26	19.5	4.42
	Assam	57.0	7.05***	26.5	6.95***
	Residence/ Sector				
	Rural ®	47.0	1	29.9	1
	Urban	70.0	2.78***	11.3	0.58**
H e a l t h f a c t o r s	**Type of ailment**				
	Infectious ®	53.7	1	28.1	1
	NCDs	45.3	1.45	5.1	0.46*
	Disabilities and Injuries	56.1	1.28	37.9	0.59
	Others	59.9	1.59	30.0	0.78
	Duration of illness				
	A week ®	55.6	1	32.9	1
	Up to 15 days	56.7	1.20	14.7	0.60
	> 15 days	48.4	1.45	10.4	0.22***
	Duration of activity restricted				
	< 3 days ®	58.2	1	31.5	1
	Up to a week	46.2	0.63	16.0	0.22***
	Up to 15 or more days	45.2	0.97	18.1	0.24**
	Total	**53.5**		**25.6**	

Model (a) Log likelihood = -379.88322 Pseudo R2 = 0.2963

Model (b) Log likelihood = 422.09721, Pseudo R2 = 0.2452

® = Reference group; Exponential coefficients; * p<0.05, ** p<0.01, *** p<0.001

Discussion and conclusions

Firstly, with the rising population, the burden of illnesses and the prevalence of health conditions is also increasing and while India is already grappling with infectious diseases, the scenery is about to be overtaken by NCDs and disabilities and injuries. The North East region of India is no different, with prevalence of 29 per 1000 for infectious and 65 per 1000 population for any ailments, which has decreased compared to the previous rounds of NSS (Paul and Singh, 2107), whereas some states like Mizoram, Sikkim, and Tripura sees a prevalence of 80 per 1000 population for any ailments. Among the morbidities, infectious disease like diarrheal infections, and NCDs like diabetes and hypertension have quite a substantial share in the NE region than other diseases. The share of disease burden for urban sector is a mix of both infectious and NCDs whereas in rural sector it is mostly infectious diseases.

Secondly, along with the double burden of diseases, the availability and choice of healthcare facility for treatment of life-threatening morbidities and other diseases in both rural and urban areas is of concern. The inequitable pattern of regional development indicates that urban areas have better amenities and resources and majority of people consider private healthcare over public facilities, even for outpatient care (Ghosh, 2014c; Patel and Chauhan, 2020*)*. In general, healthcare accessible to rural population is government facilities whereas in the urban sector more than half of its population chose private healthcare (Ngangbam and Roy, 2019). The urban residents who had utilised private healthcare for treatments were asked the reasons for not choosing public healthcare facilities, the main reasons given were long waiting time, the distance/location, and preference of certain doctors. In contrast, over half of the population in rural area who chose private sector reported because of other reasons, followed by not satisfied, and too far/long wait (Ghosh, 2014c), which indicates the quality of services at the public facilities, including shortage of manpower especially specialists and doctors in PHCs and CHCs, equipment, and infrastructure in most of the states in NE region (Saikia and Das, 2014; Saikia, 2019). This can be a major factor for Tripura and Assam having high odds of opting for private healthcare services in compare to Sikkim who belongs to high human development index with better public health facilities Some researches focusing on patient satisfaction have mentioned that public hospitals in Tripura doesn't provide proper information and quality of services, while Assam sees a long wait time with people failing to get medical attention on time due to lack of accessibility to doctors. (Bhattacharjya and Das, 2014). Similar studies in Sikkim points that there was overall satisfaction in public healthcare received by outpatients (Khandelwal et al., 2017). It is also found in the study that, among the background characteristics, mostly it is the richer households and urban residents who opt for private health facilities (Ghosh, 2014a; Pandey et al, 2017), whereas age and education doesn't show any relation with public-private HC and untreated morbidities as there seems to exists a perception irrespective of any characteristics that government health care services are not of high quality and patients do not receive adequate care leading them to choose private HC or in some rural areas over the counter medication, other traditional methods or simply ignore the health conditions. Thirdly, the study brings out the necessity to understand the nature of untreated morbidities among those who had spells of ailment but did not seek any formal medical treatment. Even though a declining trend is observed in untreated morbidities over the last decade in India (Anushree and Madheswaran, 2018), in NE region over one-fourth (26%) did not treat their ailments or seek any medical advice. The share is higher in the rural areas (30%) compared to urban areas (11%), mostly for disabilities and injuries in rural areas, and other diseases in urban areas. The main reasons reported for not seeking/treating ailments were also

similar with previous studies (Pandey et al., 2017; Ngangbam and Roy, 2019), such as perceiving morbidities as not serious enough to seek treatment (80%). Females tend to be less likely to treat morbidities compared with men (Bora and Saikia, 2015), followed by the tribes (Raushan and Acharya, 2018). Among the states in NE region, those highly likely not to treat morbidities are Nagaland, Mizoram, and Manipur and the least in Arunachal Pradesh. It is also observed that the increasing number of days with illness and activity restriction, the lesser is the untreated morbidity, i.e., an inverse relationship between them (Srivastava and Gill, 2020). Previous studies have focused on poor and non-poor, gender or age to explain the horizontal inequity over health care utilisation but the factors influencing untreated morbidities remains far-fetched (Pandey et al, 2017; Anushree and Madheswaran, 2018; Baru et al, 2010; Ghosh, 2014a; Ghosh, 2014b).

This study clearly reveals the wide gap in untreated morbidities between rural and urban areas, and among the four diseases examined, disabilities and injuries, infectious, and others diseases are more likely to go untreated in the region. Evidently, it is highly important that the state governments prioritise healthcare services in the rural areas, focusing mostly on disabilities and injuries and infectious diseases and at the same time keeping in mind the rising NCDs, so as to reduce both untreated morbidities as well as the rural-urban health inequalities in the NE region of India. The focus should not only be on introducing a program but proper implementation and governing it by maintaining its standard and demand according to the needs of the locals.

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