

## Tuberculosis Burden in the Tea Gardens of Assam: A Discussion on the Risk Factors and Social Determinants

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**ABSTRACT** Tuberculosis (TB) is one of the deadliest diseases identified as the 'disease of the poor'. India has the highest yearly incidence of TB in the world. Besides bio-medical determinants and risk factors, social determinants increase the risk factors of exposure to TB germs and after-exposure effects on a population. Growing experiences in TB control advocate more focus on intervention in social determinants as a complementary measure to the curative TB control regimen, as the curative TB control programme alone has been unable to control TB effectively. There is a high TB burden in the tea gardens of Assam despite the presence of a TB monitoring mechanism in place. This paper explores the extent of risk factors and social determinants prevalent among the tea garden worker population, which might help policy planning for controlling TB in Assam's tea gardens.

### INTRODUCTION

#### Basic Understanding about TB

Tuberculosis (TB) is an airborne disease created by the action of a bacterium called *Mycobacterium (M) tuberculosis*, also called tubercle bacilli. The airborne particles called droplet nuclei carry these bacteria. Persons having active pulmonary or laryngeal TB disease may generate infectious droplet nuclei when they cough, sneeze or shout. Such infectious particles may be suspended in the air for several hours, depending upon the environment. When a person inhales the droplet nuclei containing *M. tuberculosis*, transmission occurs.

#### TB Burden in India

Although India has been engaged in Tuberculosis for more than 50 years, TB continues to be India's deadliest disease. The National Strategic Plan for Tuberculosis Elimination 2017-2025 (NSPTE 2017) shows 2.8 million new cases in 2015, placing India at the top of the most TB burdened countries. Indonesia with 1.02 million

cases, and China with 0.92 million cases, follow India. Nevertheless, the incidence of new cases per 100,000 populations is 217 in India, and it places India at the 24<sup>th</sup> position among the 30 most TB burdened countries in the world. South Africa has emerged as the most rapidly TB infected country with 833 new cases per 100,000 populations, followed closely by Lesotho with 794 new cases per 100,000 populations. China, the most populous country globally, has an infection rate of only 67 cases per 100,000 populations occupying 29<sup>th</sup> and Brazil, with 40 new cases per 100,000 populations placed at the 30<sup>th</sup>. The estimated TB death in India remains at 480,000 per year.

#### TB Control in India

In India, the TB control programme has been facing intimidating challenges due to various factors. Besides people's weakened immune resulting from undernourishment, diabetes, indoor air pollution from cook-stoves, or smoking. India is the victim of TB burden due to decades of unrestrained transmission, leaving hundreds of millions of Indians with latent TB infection, which may re-activate at any time.

The delayed diagnosis and late and inadequate treatment increase the risk of transmission of TB. There has been evidence of non-adherence to complete treatment among one-third identified TB patients. The country is also bearing a large burden of multi-drug resistant

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(MDR-) TB and extensively drug-resistant (XDR-) TB. A lot of them are undetected and continue to transmit disease.

Although the RNTCP has managed to treat more than 10 million TB patients in India, the TB decline rate does not seem promising to achieve the 2035 “End TB target”. Looking at the inadequate decline while continuing the prior effort in TB control, the National Strategic Plan for Tuberculosis Elimination (TSPTE 2017-25) has advocated for a new, comprehensively-deployed interventions plan to speed up the rate of decline of incidence of TB. The new strategy is a structure of integrated four strategic pillars, namely “Detect – Treat – Prevent - Build” (DTPB).

Under the pillar of “Detect”, it aims to find all Drug-Sensitive TB and the Drug-Resistant-TB cases with an emphasis on reaching TB patients seeking care from private providers and undiagnosed TB in high-risk populations. Under the pillar of “Treat”, it aims to Initiate and sustain all patients on appropriate anti-TB treatment wherever they seek care, with patient-friendly systems and social support. Similarly, under the “Prevent” it aims to prevent the emergence of TB in susceptible populations, and finally, under “Build”, it tries to build and strengthen enabling policies, empowered institutions and human resources with enhanced capacities.

### **TB as the Disease of the Poor**

WHO (2000) reveals that low and middle-income countries account for more than ninety-five percent of TB-related deaths resulting from a lack of proper sanitation, as people cannot develop better lifestyles. A strong association is present between low GDP per capita income and national TB incidence in non-African countries (Lönnroth et al. 2010). Due to the weakened immune system of HIV patients, TB remains more prevalent in African countries. Out of all TB-related deaths, nearly ninety-five percent of deaths occur in developing countries. Notably, out of these ninety-five percent deaths, more than sixty percent occur in the twenty percent poorest countries. Further, eighty percent of the total TB burden of the world is found in 22 countries. Out of these high TB burdened countries, 15 are low-income countries (Hanson et al. 2006).

### **Factors Leading to Exposure to and Infection of TB**

Since TB is an airborne disease, exposure to germs is the crucial cause of infection. To get the infection to occur, contact with a person having active TB disease is a necessary risk factor. The risk of exposure and subsequent infection to TB is dependent on both direct and indirect factors. There are some directly responsible factors leading to different levels and durations of exposure to droplets containing TB germs. Lönnroth et al. (2010) identify these factors as the ‘downstream risk factors’.

### ***Disease Burden and Physical Conditions***

How easily a person will get infected with or get exposed to an infected person depends on two conditions: the extent of disease burden within the community and how quickly the persons with infection are identified and subsequently treated and cured. Besides disease burden, some other congenial physical conditions catalyse or facilitate the possibility of exposure to and infection with infectious droplets of TB. A crowded place where ventilation is inadequate increases the possibility of exposure to infectious droplets. Such a physical environment may be anything like a household with many family members and lack of adequate ventilation, a clinic, workplaces, public transport, and prison (Rieder 1999; Menzies and Joshi 2007). Likewise, the duration of exposure depends on what way the person concerned is related to those places.

### ***Weaken Defence System of the Hosts***

TB germs may remain dormant in an infected person and may or may not exhibit symptoms in their entire lifetime, depending on the person’s defence system.

### ***Impact of Tobacco Smoking***

The defence system may turn weak due to tobacco smoke exposure, indoor air pollution due to burning solid fuel in a poorly ventilated house, and some other air pollution types. Physiologically, such exposure reduces the ability to clear bacilli from a person’s airway, leading to an

increased risk of infection in exposure to infectious droplets (Rehfuess 2006; Lin et al. 2007). Tobacco smoke impairs the lung's defence mechanisms against infection in various ways, like decreased mucociliary clearance and alveolar macrophages' phagocytic function. Such an impaired immune response in smokers could affect the performance of IFN- $\gamma$  Release Assays (IG-RAs) (Altet et al. 2017). Due to these physiological changes and mechanisms, smokers have an increased risk of infection if exposed to *Mycobacterium tuberculosis* (Underner et al. 2012a) and have an elevated risk of active TB if infected (Underner et al. 2012b). Padrão et al. (2018) have identified the threshold risk factors of smoking cigarettes per day for TB. They found that young age smoking is significantly related to TB infection, and a WHO study (2016) also supports it. Similarly, Gopi and Kolappan (2002), Lin (2009) and Amere et al. (2018) also have found an association between increased risk of TB and smoking.

#### *Impact of Malnutrition*

The host's defence system also becomes weak due to malnutrition, as has been found by several researchers, and such a weakened defence system may lead to TB infection in a risky environment (Cegielski and McMurray 2004). Reviewing the studies based on observations in humans and experimental animal studies, Cegielski and McMurray (2004) have indicated a clear-cut relationship between malnutrition and TB incidence. Hoyt et al.'s (2019) study also reveals a similar observation. Edwards et al. (1971) found a four-fold higher risk of TB among men who were at least ten percent underweight at baseline than in men who were at least ten percent overweight. By assessing the data from the Demographic Health Survey (DHS) of 2006 for India, Oxlade and Murray (2012) found that low BMI had the most potent mediating effect on the association between poverty and prevalent TB. Similarly, Tverdal (1986) reveals a more than five-fold higher risk of TB infection. In more direct evidence relating malnutrition with TB, Chan et al. (1997) point out a link between malnutrition and secondary immunodeficiency, leading to increased host's susceptibility to infection.

The link between malnutrition and TB has been bi-directional. While malnutrition is a possible risk factor for TB infection, TB may also lead

to malnutrition in a patient (Ingabire et al. 2019; Feleke et al. 2020). Gupta et al. (2009) have found significantly lower nutritional status in patients with active tuberculosis than healthy controls. Jahnavi and Sudha (2010) showed that nutritional supplementation was associated with significant improvements in sputum conversion, cure rates, treatment completion rates, and performance status. Lonnroth et al. (2010) have revealed that TB's risk increased by about fourteen percent on each unit reduction in BMI. However, such findings are not without negative results, as shown by Sinclair et al. (2011).

#### *Impact of Alcohol Use*

There have been researches on the relation between alcohol use and TB infection across the world. Alcohol consumption is a significant contributor to the tuberculosis burden, with the most severe impacts estimated for the African region (Sameer et al. 2017). Zixin et al. (2017) find an increased TB risk related to a higher amount of alcohol use among smokers. The risk of active tuberculosis elevates substantially with the alcohol consumption of more than 40 grams of ethanol per day (Lonnroth et al. 2008). This increased risk of infection is also associated with the specific social mixing patterns among alcohol users and the influence on the immune system of alcohol itself and alcohol-related conditions. There has also been a strong association between heavy alcohol use/alcohol use disorders (AUD) and TB (Rehm et al. 2009). Vendhan and Richard (2009) reveal evidence of an increased incidence of pulmonary TB among those who smoke and those who drink.

There is also an indirect impact of alcohol in terms of tuberculosis infection that affects the maintenance of innate and acquired immune systems by alcohol-induced conditions like malnutrition, liver disease, and social drift. Moreover, alcohol consumption may facilitate people to be present in social environments where the risk of spread of tuberculosis infection is high, for instance, in bars, shelters, prisons and social institutions.

#### *Social Determinants of Exposure to and Infection with TB*

Poor working-class people are likely to live in crowded and inadequately ventilated hous-

es, and they are likely to get exposed to the smoke of solid bio-fuels, they are likely to work in crowded and ill-maintained unhygienic conditions, and they are also more likely to travel by crowded public transport.

### ***Housing Conditions as a Risk Factor for Exposure to Infectious Droplets***

Larcombe and Orr (2007) reveal a relationship between TB incidence and the housing conditions like high household occupancy density, low air quality, and inadequate ventilation through a study among the First Nations, Inuit, and immigrant populations in Canada. The authors point out that in populations that already suffer high TB infection rates, crowded housing and inadequate ventilation increase the risk of transmission and progression to disease among those who share living space. A similar observation has also been made by Clark et al. (2002), who find a significant association between housing density, isolation, income levels, and TB incidence. Similarly, in their study in Tanjungpinang District in Indonesia, Madhona et al. (2016) have found a significant correlation between occupancy density, lighting, and humidity with TB incidence. Back home in India, based on National Family Health Survey (NFHS-4) data, Singh et al. (2018) have opined that a contaminated household environment increases the risk of tuberculosis in India. Further, lower socioeconomic status is also directly related to malnutrition. A concise note on the relations between malnutrition and TB infection has been made above.

The lower socioeconomic status is also associated with the characters, like lack of awareness about health care, lesser power and authority to act on existing healthy behaviour and policy, limited access to the food security program, and better health care. Further, such conditions are also related to risky lifestyles, including tobacco use, excess use of low-quality alcohol, imbalanced dietary habits, unsafe sex leading to HIV-AIDS, and more.

### **Differential Impacts of Risk Factors and Determinants on Poorer and Richer Populations**

Depending upon the community's socioeconomic status, the impact of risk factors and de-

terminants tends to be different (Blas and Kurup 2010). While the influential and more affluent people are resilient to cope with risk factors and situations, the more impoverished people are stigmatised to live with the risk at the cost of their health. Thus, a similar level of exposure to risk factors may not have a similar effect across different population groups. An increased disease burden within a population group where social exclusion, low income, alcohol abuse, malnutrition, crowded housing, and poor access to health services are prevalent will undoubtedly lead to more infection and disease compared to people who are free from such burdens.

Further, if one looks at the policy issues, a uniform health care strategy for all population groups may result in differential health care outcomes due to different socio-cultural and socioeconomic contexts. Even if similar health conditions exist, the consequences will not be the same, mainly because people in advantaged positions possess better health care options, job security, and insurance cover to mitigate losses. In contrast, the more impoverished and disadvantaged people are likely to experience financial loss, job loss, and lesser quality of health care affecting the health outcome as the consequences of similar health conditions.

### **The Problem Setting**

There have been reports of tuberculosis' incidence among the tea gardens of Assam to a great extent. In Dibrugarh district, forty percent of total TB incidents are found in tea gardens and considering their percentage share to the district's total population, and it is a significant number. Although the tea gardens have health care facilities, monitored under the Revised National TB Control Program, including DOTS, TB incidence has been recurring over a while. Such incidence leads to the necessity of a complementary approach to the bio-medical regimen of TB cure program where the focus in and addressing the social determinants may play significant roles. TB burden in tea gardens results from a cyclical process derived from the interaction between both pathological and socio-cultural components. The social determinants discussed above have been prevalent in Assam's tea gardens; nevertheless, there is no detailed

study conducted among Assam's tea gardens on these issues.

Tea Tribes in Assam refer to the population group who has been the labourers in Assam's tea gardens. British tea planters brought their forefathers from different parts of mainland India. Although their forefathers came from tribal-dominated areas, the tea garden labourers did not have the status as a Scheduled Tribe in Assam. At present, there are approximately 96 different ethnic groups among the tea tribes in Assam. Administratively, their development and welfare responsibilities are partially vested in the Department of Welfare of Plains Tribes and Backward classes of Assam, Government of Assam. They do not fully come under this department's purview because they are bound by the Tea Company's Plantation Labour Act and many other draconian laws.

From their traditional domain, the forefathers of the present-day tea tribes entered into an agro-industrial environment as labourers having no independent access to natural resources and any say over their production. They were also generally away from urban contact in that they had minimal opportunity and capability to interact with urban life due to strict rules and dire poverty. Thus, confined to a peculiar situation, they retained several of their age-old beliefs and practices and imbibed crowded industrial labourers' harmful behaviour like alcoholism. While people have encountered the risk of alien diseases, their attachment to traditional practices creates a conflicting situation.

The paper is the outcome of a research study conducted in four tea gardens of Assam, sponsored by the Research Council, Tata Institute of Social Sciences, Mumbai with a title "Health and treatment seeking behaviour among the tea-tribes of Assam with special reference to the incidence of TB". While preparing the report, it became evident that social determinants related to TB had not been studied and addressed adequately in the state. Though the RNTCP and DOTS had been successful in a positive outcome in treatment, it was so far unable to arrest the new incidence occurring in the tea gardens. Thus, the primary concern of the paper is to deliberate the issues related to social determinants perceived or established through research globally, as the responsible factors for the spread

of TB. As only the relevant part of the study's full findings has been used to develop the paper and its objectives, the methodology used, objectives set for the study may not appear fit adequately. The primary difference between the full study report and the paper is the focus of the discussion - the social determinant, instead of health and treatment-seeking behaviour.

### Objectives

The primary objective of the paper is to deliberate on the social determinants that increase the risk of exposure to and infection with TB disease. The primary objective may be divided into the following theme-based objectives:

- i) To examine, with the help of primary data, the prevalence of the risk factors like smoking, alcohol consumption, dietary habit, working condition, and living conditions among the tea garden population.
- ii) To examine, with the help of primary data, people's perception and action in terms of causes of illness, diagnosis, treatment preference and adherence to treatment and awareness with special reference to TB.
- iii) To discuss in details, the findings with the help of specific literature on health issues in the tea garden of Assam, and find out the gap in information on social determinants of TB, specific to tea gardens of Assam employing the available global literature on the issue.

### MATERIAL AND METHODS

The paper focuses on the social determinants of TB using the data derived from a primary field investigation. Secondary data like literature relating to the tea garden worker population in Assam with special reference to disease, life-style, living conditions etc. have been extensively used to substantiate the primary data. The Global literature on TB and social determinants relating to TB has been discussed to find out the gap in information regarding social determinants of TB in the tea gardens of Assam.

The researcher collected primary data from four tea gardens, namely, Mankatta, Sessa, Maijan and North Balijan situated in the Dibru-



garh district. Using the information available in the TB control centre located in Assam Medical College Hospital, Dibrugarh, these tea gardens were selected. The selection criteria of tea gardens and respondents are as follows:

### Selection of Tea Gardens

- i) Incidences of TB were towards the higher side in the selected tea gardens.
- ii) Four tea gardens were selected, two each from relatively urban proximity and rural areas.
- iii) One tea garden from each locality as registered with the Assam Branch of Indian Tea Association (ABITA) and one tea garden owned by a bigger business house/company.

### Selection of TB Patients

Total 32 TB incidences from the 4 selected tea gardens were taken for the study, 8 from each tea garden on the following criteria:

- i) TB patients, with an outcome – death and unsuccessful due to non-adherence.
- ii) Relapse cases and/or re-started treatment
- iii) Successfully treated and completed cases.
- iv) Fresh cases of at least one-month old.
- v) Based on the fulfilment of above criteria, and depending upon the availability and accessibility, 10 males and 22 females were selected for the study.
- vi) Age was not a criterion.

Further, 32 caregivers/head of the family of selected patients and 10 respondents from each selected gardens were selected (20 males and 20 females).

### Reason for Selecting the Stakeholders

Since the study aimed to determine people's health and treatment-seeking behaviour, the selection of patients, caregivers, and the general population was necessary. The general population as a stakeholder was thought to be important because their perception and action help understand the inherent characters and factors influencing or determining the community's health and treatment-seeking behaviour, which is likely to be reflected through a patient's and a

caregiver's behaviour. This group was selected to know the people's general perception and action regarding illness, not as a control group to assess any bio-medical issues concerning selected TB patients.

Separate questions were asked for different categories of stakeholders to assess:

- i) The folk concept of illness, causes, progression and curative action
- ii) People's knowledge on bio-medical terminology of illness
- iii) Day to day life, dietary behaviour, work burden, income and poverty, education and awareness and welfare measures include healthcare facilities.

### Data Collection and Analysis

A survey schedule was used to assess people's perception of symptoms of various illnesses, the folk concept of illnesses, their progression, perceived reason and folk and popular remedial measures, and hypothetically. Further, in-depth interviews were conducted with all the selected stakeholders. Patient's explanatory model (Kleinmen 1975) was created to assess the above-mentioned queries. Survey data were analysed using the SPSS package, and qualitative data were analysed using Atlas-ti package.

### Ethical Consideration

As it was a Research Council (TISS) sponsored study, the Institutional Review Board (IRB) had examined the research proposal for its scientific quality and ethical issues and cleared it for both. Respondents Information Sheet, Informed Consent Forms were prepared according to the guideline provided by the IRB.

## FINDINGS

The paper's findings result from a systematic literature review and the primary data collected from four tea gardens in Dibrugarh District.

### Education among the Respondents

The level of education is very low in these tea gardens. Among the 32 patients, fifty-three percent are illiterate, nearly nineteen percent are only primary educated, and another twenty percent are High school educated. There is no re-

spondent studied beyond class X. Among the caregivers, sixty-one percent are illiterate, twenty-nine percent are primary educated, and only ten percent are high school educated. Among the general respondents, 42.5 percent are illiterate, 37.5 percent are primary educated, and twenty percent are high school educated. This shows the very backward position of tea tribes in terms of education.

### Healthcare Facilities in Tea Gardens

A survey on the health care facilities present in the four tea gardens under the study reveals that one regular doctor and one or more than one nurses are present in each of the tea garden hospital. The North Balijan tea garden has 20 health care professionals, Maijan tea garden has 9, Sessa tea garden has 7, and Mancotta tea garden has 5. The tea garden authority provides free medicines, free ambulance facility, free health check-up, and free of cost supplementary diet for Active TB patients. Nevertheless, if the patients opt for private treatment, the garden authority does not provide these facilities.

Under the DOTS system, the tea garden clinic provides medicine for initial symptoms for cough and fever. If it does not subside, they initiate the first stage test for TB, and if found positive, the patient is sent to AMC for further diagnosis. Once the presence of TB is established, the patient is sent back to the garden Hospital or home to take medicine. If the condition is worse, he is kept in the TB ward of AMC for recovery.

### Risk Factors Relating to TB Prevalent in Tea Gardens of Assam

#### *Disease Burden in Tea Gardens and the Risk of Exposure to Infectious Droplets of TB*

Information collected from the TB control centre in Dibrugarh reveals that the district's tea gardens are burdened with TB a lot. The centre accumulates data on the general population as well as tea gardens. It shows that between the years 2011 and 2015, there are 11,997 TB cases recorded in the Dibrugarh district by the centre, of which 4,789 have been recorded in tea gardens alone, indicating a forty percent share of

TB cases in the district. While the tea garden population constitutes less than twenty percent of the state, the forty percent share of TB incidence among them is significant for the policy planners. The effect of such a high TB burden in the community has also been reflected in primary data collected from the tea gardens.

The primary data collected from four tea gardens reveals that among the selected TB patients, 34.4 percent had close relatives as TB patients, 28.1 percent had a family member at home as TB patients, and 18.8 percent had neighbours as TB patients with whom they used to interact. The remaining 3.1 percent of respondent TB patients did not have any known exposure. Among the 40 general respondents, 45.0 percent have family members currently having or had TB. Another 12.5 percent have TB patients among their close relatives, whereas 42.5 percent of respondents have no closely related TB patients.

### *Housing and Workplace Conditions*

Primary data reveals that the housing arrangement in tea garden lines is very congested, rooms are small, and there is no proper ventilation facility, especially in bedrooms and kitchen. Forty-seven percent of TB patients have up to five family members; thirty-eight percent of respondents live with up to seven members, whereas nearly sixteen percent of families live with eight or more members. Among the non-patient general respondents, 67.5 percent people live with six to seven family members. These data indicate that people mostly live in crowded houses. Such a situation increases the risk of exposure to TB, as indicated by global research literature. Field data show the incidence of TB cases in the same family one after another, sometimes within the same generation and sometimes across the generations. The workplace of the tea garden workers is not as crowded. Being an agro-based industry, the workers are, to some extent, exposed to pesticides and herbicides. Women as leaf pickers and men as cleaners and cutters work in the open air.

It is important to note that all TB infected persons are not contagious. A person is contagious only when the infection becomes active with symptoms. An infected person without TB

symptom is non-contagious. TB symptoms may surface very gradually, and people often get confused with symptoms of other diseases for which timely detection and subsequent treatment get delayed. In such a case, people can unknowingly transmit tuberculosis to others. People with symptomatic TB remains contagious at least till two weeks from the start of medication. After that, though the germs may remain in them with symptoms, they are no longer contagious. Such conditions of transmission necessitate that early detection and early treatment are the keys to arrest the spread of TB in a risky environment. In a condition where there is high TB burden in the community, and people live in congested houses without proper ventilation, the late detection and treatment have a greater possibility of transmitting the germs to the person living nearby.

#### ***Gap between Appearance of Symptoms and Start of Treatment***

The study reveals that people usually wait and watch for a few days for a natural cure. After that, they go to the tea garden clinic and take medicine. Sometimes they simply bring medicine from clinic and take at home. Fifty percent respondents went to a doctor after a week since symptoms first appeared. Another twenty percent respondents reported doctor in 15 days. Nearly twenty-two percent respondents reported after 15 days of symptoms appeared. These indicate that people mostly prefer to wait and watch and prefer not to go to a doctor as far as possible. The reason behind this gap is varied in nature. Most respondents thought they were suffering from some usual illness (47%), while thirty-eight percent were waiting for self-cure. Only 12.5 percent respondents went to the garden doctor to take medicine. Such a treatment-seeking behaviour is crucial in the TB control programme in that the period between the appearance of symptoms and 15 days after the start of treatment, the infected person remains highly contagious.

#### ***Exposure to Household and Tobacco Smoke***

There is scientific research literature indicating that household and tobacco smoke weak-

ens the host immune system in defending TB germs. The very important aspect of the TB germ is that exposure to and inhaling TB germ may not lead to an active TB disease in all persons. Scientific evidence reveals that a person's healthy immune system helps defend against the progression of tuberculosis infection into active TB disease, although the person is infected with TB germs. Scientific evidence reveals that less than ten percent of people infected with tuberculosis bacteria go on to develop active tuberculosis disease. Contrarily, people with weakened immune systems are much more susceptible to actually developing active tuberculosis disease after infection. In a lot of people, the TB bacteria remain dormant and may never develop into active disease. Scientists have found that HIV-AIDS, malnutrition, exhaustive working condition, tobacco smoke, alcohol etc. make a host's immune system weak. Tobacco smoke is responsible for making smoker's airways weak enough to clear TB germs while inhaled.

A general observation in the field reveals that the tea garden workers to collect firewood from the nearby places including the pruned branches of tea bushes and the dry branches of shade trees planted in the tea gardens. They use these for cooking food. In the winter, they also sit around the fire to warm their body. Thus, people are invariably exposed to household smoke in poorly ventilated houses.

Observation also reveals that smoking *bidi* is quite prevalent among adult males, and many women also smoke. The primary data collected from the tea gardens reveal that nearly seventeen percent of patients have continued smoking even after detection of TB. Among the patients, nearly sixty-three percent chew tobacco. Among the general population, fifty-eight percent of respondents smoke either *bidi* or cigarette or both. Besides, a lot of males and females also chew tobacco regularly. This number may be higher as people are reluctant to reveal such behaviour.

#### ***Prevalence of Malnutrition among the Tea Garden Population***

Global scientific studies have found an association between malnutrition in people and TB, thereby explaining that malnutrition weak-



ens hosts' defence mechanisms against TB. The present study did not include an assessment of the nutritional status of the studied people directly. Instead, the study dealt with a brief survey of the dietary habit of the people. The study reveals that the people in tea gardens usually take two heavy meals, one in the morning and the other at night. Rice and roti are two primary food items they eat. Only thirty-four percent of patients reported that they used to take other food supplements like a health drink, milk and eggs. Intake of meat and food supplements is not easy for them due to the cost factor. Their diets are not balanced and compared to their workload, and their diets are not sufficient in most cases. Such conditions lead to malnutrition among the male and female workers as well. The researcher has relied on secondary sources of information like research literature that indicate almost universal malnutrition among the tea garden population in the state.

#### *Use of Alcohol*

The people in tea gardens are generally known to be excessive drinkers of liquor. They drink both locally made alcohol made of rice (called *Hadiya* or *Laupani*), and branded liquor available in the garden shops and vendors. Fermented spirit, locally called *Chulai*, is also a favourite alcoholic drink for these people. Though several researchers have deliberated alcohol use among the tea garden workers, there is a lack of focused studies relating alcohol to any particular disease, including TB.

Primary data collected from tea gardens reveals that among the general population selected for the study (40 respondents), 62.5 percent of people drink liquor, and the number may go up, as people are reluctant to reveal it. Adult males spend many of their earnings on liquor. Nearly forty-eight percent of the respondents are habitual drinkers who drink daily. Fifteen percent of the respondents say that they drink twice or thrice a week. People drink till they are inebriated. The study also reveals that some TB patients have been drinking liquor even after being diagnosed with TB. While many of the respondents are tight-lipped regarding their drinking behaviour, considering the environment, one can say that many TB patients indulge in drinking.

The social situation in the tea garden is congenial to drinking liquor. Almost all adult males among the tea garden workers drink liquor. Many families brew liquor at home either to sell or to consume at home or both. Besides, branded alcohols are also available in the garden through local shops. There are suppliers of local liquor in the tea gardens. It is also a general belief that having few liquor pegs reduces tiredness and body pain after a day's work. People take drinking as a means of entertainment and leisure time engagement. There have been frequent hooch tragedy incidents in the tea gardens due to a lack of quality control mechanism in locally produced liquor.

#### **Social Determinants of TB in Tea Gardens**

##### *Poverty and Economic Conditions*

Poverty and the poor economic condition have been the characteristic feature among tea garden workers due to low wage structure and low human capital in terms of education, skill and awareness to diversify their livelihood. The low wage structure has the colonial legacy continued by the successive Indian tea planters, which have compelled the tea garden workers to reel under everlasting poverty and financial hardship. Based on several records, Dasgupta (1986) observes that the near-starvation wage level was rationalised on the ground that if the planters pay the 'coolies' higher wages, that is, wages above what was considered by the planters as subsistence level, there would be an increase in 'coolie indolence'.

Primary data collected from the selected tea gardens have revealed that sixty-six percent of the TB patients work in this tea garden. Others are non-earners. The average minimum payment is INR 115 per day for the tea garden works. Thus they get around INR 3000 per month on an average, which is quite a poor salary for one to get in these days. People get food items like rice, dal, wheat flour, medicine, and some dresses, either free or heavily subsidised. The permanent employees and their family members get health care benefits in tea garden clinics and hospitals. Their meagre income does not allow them to buy nutritious food items or vegetables, which cost a lot. There is a definite compulsion to compromise health owing to economic conditions.

### *Perceiving Health and Illness and Causes of Illness and Cure*

The primary data collected from the selected tea gardens show that thirty-seven percent of patients believe in the cause-effect relationship between supernatural power and illness and misfortune. Forty-seven percent of patients reveal that they have done one or the other form of rituals in the course of their illness. Contrarily, people have also witnessed the effectiveness of medicines and doctors all along in curing diseases for which they usually do not wait for a ritual cure in most cases. Out of 40 respondents from non-patients, 82.5 percent accept the existence of supernatural power and their effect on human health and well-being. Some sixty percent of respondents believe that the action of spirits, black magic, and evil deeds of people cause illness, and by performing proper rituals and counter-magic, the impact of illness can be reduced or removed. A total of 32.5 percent of families perform rituals at the family level quite often, while 37.5 percent of respondents informed that they performed rituals very rarely.

Among the 31 selected caregivers, nearly sixty-one percent believe that there are ghosts and spirits and create illness among people if they are aggrieved or not appeased. Another twenty-nine percent of respondents say that they do not believe in ghosts and spirits, though most of their fellow people believe in these entities. Among the general respondents, nearly forty-two percent believe that performing rituals and counter-magic can cure or reduce the effect of illness caused due to the spirits and human activities like black magic and casting evil eyes. As many as fifty-two percent of respondents say that they do not believe in such activities. However, they reveal that their community, in general, believes in such actions. Thus, by these views, the tea garden worker community mostly believes in supernatural beings and their influence on the human body and soul. Subsequently, nearly forty-two percent of caregivers informed that they had performed one or the other rituals at home or community level to better the family and the ill persons. People mostly believe that there are some illnesses caused by the action of such supernatural beings. Most of these respondents have believed it, but they cannot

pinpoint what type of illness is created by such powers (58.1%). Another 38.7 percent of caregivers say that chickenpox occurs due to the influence of deities.

In practice, people show more inclination towards modern healthcare facilities around them and think least about spirits' influence. So, they take the diseased person to hospital irrespective of the type of illness. However, some caregivers opined that performing rituals before taking to doctors is essential in some illnesses. Contrarily, nearly seventy-seven percent of caregivers deny that one should perform rituals before going to the doctor. There are several instances where prolonged illness makes people think of supernatural power and black magic. They invariably perform rituals and counter-magic activities with the help of priests and traditional healers. Such activities are quite a familiar scene in the tea garden.

It is quite interesting to observe that people do not think of a total physical cure through rituals and counter-magic. Some of them believe that doctors and modern medicine can cure the physical harm done by such forces. Some people believe that until the influence of supernatural beings or black magic persists, the body cannot respond to a doctor's medicine. So, it is essential to remove the influence of spirits and black magic before one takes the patient to the doctor. So, many people do a ritual before taking the diseased person to the hospital. Nearly fifty percent of respondents believe in this procedure.

### *Perceived Causes of TB*

The study reveals that TB patients mostly express their ignorance about what causes TB. As many as eighty-four percent of TB patients have revealed that they have no clear idea of what caused TB in them. They were mostly tight-lipped about the disease's spread from their family members or close relatives because that would hold those persons responsible. Instead, they tried to falsify the contact to be a reason for the spreading of the disease. In their views, many TB patients do not have any contact with any other TB patients. They also opine that illness may occur at any time and any circumstance. Contrarily, sixteen percent of respondents say that others have infected them. Among the car-

egivers, 93.5 percent did not have a definite idea what causes TB. They have a very vague idea about it. Another 42.2 percent caregivers feel that TB occurs as other diseases occur among them. Among the general respondents, 87.5 percent people did not have proper idea how people got infected with TB.

By explaining the patient's explanatory model, the study finds that some patient believes their illness as a result of their destiny and bad luck. They accept that some supernatural power or connection is responsible for such destiny and bad luck. There are also TB patients who think that a cure from TB takes longer time due to back magic inflicted on them. The inquiry also reveals that the course of treatment is directly related to the perceived cause of illness. If the cause of the illness is perceived as supernatural, they will prefer rituals to bio-medical treatment, at least for the initial stage of treatment.

Further, patients are mostly clueless about what triggered their illness. However, with certain uncertainty, few patients think that their drinking habit, hard works when they are weak lead to TB. Some stick to destiny, as well. Some patients believe that their previous illness triggered the incidence of TB in them.

The in-depth interview reveals that people accept the severity (fatality) of TB, but they are not serious about susceptibility to it. They have seen TB patients in their neighbourhood, mostly cured after treatment. They have available and easily accessible health care facilities. They cannot opt for a different lifestyle and work environment even though they are at risk of getting TB, due to lack of option open to them. This perhaps makes them casual about this fatal disease. This has been manifested in their risky lifestyle. Several patients and non-patient respondents expressed such perceptions. Further, the inability to separate TB symptoms from other respiratory and related diseases makes the situation worse as it leads to failure in timely detection and subsequent treatment on time.

#### ***Knowledge about TB Symptoms among the Patients Before Getting Diagnosed***

The interviewed TB patients revealed that doctors and nurses did not inform them about

various aspects of TB. The health department has been running awareness campaigns in various ways. The ground reality is that it has hardly reached the targeted people, especially the tea garden population. Relative isolation, low literacy, easy access to doctors and medicines, and the inherent belief system might influence it. As many as seventy-eight percent of patients did not know about TB symptoms before being diagnosed with it. The twenty-two percent of respondents said that their knowledge about the TB symptoms was not perfect. Instead, they perceived the illness symptoms either as simple cough and fever or usual illness. The illness' progression led them for further action, like going to doctors and screening for TB. A total of seventy-five percent of the respondent TB patients know that TB is a fatal disease if not treated properly. However, only forty-seven percent of them knew this before they were diagnosed with TB. Among the total 32 patients, thirty-one percent were informed by fellow patients about the fatality, while doctors told only 9.4 percent. These findings indicate that awareness programs are unable to make people aware of TB.

### **DISCUSSION**

Without denying the success and promising outcomes of the bio-medical TB control regimen, the public health professionals and social scientists explicitly express the crucial roles of social determinants in the TB control program. The probability of exposure to infected droplets of TB, getting infected, and the manifestation of the disease depends on factors determined by social conditions in and around people. The study deals with the nature and extent of such determinants in the tea gardens based on literature review and primary data and discussed as follows.

#### **Risk Factors to Exposure among the Tea Garden Workers Population**

#### ***Disease Burden in Tea Gardens of Assam***

Data collected from the TB control centre of Assam Medical College Hospital clearly reveals the high TB burden prevalent in tea gardens of

Assam. The effect of high TB burden on the studied population gets manifested from the finding of the field study also as it finds multiple TB patients from a single family from the same generation or across the generations at different times. Literature available specific to health issues in Assam's tea garden population also supports such findings. For instance, Chelleng et al. (2014) revealed the importance of tracing the family history of Pulmonary TB. Researchers like Deb Nath (2000), Sahoo et al. (2010), Deb Nath and Nath (2014), Khan et al. (2015) and Hazarika and Arakeri (2019) revealed the prevalence of TB and various factors responsible for the spread of TB in tea gardens of Assam.

#### ***Physical Surrounding and Risk of Exposure***

Some conditions where a person lives or treads through determine the risk of exposure to infectious droplets. There is a greater possibility of contact with infectious droplets under specific physical environments, as has been shown by Rieder (1999) and Menzies and Joshi (2007). Further, the duration of exposure depends on how the person concerned is related to those places. Besides, disease load in the surrounding congested and overcrowded living or working conditions without proper ventilation is also risky.

#### ***Housing Conditions as a Risk Factor for Exposure to Infectious Droplets***

The primary data shows that people in tea gardens live in congested and poorly ventilated houses with a large number of family members. The global literature reviewed indicates that in a high TB disease burdened condition, late detection and subsequent delay in treating active TB patients may lead to spread of TB, especially in a crowded environment as found in tea gardens. The primary data indicate such a possibility of TB transmission in tea gardens of Assam.

Such high household occupancy density, low air quality, and inadequate ventilation have been linked with TB in a study in the Canadian context by Larcombe and Orr (2007), Clark et al. (2002), and Madhona et al. (2016). In India, Singh et al. (2018) also opine that a contaminated household environment increases tuberculosis risk. Although the research literature available

on tea garden in Assam does not deal with of any such cause-effect relationship, these studies certainly substantiate the findings of primary data by showing the high occupancy of households in tea gardens as shown by researchers like Baruah (2009), Sahoo et al. (2010), Dutta et al. (2011), Dowerah (2013) Bora (2015), Deori and Saikia (2016), Saikia (2017), Boruah (2018), Hazarika and Arakeri (2019) and many more.

#### ***Factors Related to Weakened Host Defence System***

##### *Impact of Tobacco and Household Smoke*

The primary data shows that smoking and chewing of tobacco have been prevalent among the tea garden population and the selected TB patients. *Bidi* is a popular item for smokers in the tea gardens. The young people also indulge in smoking tobacco. It has been revealed that the parents are least concerned about smoking and chewing tobacco by their children at a young age, as it remains a usual practice across gender and generations. Awareness against tobacco use is at its minimum. The earning young generation justifies their smoking habit because it is their earning, and no one has to do anything about it. The following generation learns and imbibes the practice of tobacco use from their parental generation as well. Further, the tea garden people use firewood for cooking and heating purposes in an inadequately ventilated house, leading to tobacco and household smoke pollution exposure.

The global research literature reveals a direct association between tobacco smoking and weakened host immune system increasing the risk of getting infected with TB germs. Studies conducted by Underner et al. (2012a,b) and Al-tet et al. (2017) show smokers developing a weakened defence system. Similarly, Padrão et al. (2018) have identified the threshold risk factors of smoking cigarettes per day for TB. Researchers like Gopi and Kolappan (2002) and a WHO study (2016) found the association between tobacco smoking and pulmonary tuberculosis development and the activation of latent TB infection (Amere et al. 2018). Further, smoking has a twofold risk of an increase in TB, as Hsien-Ho Lin (2009) shows.

It is worthwhile to mention that there is no scientific study conducted among the tea garden worker population establishing the link between exposure to smoke and weakened host defence system. Among the few available literature, Medhi et al. (2006), Balgir (2009), Sahoo et al. (2010) and Sharma and Bhuyan (2018) reveals that adult males and adolescents, and to a certain extent, women also use tobacco, smoking, and chewing which substantiate the finding so of the primary data. Considering the evidence of exposure to tobacco and bio-fuel smoke in tea garden population, and considering the global evidence it can be said that tobacco use has increased TB infection and disease risk in tea gardens, and the people in the tea garden are also at such risk due to prevalence of smoking.

#### *Malnutrition and TB*

As stated in the finding section, the study did not deal with the tea garden population's malnutrition status and its link with the incidence of TB. Instead, the study briefly inquired about the dietary habit of the people. Thus, the study reveals a poor nutrition and food in-take compared to the nature of work the people do.

The tea garden worker populations, both males and females, are involved in menial and laborious works. They have to work from 8 o'clock in the morning till 4 o'clock in the afternoon. To fulfil the given target, the labourers have to work sometimes beyond their usual capacity. The reviewed literature and information collected suggest that the tea garden workers do not get the minimum wage set by the government for other workers. The meagre earning puts them into poverty, leading them to various other related problems like the inability to get adequate nutritious and balanced food and health education, and general well-being.

The supply of subsidised food grain mostly falls short of the requirement of the tea garden population. Further, due to meagre earning and the spending of money on alcohol and other non-essential commodities, it worsens. People are seen habitually less concerned about their diet in terms of good health and follow the usual food habit, lacking in required nutrition and quantity. Rampant anaemia among these people, es-

pecially among women, is related to their food habits, poverty, and work burden.

The global research literature on the link between malnutrition and risk of infection with TB disease reveal a bi-directional association between the two. While malnutrition creates a congenital condition for TB infection, TB disease itself may lead to malnutrition in patients (Cegielski and McMurray 2004; Gupta et al. 2009; Hoyt et al. 2019; Ingabire et al. 2019; Feleke et al. 2020). Malnutrition can also lead to secondary immunodeficiency, increasing the host's susceptibility to infection Chan et al. (1997). Furthermore, low BMI had the most substantial mediating effect on the association between poverty and prevalent TB (Oxlade and Murray 2012).

Although the available research studies specific to tea gardens in Assam do not focus their attention towards any such established link, these literatures explicitly indicate widespread malnutrition among the tea garden worker population attributable to the poor economic condition and lifestyle (Sahoo et al. 2010; Chelleng et al. 2014; Deori et al. 2016; Saikia 2017; Dey 2019; Borgohain 2020). Other researchers have revealed the calorie and protein deficiency among these people resulting from the inadequate intake of essential food constituents (Deb Nath 2000; Medhi and Mahanta 2007; Panyanget al. 2018; Konwar et al. 2019). Nevertheless, the discussion indeed points out that the tea garden population is at greater risk of getting infected with TB germs amidst the prevailing high disease burden because they live in poverty, do hard physical labour, have low-calorie intake and established malnutrition.

#### *Alcohol Use, Social Underpinning, and TB*

Field observation and primary data collected from the field clearly reveal that drinking liquor, mostly in excess, has been a usual way of life among the tea garden population. Even some of the current TB patients also indulge in drinking alcohol. The study also reveals that the social situation and perception related to alcohol consumption benefits make the situation congenial for alcohol use in excess.

It is also a general belief that having few liquor pegs reduces tiredness and body pain after a day's work. People take drinking as a means



of entertainment and leisure time engagement. Some people celebrate several rituals and ceremonies with plenty of liquor use. Parents hardly restrict their children from drinking liquor, and the children also imbibe the same behaviour of indulging in drinking following their parents. Among the Christian converts, the use of alcohol is less compared to traditional people. There have been frequent hooch tragedy incidents in the tea gardens due to a lack of quality control mechanism in locally produced liquor.

Excess use of alcohol compounded with the lower quality of alcohol and poor dietary habits makes their immune system weak, and they become vulnerable to fatal disease like TB.

The available national and international level research evidence shows that a higher level of alcohol consumption is associated with an increased TB risk (Sameer et al. 2017; Zixin et al. 2017). Heavy alcohol use or AUD constitutes a risk factor for incidence and re-infection of TB with a higher rate of treatment defaults and the development of drug-resistant forms of TB (Rehm et al. 2009). Social mixing patterns associated with alcohol use hinder TB treatment response (Lönnroth et al. 2008). This evidence suggests that considering the heavy drinking habit of tea garden worker populations combined with poverty, malnutrition, and lack of awareness about several health aspects, pose a grave health concern, including TB incidence. At the level of tea gardens of Assam, research studies reveal widespread use of alcohol in the tea gardens of Assam substantiating the study's findings (Sharma and Bhuyan 2016, 2018; Medhi et al. 2006; Sahoo et al. 2010; Bora 2015).

#### ***Linkage Between Poverty, Living Conditions, Work, Malnutrition and Unhealthy Habits***

It has been evident from the study that the tea garden worker populations are bound to live in the labour lines (colony) as per their service agreement as well as for their future job security. The people themselves are also least concerned about changing the surrounding in terms of cleanliness and hygiene. As their earning is directly related to whether they can fulfil the set daily target of work, the workers have to do their duties even at the cost of their health. They are kept at the threshold of income so that every-

day work is their compulsion to survive. As mentioned in the findings, this legacy of low payment continues from the colonial regime.

Indeed, income poverty is directly related to malnutrition. However, this is not the only determinant of malnutrition. People's lifestyles and food habits also have significant effects on people's nutritional health. People are hardly concerned about the balanced and nutritional aspect of their food, and they do not put variation in their diets. The frequency of meals and the gap between meals also has a determining effect on their health. They go to work early with the first meal in the morning and hardly eat anything substantial during the day. They mostly miss the afternoon meal. Black tea with salt has been their refreshing drink between working hours.

Further, they indulge in drinking liquor, and the male adults spend a larger part of their income in drinking, making the women workers in the family manage the household expenses, including expenses on food. Thus, one can see an unbreakable linkage between the tea gardens' labour administration policy, poverty, living conditions, malnutrition, and unhealthy lifestyle. These increase the risk of exposure to infectious droplets of TB and weaken the host's defence system, which increases the risk of infection and the manifestation of TB disease among the exposed population.

#### ***Perception and Action about Health and Treatment***

A substantial number of tea garden worker populations have mentioned their beliefs and practices related to health and treatment-seeking behaviour, directly or indirectly related to the beliefs in the action or influence of supernatural power, non-material and non-biomedical causes. One can see the blend of traditional beliefs and practices and the use of a bio-medical regimen to treat illness in tea gardens. Such perceptions and actions have some determining impact on the delay in diagnosis and treatment initiative, adherence, and withdrawal, especially in TB diagnosis and treatment. In the Indian context, several social scientists have explored specific traditional health and treatment-seeking behaviours among the tribes. Several perceptions

and actions of tea garden worker population resemble those perceptions and practices.

The medical anthropologists have established the importance of understanding the cultural factors in health care practices globally (Othon 2011). The influence of local culture on the interpretation of causes and symptoms of illness, which to a great extent, influence the onset of treatment-seeking among people, has been mentioned by several anthropologists (Liefoghe et al. 1997; Yamada et al. 1997; Auer et al. 2000; Banerjee et al. 2000; Ngamvithayapong et al. 2000; Wandwalo and Morkve 2000; Edginton et al. 2002; Viney et al. 2014). Relating the causes of illness to the effect of supernatural power, wrongdoing, bewitching, and breaking cultural rules of sexual abstinence, have been established globally (Pronyk et al. 2001; Eastwood et al. 2004; Viney et al. 2014). These researchers found the perceived causes significant, in that, based on the cause of illness, people seek treatment pattern. Thus, finding no link between causes of illness and modern health care practices remains one of the crucial reasons of non-compliance and non-adherence to a particular bio-medical treatment regimen by indigenous people (de Villiers 1991; Liefoghe et al. 1997; Shrestha-Kuwahara et al. 2017). To some extent, such behaviours are also prevalent among the tea garden population.

There has been very scanty research on the perception and action about health and treatment-seeking among the tea garden worker population in Assam. It will be beneficial for social sciences researchers to have a concrete insight into the inherent folk perception prevalent among the tea garden population about causes of illness, health, and treatment-seeking expectations to make TB control programs more inclusive.

#### ***Role of IEC in Awareness Building about TB***

Information, Education and Communication (IEC) have been the integral parts of the TB control program where the community participation component has been infused recently in RN-TCP. As per the literature reviews and primary field investigation, there is minimal impact of any such IEC program among the tea garden worker population. Some people came to know a few details about TB only after they were diagnosed

with the disease. Some are aware of the disease from other community people, and their information is not complete.

The study has revealed that people in tea gardens are not well aware of TB in terms of its causes, mode of spread, and preventive measures. They are also not well aware of the susceptibility to the disease. Causes of TB, as forwarded by these people, include bio-medical, supernatural, and climatic conditions. They are mostly concerned about sharing TB patients' utensils, as they think it is the mode of transmission.

#### **Differential Impacts of Risk Factors and Social Determinants on Tea Garden Populations**

The paper discusses the logic behind the differential impacts of risk factors and social determinants on the population having different socio-political backgrounds mentioned in the paper's introduction. The following are the discussion on the impact of risk factors and social determinants on tea garden populations based on that argument forwarded by Blas and Kurup (2010).

The people of the tea gardens of Assam find themselves at the lowest level of the social and economic domain. Till the 1980s, people used to address them as "coolie", a term, given by the British tea planters. Their social status was low, and they were an excluded population from the mainstream Assamese society. To date, they are far lagging behind in terms of education, economic status, jobs and skills. They have limited options to come out of their tea garden domain. Lack of awareness about rights and privileges and health and wellbeing has made them vulnerable to many odds.

Further, political parties use these people as their vote bank. Considering their population and their concentration in certain parts of the state and their voting behaviour, political parties compete to lure and manage them. Although the tea garden population's importance is immense for political parties, the concerned authorities have done very little to improve their condition. They are even devoid of the minimum wage they are supposed to get. There is no denying that a few people from tea gardens became elected MLAs and MPs. However, they are roped into power only to serve the purpose of the political parties. The ordinary people of

tea gardens have little or no voice in policy issues. They are dependent on the tea garden authorities and the government.

Exposure to infectious droplets due to high disease burden is likely to affect more in the tea garden population in that there is evidence of delayed diagnosis and late treatment-seeking due to various reasons mentioned elsewhere in this paper.

Malnutrition, which is rampant among the tea garden population, affects people differently in that their works are tedious and laborious. They are the least aware and concerned about the nutritional aspects of the food they eat. Their poorer condition and their viewpoints on food and health do not allow them to get rid of the cycle of poverty, malnutrition, and TB infection. Further, researches have revealed that TB infection leads to malnutrition as well. In such cases, poverty, lack of awareness, ill perception about health, and lack of social security network as prevalent among the tea garden worker population affect them severely, as it is hard for them to come out of the situation.

Though smoking is prevalent among the well to do population groups, its consequence is different for the more impoverished and uneducated. The people in better socioeconomic positions will cease to smoke due to their greater awareness about the effect and susceptibility and familial and social pressure. In contrast, there is no such option or conditions available in tea gardens. Unavoidable exposure to infectious droplets and weakened defence mechanism of smokers lead the people to TB infection and its consequences.

Another crucial aspect is alcohol consumption. Consumption of alcohol is also quite prevalent among the richer and well to do population groups. Nevertheless, the quality of alcohol, the nature and extent of drinking liquor, food habits and drinking habits make a differential impact. The people in tea gardens mostly drink locally made liquor with no quality assurance. There have been hooch tragedies in tea gardens. The branded liquors also have no quality assurance in that local people have sold these without holding proper or no licenses. Further, the tea garden workers perceive alcohol as an energy booster, painkiller, and tiredness killer. Such sort of perceived substitution to regular energy-pro-

viding foods deteriorates their health further. Frequent assembling and drinking together in a disease-burdened situation again increase the risk of exposure. The weak health due to irregular diet and excessive drinking increases the risk of developing the disease if a person gets exposed to infectious droplets, which is very likely in tea gardens.

There have also been reports of differential treatment in the health centres by the health care providers with the tea garden workers because there is a general notion among the people outside the tea garden that the labourers of tea garden are ignorant, unclean and uneducated. They are powerless and thus cannot assert their rights. Such perceptions get translated to discriminative actions in some instances, as has been reported.

## CONCLUSION

Analysis of TB control programs across the world leads to a suggestion that for sustainable control of TB, the curative interventions need to go hand in hand with preventive interventions that are likely to reduce people's vulnerability to TB infection and disease. Interventions require at the downstream risk factors for vulnerability and more upstream social determinants. The current TB control program primarily focuses on addressing the factors that lead to inadequate access to quality curative services. Thus, the present paper focuses on social determinants and risk factors relevant to TB prevention.

The prospect of controlling TB without addressing the social determinants of TB as preventive measures seem to be not adequate in that the focused interventions in tea gardens of Assam has not been able to arrest the spread and incidence of TB. Thus, based on the evidence drawn from the research literature, some broad social determinants of TB have been identified and discussed in detail, highlighting the possible causal pathways through which they increase TB risk.

From the findings and discussion above, it becomes evident that the social determinants prevailing in tea gardens have a direct bearing on the success of TB control programs in that the high disease burden situation as prevails in tea gardens increases the risk of exposure to TB germs as well as infection and the manifestation

of TB disease among these people. Therefore, addressing the social determinants (intervention) will help control TB among the tea garden population. Because the tea garden worker populations have a fixed residential location and are concentrated in tea gardens only with an almost similar kind of social, economic, and administrative setup, it should be easier to frame a plan to address them. It is also equally essential to point out that amidst the numerous studies on the tea garden population, there is hardly any substantial finding that can reveal a scientifically established link between social determinants and TB incidence.

### RECOMMENDATIONS

Following are some recommendation based on the findings and discussion above:

- i. An extensive scientific study is required to establish and assess social determinants' impact in terms of increased risk towards exposure to and infection with TB germs.
- ii. Integration of IEC with community-based agency activities so that people find them as their own programme with a meaning. The issue of malnutrition, tobacco use, alcohol use, and healthy dietary habits must be included in the IEC specific to the tea garden population.
- iii. Women's empowerment should be at the core of each of these measures to be taken.

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