Factors Associated with Tuberculosis Treatment Default Amongst Migrant and Mobile Populations in Myanmar

by

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the Global Health Program Duke Kunshan University and Duke University

2017
ABSTRACT

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Abstract

Background: Ending the global tuberculosis (TB) epidemic by 2035 will substantially depend on the effective control of the “lost to follow-up” (LTFU) from TB treatment. Myanmar is one of the 14 countries with high burden of TB, TB/HIV, and Multidrug-Resistant TB (MDR-TB). The aim of the study is to identify the factors associated with LTFU from TB treatment among migrant and mobile populations in Mon and Kayin States in Myanmar.

Methods: This was a prospective cohort study with a convergent mixed methods design. 146 new TB patients were surveyed and 14 “treatment after LTFU” patients were interviewed between June and September, 2016. Upon the treatment outcome data made available in February 2017, the survival analysis was conducted to measure the effect of potential predictors on time to LTFU during the full duration of treatment using Stata 14.0 version for Mac. Thematic networks analysis was applied to the qualitative data analysis by NVivo software 11.3.2 version for Mac.

Results: Of the 146 patients included, 10 (6.85%) new patients were LTFU from treatment. Having a family and/or community member support during the six to eight months’ treatment was a protective factor (Hazard Ratio (HR) 0.146; 95% CI 0.037 - 0.576; p = 0.0075), whereas the intention to stay for less than three months at the current place was a potential risk factor (HR 6.323; 95% CI 1.403 – 28.499; p = 0.0075) for getting
LTFU from TB treatment. Having a lack of knowledge, but a positive attitude towards TB predisposed migrant TB patients to look for health education. However, financial constraint and social stigma of TB reinforced them to get LTFU from TB treatment. Poor provider-to-patient communication and barriers to accessibility of services were the enabling factors for the delay seeking care and treatment.

**Conclusions:** People on the move who are intended to stay in working area for less than 3 months are the high-risk group for TB treatment default. Having no family and/or community member support is a risk factor associated with tuberculosis treatment default among the migrant and mobile populations in Mon and Kayin States of Myanmar. National Tuberculosis Program should strengthen the existing multilateral community-based TB care with an integrated referral system inclusive of people on the move who are intended to stay in working area for less than three months. Fostering self-efficacy of TB patients by patient-centered communication and informed decision-making in the clinical setting as well as in the community will enable the better adherence to TB treatment among the migrant and mobile populations.
Dedication

This work is dedicated to my mother who sacrificed her career for the well-being of me and my sisters. As you always say, my faith in God has guided me through this journey.
Contents

Abstract.............................................................................................................................................. iv

List of Tables ........................................................................................................................................ x

List of Figures ...................................................................................................................................... xi

Acknowledgements ................................................................................................................................. xii

1. Introduction ....................................................................................................................................... 1
   1.1 Country profile of Myanmar ........................................................................................................... 2
   1.2 TB disease burden, TB care and control in Myanmar ................................................................. 5
   1.3 Literature review on “Lost to follow-up from TB treatment” ................................................... 10
   1.4 General objective ........................................................................................................................ 13
       1.4.1 Research questions and hypotheses ................................................................................... 13
   1.5 Research Collaborator ................................................................................................................ 14

2. Methods ............................................................................................................................................. 16
   2.1 Setting ............................................................................................................................................ 16
   2.2 Study population .......................................................................................................................... 17
       2.2.1 Operational definition of migrant category ........................................................................ 18
       2.2.2 Inclusion criteria ................................................................................................................. 18
       2.2.3 Exclusion criteria ............................................................................................................... 19
   2.3 Procedures .................................................................................................................................... 19
       2.3.1 Data Management Team ................................................................................................... 19
2.3.2 Data Collection ............................................................................................................. 20

2.4 Measures .......................................................................................................................... 21

2.4.1 Event variable .............................................................................................................. 21

2.4.2 Time variable ............................................................................................................... 22

2.4.3 Predictor variables ...................................................................................................... 22

2.4.3.1 Socio-demographic factors .................................................................................... 22

2.4.3.2 Migration and mobility-related factors ............................................................... 23

2.4.3.3 Patient factors ....................................................................................................... 23

2.4.3.4 Health system factors ......................................................................................... 23

2.5 Analysis ........................................................................................................................... 24

2.5.1 Quantitative analysis ............................................................................................... 24

2.5.2 Qualitative analysis ................................................................................................... 25

3. Results ................................................................................................................................ 28

3.1 Description of the sample ............................................................................................. 28

3.2 Quantitative findings ..................................................................................................... 29

3.2.1 Factors associated with tuberculosis treatment default ........................................... 30

3.2.2 Migration pattern and tuberculosis treatment default ............................................ 31

3.3 Qualitative findings ....................................................................................................... 33

3.3.1 Barriers to adherence to TB treatment .................................................................... 34

3.3.2 Measures to improve the adherence to TB treatment ............................................ 42

4. Discussion ......................................................................................................................... 48

4.1 Implications for policy and practice ............................................................................. 52
4.2 Implications for further research .......................................................... 55
4.3 Study strengths and limitations ............................................................. 56
5. Conclusion ................................................................................................. 59
Appendix A ................................................................................................. 60
Appendix B ................................................................................................. 61
Appendix C ................................................................................................. 62
Appendix D ................................................................................................. 63
Appendix E ................................................................................................. 64
References .................................................................................................. 66
List of Tables

Table 1: Characteristics of study population. .............................................................. 28
Table 2: Univariate Cox Regression. ........................................................................... 30
Table 3: Perceived knowledge of TB ............................................................................ 38
List of Figures

Figure 1: Trend of TB cases in Mon State (2006-2015) (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016). ................................................................. 9

Figure 2: Nelson-Aalen cumulative hazard curve. ................................................................. 29

Figure 3: Migration pattern effect on time-to-LTFU (family and/or community member support present). ........................................................................................................... 32

Figure 4: Migration pattern effect on time-to-LTFU (no family and/or community support). ......................................................................................................................... 32

Figure 5: Tree Map. Barriers to the adherence to tuberculosis treatment.................................. 34

Figure 6: Sunburst Chart. Patient factors.................................................................................. 35

Figure 7: Sunburst Chart. Health system factors........................................................................ 40

Figure 8: Tree Map. Suggestion for improving TB treatment adherence. ................................. 43

Figure 9: Sunburst Chart. Suggestions for social support............................................................ 44

Figure 10: Sunburst Chart. Suggestions for health system. ......................................................... 45

Figure 11: Conceptual framework. The PRECEDE-PROCEED Model for health promotion program planning (Green & Kreuter, 2005; "PRECEDE/PROCEED," 2016). 60

Figure 12: Modified Conceptual Framework. The PRECEDE-PROCEED Model for health promotion program planning (Green & Kreuter, 2005; "PRECEDE/PROCEED," 2016). 61

Figure 13: Study design and timeline of data collection. ......................................................... 62

Figure 14: Mind Map of conceptual framework for coding in NVivo. ..................................... 63
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1. Introduction

Tuberculosis (TB) is the fifth leading cause of death worldwide estimating 21 deaths per 100,000 populations in 2012 and the third leading cause of death in Myanmar estimating 49 deaths per 100,000 populations in 2015 (Institute for Health Metrics and Evaluation, 2017; WHO, 2015c, 2016). The economically impoverished population is substantially affected by TB due to income loss of more than 50% of their income (WHO, 2015b). The emergence of multidrug-resistant tuberculosis (MDR-TB) and extensive drug-resistant tuberculosis (XDR-TB) pose greater risk to those who are affected as well as the general population. One of the three global targets of ending the global TB epidemic by 2035 is aimed at 95% reduction in the absolute number of TB deaths and it will substantially depend on the effective control of the non-adherence to TB treatment, particularly of those 3.6 million people with TB missing by health systems every year (WHO, 2015b).

Globally, extensive research has been conducted on identifying the determinants of non-adherence to TB treatment, but few researches have been carried out to identify the factors associated with tuberculosis treatment default among migrant and mobile populations. Myanmar is one of the 14 countries with high burden of TB, TB/HIV and MDR-TB (WHO, 2015d). The aim of this study is to identify the factors associated with tuberculosis treatment default among the migrant and mobile populations in the post-conflict Mon and Kayin States in Myanmar.
1.1 Country profile of Myanmar

The Republic of the Union of Myanmar is the second largest country in Southeast Asia with a total population of 56.8 million people (CIA, 2017). Myanmar consists of a highly differentiated community with 135 ethnic groups including Burman 68%, Shan 9%, Karen 7%, Rakhine 4%, Chinese 3%, Indian 2%, Mon 2%, and other 5%. Myanmar is a lower middle income country with a GNI per capita of US$1,160 (The World Bank, 2015). In 2010, 25.6% of total population lived below the poverty line (ADB, 2016). 70% of the total population resides in the rural area and the average household size is 4.4 (Department of Population, 2016b).

The net emigration rate is -0.3 migrants per 1000 population in 2016 (CIA, 2017) with an uneven distribution of in- and out-migration across the country mostly due to the employment opportunities. According to the latest consensus, 2014 Myanmar Population and Housing Census (MPHC), Kayin State has a positive net migration rate of 43.1 per 1000 population with a high rate of in-migration (58.3) and a low rate of outmigration (15.2), whereas Mon State has a negative net migration rate of -2.2 per 1000 population with the in-migration rate of 35.4 and outmigration rate of 37.7 per 1000 populations (DP, 2016a). Particularly, Myawaddy district in Kayin State has the highest rate of in-migration (201.2), due to the cross-border trade with Mae Sot’s special economic zone in Thailand. In addition to this, nearly half of the migration flow has
been from urban to urban (47.3%) followed by rural to rural (25.7%), urban to rural (16%), and rural to urban (10.4%) migrations respectively in 2014 MPHC (DP, 2016a).

The Republic of the Union of Myanmar has a dual public-private health system in terms of financing and service delivery with separate training institutes and decentralized provision of health care. The public system consists of health care facilities of Ministry of Health and Sports for general public, and of Ministries of Defense, Railways, Mines, Industry I and II, Energy, Home and Transport, and Labour, Employment and Social Security for their employees and their families under the social security scheme (Sein et al., 2014). The private system consists of two main entities including the Myanmar Medical Association (MMA) providing continuing medical education for private general practitioners and Population Services International (PSI) mobilizing private health providers under their Sun Quality and Primary Health Network (Sein et al., 2014).

The total expenditures on health per capita was 25,997.5 MMK (kyats) and as a share of GDP was 2.34% in 2013. The health financing in Myanmar is featured by low public expenditure (38.53%) and high household out-of-pocket spending (54.56%) (MoHS, 2014). The previous studies with the extreme poverty threshold (consumption below 1 USD per day) and higher poverty threshold (consumption below 2 USD per day) have found that 12-18% of the households had experienced catastrophic health expenditure in Myanmar (Sein et al., 2014). Yet there is no formally established social
protection mechanism for preventing the households from catastrophic costs due to any illness, which leads to health inequity and fragmentation of the population.

During the past six decades of internal conflict between Myanmar’s armed forces, known as the Tatmadaw, and the ethnic armed organizations (EAOs) as well as the smaller armed groups, known as militias (Buchanan, 2016), a dual health system has been developed at the fragile and conflict-affected states (FCAS) creating large health disparities in Southeast Myanmar. More importantly, as B. Davis and Jolliffe (2016) states that “counter-insurgency practices employed by the Tatmadaw, and human rights abuse by a wide range of armed actors, have left communities devastated” and EAOs have restricted their people to get access to health care only from their Ethnic and Community-based Health Organizations (ECBHOs) rather than the health care facilities belonging to the Ministry of Health and Sports.

Existing health disparity in Southeast Myanmar is evident from significantly poor health indicators compared between the national average and the ECBHO areas of the post-conflict states. For example, in Mon State, the infant and under five mortality rates in ECBHO areas are approximately 10 times higher than the observed rates in the public health facilities (94.2 vs. 10.5 and 141.9 vs. 14.3 per 1000 live births, respectively) (Ministry of Health and Sports, 2015; Parmar et al., 2015), whereas the number of sanctioned health workers (doctors, nurses, and midwives) in Mon State is 0.33 per 1000 population which is lower than the national average (0.68) and far below the global
standard (2.28) (Sein et al., 2014). As a result of six decades of armed conflict, there is a widespread of poverty which yield structural violence (i.e. “lack of skilled human resource and basic medical supplies”) within the dual health system (W. W. Davis, Mullany, Schissler, Albert, & Beyrer, 2015; Ministry of Health and Sports, 2012).

Despite of such dueling between Myanmar government and the EAOs, the local governmental as well as the local and international non-governmental organizations have been converging their action towards implementing the national programs on the priority health problems including tuberculosis (B. Davis & Jolliffe, 2016).

1.2 TB disease burden, TB care and control in Myanmar

Tuberculosis is the third leading cause of death in Myanmar estimating 49 deaths per 100,000 populations (IHME, 2017; WHO, 2016). During the MDGs era and the Stop TB Strategy 2006-2015, the Republic of the Union of Myanmar has been among 22 high-TB-burden countries, 41 high-TB/HIV-burden countries, and 27 high-MDR-TB-burden countries. Today all three HBC lists include 30 countries with accounting for 85-89% of the global burden in which Myanmar is one of 14 countries with high burden of TB, TB/HIV and MDR-TB (WHO, 2015d).

The incidence rate of TB including TB/HIV in 2015 is estimated at 365 (267-479) per 100,000 populations in which 88% are pulmonary tuberculosis and 39% of pulmonary tuberculosis cases have been bacteriologically confirmed (WHO, 2016). In the private sector, the MMA and PSI together identified 15% of all TB cases in 2011
Among the total TB cases notified, the TB burden accounted for men is higher than women across all age groups in Myanmar, which is concordant with the global M:F ratio of 1.7 for case notifications (WHO, 2016).

The Department of Health at the Ministry of Health and Sports oversees the National Tuberculosis Programme (NTP) delivered through the township health system with a primary health care (PHC) approach (Sein et al., 2014). There are 14 Regional/State TB centers and 101 TB teams at district and township levels implementing the Directly Observed Treatment, Short course (DOTS) strategy since 1997. Since the Public-Private Mix DOTS (PPM-DOTS) was adopted for TB care and control in Myanmar in 2004, the collaborating local and international NGOs have been expanding its coverage across the country led by the MMA covering 122 townships with 1286 active PHC providers, and PSI covering 198 townships with 1827 active PHC providers (Nwe, 2013; Sein et al., 2014). The PHC providers, in other words general practitioners (GPs), are engaged in three schemes of PPM-DOTS through the collaborating partner NGOs (Nwe, 2013):

1. Scheme 1: health education and suspect referral
2. Scheme 2: health education, suspect referral, and DOT
3. Scheme 3: suspect referral, diagnosis, treatment, and DOT

The Stop TB Strategy was adopted in 2007 providing the fixed-dosed combinations of anti-TB drugs as TB kits for the type of TB. Since 2011, community-
based TB control activities have been incorporated to the PPM-DOTS in which the defaulter tracing activities has become the routine duty of the basic health staff (BHS) at the basic management unit (BMU) in public sector and of the village health workers in the private sector (MOH & WHO, 2012; Sein et al., 2014).

The national TB budget is estimated to be 69 million USD in 2016. TB financing is largely subsidized from the international donor funding (52%), particularly the Global Fund through its Principal Recipients for the Myanmar grants, UNOPS and Save the Children, and the Three Millennium Development Fund (3MDG) (Sein et al., 2014; The Global Fund, 2014; WHO, 2016). Furthermore, 21% is domestically funded leaving the funding gap of 28% in TB financing (WHO, 2016).

Such high dependence on external funding and the funding gap pose greater risk and vulnerability to catastrophic health expenditure for TB patients, especially due to the availability of the quality-assured anti-TB drugs. It is estimated that the price of the anti-TB drugs that are imported and sold locally by the private sector is four times higher than the price of anti-TB drugs that are purchased by the Global Drug Facility (GDF) by the Global Fund. Such commercial prices include, but not limited to, the mark-ups of wholesalers (5-7%), retailers (10%), and transportation cost (Sein et al., 2014). Hence, among the new and relapse TB cases in 2014, TB treatment success rate was 87% in Myanmar (WHO, 2016).
However, the treatment outcome of those remaining TB patients can be either died or treatment failed in which they developed MDR-TB or lost to follow-up (LTFU) from TB treatment or not evaluated yet, there is a “significant increase in MDR-TB among retreatment cases (27.1%)” as opposed to a “marginal increase in MDR-TB among new cases (5%)” (WHO Myanmar, 2017). MDR-TB and XDR-TB are the emerging global health threats that have the longer duration of treatment and more devastating consequences on quality of life than TB alone. Therefore, the significance of improving the adherence to the initial regimen of TB treatment among new patients is highlighted in the audit report on Global Fund grants to Myanmar as “there is a need to clearly identify key under-served population groups and to articulate strategies on how to reach them” (The Global Fund, 2014, p. 3).

The Mon State is located in Southeast Myanmar stretching along the coastal line of the Andaman Sea. This is a post-conflict state with a total population of 2,054,393 with a population density of 167.1 per sq.km (Department of Population, 2015b). There are two districts and 12 townships. The TB service delivery points include one TB team at district level and five TB teams at the township level (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016). There is one sputum collection center for culture methods of TB diagnosis at Mawlamyine township. There are two rapid Xpert MTB/RIF testing laboratories at Mawlamyine and Thaton townships for TB diagnosis and treatment monitoring. Both Station Hospitals and Regional Health Centers are
equipped with 10 microscopes in total for the sputum smear microscopy testing for TB disease (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016).

During 2006 – 2015, the new cases have been mostly clinically diagnosed rather than bacteriologically confirmed (Figure 1). The case notification rate of the bacteriologically confirmed TB cases in Mon State was 102 per 100,000 populations, the case detection rate was 82%, and the treatment success rate was 85% in 2015. In addition, the townships with high LTFU rate were Ye, Thaton, Mawlamyine, and Kyeikhto (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016).

![Figure 1: Trend of TB cases in Mon State (2006-2015) (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016).](image)

The active case finding activities conducted by NTP include mobile team activities, initial home visit and contact tracing, as well as drug reseller referral by PSI.
Through the collaboration with NGO and INGOs operating in Mon State, community-based TB care have been assisted by MCWA, World Vision and IOM. In 2015, among 6428 presumptive TB were referred by the outreach health workers of IOM, in total of 1685 TB cases were detected in which 471 were bacteriologically confirmed TB cases (Annual Evaluation Meeting TB Control Activities in Mon State (2015), 2016).

Kayin State is another post-conflict state in Southeast Myanmar bordering with Thailand. The total population is 1,574,079 with a population density of 51.8 per sq.km (Department of Population, 2015a). There are four districts and 16 townships. Infant and under five mortality rates are equal to the national average estimating 62 and 72 deaths per 1,000 live births (Department of Population, 2015a).

1.3 Literature review on “Lost to follow-up from TB treatment”

Loss to follow-up (previously known as default) is defined as “a TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more” (WHO, 2014). The default rate is found to be significantly higher among those who had eight month long TB treatment (Alobu, Oshi, Oshi, & Ukwaja, 2014; Ukwaja, Oshi, Alobu, & Oshi, 2015). The factors associated with TB treatment default in general population have been extensively explored globally. The systematic reviews have identified four major factors associated with TB treatment non-adherence and LTFU among TB patients in developing countries: (1) Demographic factors, such as older age and male gender; (2) Socioeconomic and cultural factors, such as financial constraint,
fear of stigma, and lack of social support; (3) Patient factors, such as HIV positive status, alcohol abuse, tobacco smoking, lack of knowledge about TB treatment including the duration of treatment and negative consequences of non-adherence, and “feeling better after few weeks of treatment”; and (4) Health system factors, such as poor patient-provider communication and lack of cooperation (Munro SA, 2007; Tola, Tol, Shojaeizadeh, & Garmaroudi, 2015).

Globally extensive researches have been carried out to identify the factors associated with LTFU from TB treatment among the drug-susceptible pulmonary TB patients exclusively. The patient factors were male gender, older age (>40), low education level (below secondary education), being underweight, alcohol use, HIV positive status, (Chida et al., 2015; Garrido, 2012; Gelmanova et al., 2007; Kigozi, Heunis, Chikobvu, Botha, & van Rensburg, 2017; Kulkarni et al., 2013; Lackey, Seas, Van der Stuyft, & Otero, 2015; Masini et al., 2016; Mundra, Deshmukh, & Dawale, 2017; G. Pardeshi, 2009; Sitienei et al., 2015). Moreover, living alone, single marital status, living in confined place, injection drug use are identified as the risk factors associated with LTFU from treatment (Cayla et al., 2009; Lackey et al., 2015). In addition, lack of knowledge about TB, anti-TB drugs’ side effects and the importance of regular treatment have been found to be an independent risk factor for LTFU from TB treatment (Cayla et al., 2009; Chida et al., 2015; Kulkarni et al., 2013). Health system factors enabling the LTFU from TB treatment are a family-based DOT, and getting TB care in the public
sector, as well as the financial burden of treatment, such as transportation cost to the clinic (Chida et al., 2015; Hill et al., 2005; Sitienei et al., 2015).

A large prospective cohort study in Spain has identified that being an immigrant was a risk factor associated with defaulting from TB treatment along with other patient factors (Cayla et al., 2009). Furthermore, several studies on tuberculosis control in neighboring countries of Myanmar have found the factors associated with greater vulnerability of the migrants and mobile populations to TB treatment default. For internal migrants with pulmonary TB, the lack of knowledge about TB treatment and long distance to the nearest clinic are the factors associated with TB treatment non-adherence (Tang et al., 2015). For external migrants to delay seeking care and treatment, the predisposing factors are poor knowledge of TB and TB treatment, the lack of self-management, and the lack of awareness of health system of the host country, the reinforcing factors are the lack of social support on TB treatment adherence and poor access to TB care due to financial constraints, and the enabling factor is the lack of regional collaboration of stakeholders in TB control (Chen et al., 2013; Kaji, Thi, Smith, Charunwatthana, & Nosten, 2015; Low et al., 2014; Wang, Jiang, Abdullah, & Xu, 2007; Wei et al., 2009; Zhou et al., 2012).

The recent study determines that Myanmar migrant workers are at high risk of TB transmission in Thailand due to the overcrowded living conditions and barriers to access to TB care. Their fear of social stigma, losing job and deportation back to
Myanmar, as well as the lack of health insurance have been found to be the predisposing factors for the disparities in TB care in Thailand (Wongkongdech, Srisaenpang, & Tungsawat, 2015). As a consequence, those patients who delay seeking care have a significantly higher rate of smear-positive TB and MDR-TB than Thai patients (Hemhongs et al., 2008).

According to the electronically available research studies conducted by the Department of Medical Research – Upper Myanmar, migrant TB patients have been identified as one of the predictors for TB treatment default at TB centers in Upper Myanmar (Tint, Oung, & Myint, 2009). Also, the general practitioners in Northern Shan State have been found to have poor compliance of the National Tuberculosis Programme (NTP) management guideline in the delivery of the TB care to the remote TB patients and cross-border migrant workers (Saw et al., 2014).

A recent systematic review on the evidence of informed decision-making in TB control in Myanmar highlights that the gap in TB research is the lack of “analysis of the risk factors for TB” (Khan, 2017).

### 1.4 General objective

The aim of the study is to identify the factors associated with loss to follow-up among migrant and mobile populations in Mon and Kayin States in Myanmar.

### 1.4.1 Research questions and hypotheses

**Question 1:** Does migration and mobility patterns influence on TB treatment default?
Hypothesis: Outbound migrants and mobile workers are more likely to default from tuberculosis treatment than inbound migrants.

**Question 2:** What are the factors associated with TB treatment default among migrant TB patients in Mon and Kayin states in Myanmar?

Hypothesis: Tuberculosis treatment default is directly (positively) associated with both patient and health system factors.

**Question 3:** What are the other barriers and the measures to improve the adherence to tuberculosis treatment among new and previously treated TB patients?

Hypothesis: There are unforeseen barriers for the adherence to TB treatment and proper measures for improvement recommended by the migrant TB patients.

### 1.5 Research Collaborator

This study was a part of “IOM TB Project” conducted by International Organization for Migration – United Nations Migration Agency in Yangon, Myanmar. It was completed under the agreement between Duke Kunshan University and the International Organization for Migration – United Nations Migration Agency concerning the internship at IOM Yangon in Myanmar.

Founded in 1951, the International Organization for Migration (IOM) is the leading inter-governmental organization providing services and advice to governments and migrants worldwide. On World TB Day 2015, IOM called for renewed commitment to reaching the missing three million of TB cases worldwide and meeting the health care
needs of the key affected populations including inbound and outbound migrants as well as the migrants at transit (IOM, 2015).

Since established in the Southeast Myanmar in 2005, IOM Myanmar has been providing movement assistance, emergency and preparedness, post-crisis migration management and humanitarian assistances in the migration-affected areas of the country. Through partnership and collaboration with the Regional National TB Program (NTP), IOM implements the Community-based TB Program in Mon and Kayin States, since 2006 (IOM, 2015).

By providing technical and financial support to the village-based mobility working groups (VMWG), IOM coordinates the community mobilization of TB diagnostic testing, prevention, care and support, and referral services through the outreach health worker (IOM, 2015). The findings of this study will be incorporated into the final report of IOM TB Project in May, 2017.
2. Methods

2.1 Setting

This study was conducted in six townships in two states in Southeast Myanmar including Mon state (Bilin, Mawlamyine, Thanbyuzayat, Thaton, Ye) and Kayin state (Myawady).

2.3 Study design

This study was a prospective cohort study with a convergent mixed methods design (Appendix C). I used the PRECEDE framework of the PRECEDE-PROCEED Model for health promotion program planning as the conceptual framework of this study (Appendix A). The PRECEDE is an acronym stands for “Predisposing, Reinforcing and Enabling factors, and Causes in Educational /Environmental Diagnosis and Evaluation” (Green & Kreuter, 2005).

As defined by the authors, “predisposing factors are antecedents to behavior that provide the rationale or motivation for the behavior” which includes knowledge, attitudes, values, and self-efficacy beliefs of an individual (Green & Kreuter, 2005).

“Reinforcing factors are those factors following a behavior that provide continuing reward or incentive for the persistence or repetition of the behavior” (Green & Kreuter, 2005). This is an assessment on interpersonal level, such as family support on the adherence to TB treatment. “Enabling factors are antecedents to behavioral or environmental change that allow a motivation or environment policy to be
realized” (Green & Kreuter, 2005). More specifically, it refers to the resources required or new skills needed to enable the adherence to TB treatment in the community.

Based on the consideration of all three levels of factors, the measure instruments were developed with two main categories: patient factors and health system factors (Appendix B).

2.2 Study population

Adult migrants who started initial regimen of treating the drug-susceptible TB were recruited for the quantitative study. After the pilot testing of the semi-structured questionnaire, the inclusion and exclusion criteria were created based on the consensus of the Principle Investigators of the IOM TB Project. Between June and September in 2016, 380 new patients with drug-susceptible tuberculosis were surveyed in nine townships in Yangon Region, Mon and Kayin States under the IOM TB Project. By 14 February 2017, the treatment outcome data were available for 146 patients (38.4%) from Mon and Kayin States and thus included in the quantitative data analysis of this study. The secondary data of treatment outcome was collected from the TB registry at NTP and was cross-checked and cleaned according to the operational definition of WHO (2014) (Appendix C and E).

From 2 August 2016 to 18 August 2016, there were 20 previously treated patients and/or family members were invited for the in-depth interview under the IOM TB Project. Among which, the sum of 14 “treatment after LTFU” patients and/or their
family members in Mon and Kayin States were included for the qualitative data analysis of this study (Appendix C and E).

2.2.1 Operational definition of migrant category

I adopted the operational definitions on migration developed by IOM Myanmar in July, 2015 (International Organization for Migration, 2015).

**Inbound migrant:** those who moved into the current residing township (for urban residence) or villages and has lived in this area for not more than five years (if duration of stay is more than 5 years, they will be regarded as local/host people).

**Outbound migrant:** those who moved outside of the study area intended to stay or had stayed for more than 30 days. It includes rural to urban migration, rural to rural migration, and seasonal migrant workers migrated only part of the year (travelling outside for touring and visit shall not be accounted).

**Mobile workers:** those who regularly move around various locations from one place to another in relatively shorter time span (days or weeks) for their work.

2.2.2 Inclusion criteria

Drug-susceptible TB patients who were adults older than 18 years, male or female, registered at NTP up to one month prior to interview and mobile or migrant population (according to the operational definition, Appendix E) were eligible for the quantitative study.
Treatment after loss to follow up TB patients and/or their close family members who were adult older than 18 years, both male and female, TB patients registered for retreatment regimen and mobile or migrant population were eligible for qualitative study.

### 2.2.3 Exclusion criteria

Exclusion criteria for quantitative study included local people (if the duration of stay at the study area was more than five years), new patients who had not registered at NTP or registration at NTP after one month of treatment at the time of interview, severely ill patient, patients with severe coughing, TB patients with retreatment regimen, religious person (Monk, Nun), and mentally ill persons.

For qualitative study, local people, severely ill patients, patients with severe coughing, religious person (monk, nun), and mentally ill person were excluded.

### 2.3 Procedures

#### 2.3.1 Data Management Team

Data management team of the IOM TB Project consisted of nine data enumerators, five field research supervisors, one data management consultant, one co-investigator (me) and two principal investigators. In Mon State, there were 5 data enumerators, 3 field research supervisors, whereas in Kayin State, there were one data enumerator and one field research supervisor. Principal and co-investigators conducted training on research methodology and ethical conduct of research for the data
management team of IOM TB Project in June, 2016. We carried out pre- and post-test assessments to ensure that the team members gained basic concepts of research methods as well as responsible and ethical conduct of research.

2.3.2 Data Collection

Purposive sampling method was applied for this study. Both new and “treatment after loss to follow-up” TB patients who registered at NTP were invited for the study by the data enumerators at the township hospitals of six townships. If they were meeting the inclusion criteria and willing to participate in the study, data enumerators scheduled an appointment for interview at the IOM sub-offices in the respective community. Upon appearing at the scheduled interview sessions, the informed consents were obtained from all eligible participants after giving the detailed information about the research and the option of opting out prior to the interview sessions. Informed consents were signed or thumb printed for each participant. To ensure confidentiality, only codes of questionnaire and hospital codes were recorded on the questionnaire form. Data enumerators conducted the semi-structured surveys with the oversight of the field research supervisors. In-kind recognition (coffee/juice and snack) was offered to participants for their time contribution.

The participants for the in-depth interview were identified by the data enumerators at the township hospital. The field research supervisors recruited those who were willing to get involved in the study. The principal and the co-investigator
conducted 12 face-to-face in-depth interviews and two skype/telephone interviews. Oral consent was obtained for the two telephone interviews. In-kind recognition (coffee/juice and snack) was offered to participants for their time contribution.

All study procedures were approved by the ethical review boards at Duke Kunshan University in China and Department of Medical Research at Ministry of Health and Sports in Myanmar.

2.4 Measures

For quantitative measures, the semi-structured questionnaire was developed on the PRECEDE framework of the PRECEDE-PROCEED Planning Model (Appendix A). The predisposing, reinforcing, and enabling factors associated with the adherence to TB treatment were categorized into two main categories, including patient and health system factors (Appendix B). The pilot testing of the semi-structured questionnaire was conducted prior to the data collection within the preliminary sample population of 20 people. Based on the pilot testing results, the investigators reached the consensus of adding minor revision, such as “6-8 months” as a clarification on TB treatment.

Qualitative data consisted of two measures including perceived barriers and the measures to improve the adherence to TB treatment (Appendix B).

2.4.1 Event variable

The event of interest in this study was the loss to follow up. According to the WHO revised definitions of TB treatment outcome (WHO, 2014), the lost to follow-up is
defined as “a TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more.” As suggested by the previous studies, the event dummy variable was created by setting the loss to follow up as the event of interest (event, \( _d=1 \)) and censoring the other treatment outcomes (event, \( _d=0 \)), including cured, treatment completed, failed, died, and not evaluated (still on treatment and transferred out cases) for the survival analysis (Gelmanova et al., 2007; Moyo et al., 2015).

2.4.2 Time variable

“Days to lost to follow-up,” a time variable was created by the difference between the recorded date of TB treatment outcome and the date of treatment start as reported at TB registry in six townships.

2.4.3 Predictor variables

The effect of the potential factors on the time to lost to follow-up during the full course of treatment was the measure of survival analysis. The predictor variables consisted of sociodemographic factors, migration and mobility-related factors, patient factors, and health service-related factors. The string variables were converted to numeric variables on Stata.

2.4.3.1. Socio-demographic factors

The categorical variables included gender, race, education, marital status and occupation. The continuous variables were the number of household members, average
family income, and personal monthly income. The dummy variables were created for the following categorical variables: race, education, and occupation.

2.4.3.2 Migration and mobility-related factors

The categorical variables were migrant category, current state, household type, and the binary variables related to migration pattern including short stay, seasonal migration, long stay and mobile.

2.4.3.3 Patient factors

All variables under patient factors were 11 binary variables: (1) family or community member support present; (2) TB treatment is affordable; (3) transportation cost is expensive; (4) homeless; (5) mentally ill; (6) any cultural belief about TB; perception of TB as (7) curable, (8) genetic disease, and (9) evil; (10) informing health care provider in case of urgent leave to another place; and (11) alcoholic.

2.4.3.4 Health system factors

There were 15 binary variables under this measure: (1) informed about TB disease, (2) DOTS, (3) Duration of DOTS, and (4) adherence to anti-TB drugs; (5) have DOT provider; (6) had family member trained by DOT provider; (7) had difficulty in taking anti-TB drugs; (8) could maintain adherence; (9) had barriers for the access to clinic; (10) would stop taking anti-TB drugs if symptoms subsided; satisfied with (11) clinic environment, (12) clinic hours, (13) waiting time, (14) clinic staff, and (15) the interpersonal skills of the health care provider.
2.5 Analysis

2.5.1 Quantitative analysis

The data management consultant carried out the pre-entry data verification, the entry of data from paper-based questionnaire into electronic database, and the post-entry data verification for missing data, cross check and logical verification. The electronic dataset was prepared on the Excel spreadsheet. Stata software version 14.0 for Mac was used for data cleaning, descriptive statistics, and survival analysis (time to event analysis).

After importing the Excel dataset, the dataset was cleaned and prepared for statistical analysis. “Don’t know” and “No response” of the categorical variables were set to missing to control the outliers. Then data were analyzed by descriptive statistics and survival analysis. Sampling weight was not applied to the survival analysis. The Cox proportional hazard model with a single continuous predictor was used for the univariate analyses of the continuous predictors. For categorical variables, the log-rank tests of equality across strata and the univariate Cox proportional hazard regression were used. At the same time, the graph of the survival function of each categorical variable was checked for proportionality. All predictors with p-value less than 0.2 were selected for the multivariate Cox regression to assess the relationship of the predictors to time to loss to follow up. The interactions of potential predictors were tested and excluded from the final model.
The proportionality assumption was checked twice on the final model by first including the time-dependent co-variates in the model by using tvc option of the stcox command. Secondly, the graph of the scaled Schoenfield assumptions was created and shown no significance. All time-dependent variables were not significant thus supporting the assumption of proportionality.

Kaplan-Meier curves were created for the potential risk factors.

### 2.5.2 Qualitative analysis

The data manager prepared a separate transcript in Microsoft Word file for the open-ended survey responses in Myanmar language. The data manager also transcribed the voice recordings of the in-depth interviews. The transcripts in Myanmar had the non-identifying information about the respondent, such as the survey code and the in-depth interview code. The hired translator at IOM TB Project translated both transcripts from Myanmar language to English.

Thematic networks analysis was used as a theoretical approach for analyzing the qualitative data (Attride-Stirling, 2001). NVivo 11.3.2 version for Mac was the software used for thematic networks analysis.

Before coding, I created Excel spreadsheets of survey responses from the translated transcript and the demographic data of the respondents of both data sources. After importing the spreadsheet, I used “Auto Code” to create the case nodes and “Case
Classification,” the mixed-methods tool of NVivo software, to set up the attributes of sex, migrant category and treatment outcome for each survey respondents.

In the first cycle coding, “Mind Map” was used to create the preliminary thematic networks based on the modified conceptual framework of the study (Appendix D). Then I ran “Word Frequency Query” and “Text Search Query” to explore the most frequent words and phrases in my source data. For further exploration, I used “Word Tree” to see how the word or phrase was used in the context. While coding the basic themes according to the mind map, “In Vivo Coding” and “Emotion Coding” methods were used to create new nodes, such as “Clinic is far” and “Depressed” (Saldaña, 2014). The “Coding Stripes” assisted in exploring the density of the codes as well as viewing all codes of a particular passage.

I created analytic memos to take note of my assumptions on new complex nodes. The memos were carried on to my second and third cycle coding as the guide to re-assemble the coded contents and to review the connections between the themes.

After first cycle coding, I ran a “Coding Query” to explore the coded contents and to review the connections between the themes and new nodes. Some queries were then saved for the future use. In the second coding cycle, all coded contents were re-assembled to the basic theme through the “Matrix Coding.” In the third coding cycle, all themes were categorized into the organizing theme by using the “Comparison Diagram.”
The “Tree map” chart was used to visualize the structure of the thematic networks of each global themes, whereas “Sunburst” chart displayed the basic themes of each organizing themes by the frequency of coded references. The “Explore Diagram” and “Case classification” were used to identify the representative quotes of the basic themes.
3. Results

3.1 Description of the sample

Among 146 new patients from Mon and Kayin States, 115 (78.77%) new patients achieved treatment success and 10 (6.85%) new patients were LTFU from TB treatment.

The characteristics of study population are presented below (Table 1).

Table 1: Characteristics of study population.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n=146) n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current State</strong></td>
<td></td>
</tr>
<tr>
<td>Mon</td>
<td>116 (79.45)</td>
</tr>
<tr>
<td>Kayin</td>
<td>30 (20.55)</td>
</tr>
<tr>
<td><strong>Migrant category</strong></td>
<td></td>
</tr>
<tr>
<td>Inbound</td>
<td>34 (23.29)</td>
</tr>
<tr>
<td>Outbound</td>
<td>80 (54.79)</td>
</tr>
<tr>
<td>Mobile</td>
<td>32 (21.92)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>96 (65.75)</td>
</tr>
<tr>
<td>Female</td>
<td>50 (34.25)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>Bamar</td>
<td>81 (55.48)</td>
</tr>
<tr>
<td>Mon</td>
<td>25 (17.12)</td>
</tr>
<tr>
<td>Kayin</td>
<td>19 (13.01)</td>
</tr>
<tr>
<td>Rakhine</td>
<td>1 (0.68)</td>
</tr>
<tr>
<td>Indian</td>
<td>5 (3.42)</td>
</tr>
<tr>
<td>Other</td>
<td>15 (10.27)</td>
</tr>
<tr>
<td><strong>Tuberculosis treatment outcome</strong></td>
<td></td>
</tr>
<tr>
<td>Cured</td>
<td>48 (32.88)</td>
</tr>
<tr>
<td>Treatment completed</td>
<td>67 (45.89)</td>
</tr>
<tr>
<td>Treatment failed</td>
<td>4 (2.74)</td>
</tr>
<tr>
<td>Died</td>
<td>9 (6.16)</td>
</tr>
<tr>
<td>Lost to follow-up</td>
<td>10 (6.85)</td>
</tr>
<tr>
<td>Transferred out</td>
<td>4 (2.74)</td>
</tr>
<tr>
<td>Still on treatment</td>
<td>4 (2.74)</td>
</tr>
<tr>
<td>Treatment success rate</td>
<td>115 (78.77)</td>
</tr>
</tbody>
</table>
3.2 Quantitative findings

There are a total of 10 (6.85%) lost to follow up observed among 146 new TB patients. The Nelson-Aalen cumulative hazard curve shows the lost to follow up trend over the duration of 6-8 months’ treatment (Figure 2).

![Nelson-Aalen cumulative hazard curve](image)

**Figure 2: Nelson-Aalen cumulative hazard curve.**

The result of the univariate cox regression is shown Table 2 below. The final model of main effects included the following categorical predictors that had p-value below the cut-off point 0.2 (Table 2). The categorical predictor variable named “migrant category” was self-report of the respondents. Although it had a p-value more than the cut-off point of 0.2 by the log-rank test of equality across strata, it was included in the final model to further test the hypothesis one.
### Table 2: Univariate Cox Regression.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Unadjusted HR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>-0.311</td>
<td>-0.863 0.241</td>
<td>0.1994</td>
</tr>
<tr>
<td>Current State</td>
<td>3.843</td>
<td>1.112 13.280</td>
<td>0.0398</td>
</tr>
<tr>
<td>Short stay &lt; 3 months</td>
<td>3.382</td>
<td>.873 13.097</td>
<td>0.1096</td>
</tr>
<tr>
<td>Migrant category</td>
<td>0.814</td>
<td>.316 2.097</td>
<td>0.669</td>
</tr>
<tr>
<td>Family/Social support</td>
<td>0.226</td>
<td>0.065 0.781</td>
<td>0.0241</td>
</tr>
<tr>
<td>TB is evil disease</td>
<td>6.261</td>
<td>0.791 49.561</td>
<td>0.1668</td>
</tr>
<tr>
<td>Informed of adherence to TB treatment</td>
<td>0.214</td>
<td>0.045 1.011</td>
<td>0.0980</td>
</tr>
<tr>
<td>Have DOT provider</td>
<td>0.313</td>
<td>0.088 1.108</td>
<td>0.0686</td>
</tr>
<tr>
<td>Have family member trained by DOT provider</td>
<td>0.312</td>
<td>.0807 1.207</td>
<td>0.0754</td>
</tr>
</tbody>
</table>

#### 3.2.1 Factors associated with tuberculosis treatment default

Intention to stay for less than three months at the current place was found to be a statistically significant risk factor for getting lost to follow-up from TB treatment (Hazard Ratio (HR) 6.323; 95% CI 1.403 – 28.499; p = 0.0075) at given time holding the family and/or community member support constant.
Having a family and/or community member support for the migrant TB patients during the six to eight months long treatment has been found to be a statistically significant protective factor (HR 0.146; 95% CI 0.037 - 0.576; p = 0.0075) for preventing them from getting lost to follow-up from TB treatment at a given time holding the mobility pattern constant. No statistically significant association was found between the time to LTFU and health system factors.

3.2.2 Migration pattern and tuberculosis treatment default

The effect of the migration pattern on the likelihood of default from tuberculosis treatment is illustrated on the two graphs below. The graphs are based on the assumption of whether or not the migrant TB patients had family and/or community support during the full duration of TB treatment. The survival function slopes of the two groups are in line from the beginning and separated in between 60 – 120 days of analysis time (Figure 3 and 4). The difference between the survival curves of two groups are more significant in the graph of no family/social support. Both among the migrant patients with and without any family and/or community member support, those who described their migration pattern as “short stay up to three months in working area” is more likely to default from tuberculosis treatment over time than those who reported to stay longer than three months in the current place of residence (Figure 3 and 4).
Figure 3: Migration pattern effect on time-to-LTFU (family and/or community member support present).

Figure 4: Migration pattern effect on time-to-LTFU (no family and/or community support).
3.3 Qualitative findings

This section presents the findings of two qualitative data analysis, including the 118 responses to two open-ended questions from 146 new patients and 14 in-depth interview with “treatment after LTFU” patients and/or their family members. The response rate for two open-ended questions of survey was 80.8%.

Of the sample of 118 new patients with drug-susceptible TB, there is a significant difference in the proportion of male (64.4%) and female (35.6%), Kayin (22.9%) and Mon (77.1%), and migrant category including inbound (25.4%), outbound (53.4%), and mobile (21.2%). Majority of them completed primary school (43.2%) and married (65.25%). The common occupation in the past 12 months were manual labor/construction worker (26.27%), factory/plant worker (13.56%), and seller/vendor (10.17%), whereas slightly less than one fifth of the respondent were unemployed (19.49%). The average personal income was 132,542 MMK (mean) per month and the average family income was 251,034 MMK (mean) per month. The average household size was 4.5.

Of 118 new TB patients, 93 (78.81%) achieved treatment success with 38 (32.2%) cured and 55 (46.61%) treatment completed, whereas 10 (8.47%) TB patients were LTFU, 5 (4.24%) were died, 3 (2.54%) were treatment failed and 7 (5.93%) were not evaluated.

Among 14 in-depth interviewees, there was an equal number of “treatment after LTFU” patients and their family members interviewed. Majority of them were male (78.5%), Bamar (57.1%), inbound migrants (71.4%) and from Kayin States (71.4%).
The qualitative findings are illustrated as “Tree map” and “Sunburst chart”.

“Tree map” chart visualize the structure of the thematic networks of each global themes based on the number of items coded. “Sunburst chart” visualize the organizing themes with the share of its’ basic themes based on the number of the coding references.

3.3.1 Barriers to adherence to TB treatment

Four global themes were emerged from the thematic network analysis of the responses to the open-ended question asking the perceived barriers to TB treatment adherence (Figure 5). By the ranking of the items coded, the “Patient factors” was the most prominent theme followed by “Health system factors”, “Poor infrastructure” and “Natural disaster.”

Figure 5: Tree Map. Barriers to the adherence to tuberculosis treatment.
3.3.1.1 Patient factors

The most prominent global theme was “Patients factors”. It consisted of four organizing themes including financial constraint, lack of knowledge about TB, no social support during the full duration of TB treatment and no sputum (Figure 6).

Figure 6: Sunburst Chart. Patient factors.

Majority of the respondents expressed their financial concerns as the primary perceived barrier to TB treatment adherence. They could not afford to visit the clinic for follow-up, and to buy tonic drugs or medicines for comorbid conditions as well as food. As regards to the travel costs required for the follow-up visit at the TB clinic, it is estimated that on average 7.6% of their personal monthly income have been used for one-time roundtrip to the TB clinic. The common forms of transportation were a
motorbike and a taxi. To take for example from the basic theme – “Transportation cost,”
the patients said the following:

“To hire a three-wheeled motorbike taxi to get to the hospital, it costs 10,000
Kyats for a round trip” (as mentioned by a male, inbound migrant, new patient)

“Taxi fare is expensive. If taxi has to wait for long hour in the clinic, the taxi
driver demands more money” (as criticized by female, inbound migrant, new
patient)

“Two thousand Kyats for traveling cost is large amount to spend for the poor”
(as stressed by a male, outbound migrant, new patient)

“Although the hospital is free of charge for TB treatment, I have to spend about
3,000 Kyat for transport.” (as explained by female, outbound migrant, new
patient)

“I could not ride the bus because I felt dizzy and it cost 3000 Kyats to take
motorbike taxi to the clinic from my place. I was also very disappointed, as I
could not find food for my children.” (as suggested by a female, inbound
migrant, LTFU)

In addition to the costs of transportation and comorbid conditions, such as
mental illness, the affordability of TB treatment was hindered by their commitment to
their family. Some were more concerned about the effect of TB treatment-related cost on
their family members. For example,

“I am a head of the household and there is no one who has job in my family,
except me. Although I have a job, it is low paid. Thus, there are some financial
problems” (as expressed by a male, inbound migrant, new patient)

“The patient is head of the household. There is no one in the household, who has
job except him. But his salary is very low and he cannot take a leave to make
follow-up visit to the clinic. The family has to spend his low salary of 70,000
Kyats to cover household expanse as there is a matriculation student at home.”
(as explained by a male, inbound migrant, new patient)
“The patient could not work that he has to depend on his children. He is embarrassed to ask money from the children because they have their families to look after.” (as expressed by a female, inbound migrant, new patient)

On the other hand, some migrant patients suffered from health disparities and health inequities in which they were lost their job due to their illness condition or stopped working, because they were infected with TB. Although they did not directly express themselves, they experienced social stigma as implied by their responses, such as, “fired” and “no job as I am infected with TB” in the following quotations:

“There are many brother and sisters. They have to struggle for their living. I have to send money to home. I have no job as I am infected (with) TB” (as expressed by female, inbound migrant, LTFU)

“If I was not fired from the factory and if I did not need to move to another place, I would complete my TB treatment” (as described by a male, inbound migrant, LTFU)

The second organizing theme was the lack of knowledge about TB and wrong perceptions of TB treatment. Among 52 references, more than half of them reported that they had never received thorough information about TB and the route of transmission as well as the importance of taking anti-TB drugs regularly. In addition to this, there were three misconceptions and a wrong perception about TB and TB treatment that hindered migrant TB patients in their efforts to adhere to the TB treatment. These basic themes were presented in the table below (Table 3). As a side note, “traditional nat spirit” is a religious phenomenon related to Buddhism.
Table 3. Perceived knowledge of TB

<table>
<thead>
<tr>
<th>The basic theme</th>
<th>Quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB is a genetic disease</td>
<td>“I am infected [with] TB, because my mother is TB positive. I think [TB] is infected from the same blood type person”</td>
</tr>
<tr>
<td></td>
<td>(as described by a female, outbound migrant, new patient)</td>
</tr>
<tr>
<td>TB is an evil disease</td>
<td>“[I] doubt that [I] was infected [with] TB, because [I] did something wrong to [my] traditional nat spirit worship and the nat spirit made [me] to [get] infected [with] TB” (as described by a male, outbound migrant, new patient)</td>
</tr>
<tr>
<td>TB is not curable</td>
<td>“TB is not a disease, because TB patients have to take anti-TB drugs again and again” (as described by male, outbound migrant, new patient)</td>
</tr>
<tr>
<td>Wrong perception about TB treatment</td>
<td>“The neighbors said that the anti-TB drugs are strong and it should not be taken” (as mentioned by male, mobile worker, new patient)</td>
</tr>
</tbody>
</table>

Thirdly, having no social support was perceived to be the barrier for adhering to tuberculosis treatment among the migrant TB patients. The problems about the social supports were having no family and/or community support, no DOT provider at home, no job available, and the difficulty of taking a leave for follow-up visit at the TB clinic.
Some patients had a fear from stigma, so they did not disclose themselves to their employer. For instance,

“I was away from my factory and I did not have a chance to go and take drugs from hospital. I was away from the hospital and it took a day to take drugs. On the other hand, it cost a hundred Baht for transportation cost. Moreover, I am afraid of being arrested by the police because I had only copy of my labour card. The original card was in the hand of my Thai boss” (as explained by a male, inbound migrant, LTFU)

The last organizing theme was emerged from the analysis of in-depth interviews with the treatment after LTFU patients, which is “No sputum”. The reason why some patients stopped taking anti-TB drugs was that they could not get anti-TB drugs from the TB clinic due to their inability to produce sputum at the transition period and afterwards. Most of them tried several times, but their sputum was not sufficient enough for sputum testing and therefore they were suspended to continue to get their TB kits from the hospital.

“I did not cough and no sputum [after taking anti-TB drugs for two months]. But as I did not have any sputum, the clinic did not give any drugs when my mother went to the clinic for me. I can take only one-day leave. If I am absent for three days, I will be fired. If I am absent for a day, the factory will cut 20,000 MMK from my salary. The clinic gave anti-TB drugs for a week course. I could produce little sputum, sent it to the clinic, but health staff from the clinic rejected it because of little sputum to examine. I stopped the treatment, I was disappointed because the clinic did not provide any more anti-TB drugs to me.” (as explained by a female, inbound migrant, LTFU)

“[the main reason I stopped TB treatment is] because I could not produce pure sputum as the nurses said. As I am betel chewer, my sputum had some red color and some pieces of betel. I had to go to “Aung San” [TB hospital] for four or five times to send sputum but it was refused by the lab technician from Aung San. I also had to spend travel expense and … I was busy [selling flowers] that I stopped my TB course.” (as complained by a female, inbound migrant, LTFU)
3.3.1.2 Health system factors

The next global theme under the barriers to the treatment adherence is health system factors. In total of 32 references coded, the five organizing themes were created including “Poor provider-to-patient communication,” and “Clinic is far,” followed by “Clinic space is narrow,” “Conflict with clinic hours,” and “Long waiting time” (Figure 7).

![Sunburst Chart. Health system factors.](image)

In terms of poor provider-to-patient communication, the migrant TB patients dissatisfied with the attitude of the health care providers at the TB department. As described by the respondents, they felt “ignored” or sometimes, they were yelled at. They also mentioned that the nurses were “not tolerant to the patients.” For example,
“The treatment of TB patients is not so warm, since the hospitals and clinics distribute TB drugs free of charge” (as expressed by a male, outbound migrant, new patient)

“The health staffs did not want to answer when the patient asks some questions while the patients take out drugs from the hospital. The patient is told in anger” (as stressed by a male, inbound migrant, new patient)

“The doctor from PSI clinic did not give no more drugs to me that I stopped. I failed to visit two month’s appointment of the doctor. As I am illiterate, I did not notice the appointment date. I am now taking Myanmar traditional medicine named ‘A Soke Pon’ meaning the shape of lung, I feel I am getting better” (as described by a male, outbound migrant, LTFU)

The next prominent organizing theme was “Clinic is far.” The further the location of the clinic, the more money they spend on round-trip travel from home to TB clinic. Also, it limited the options for transportation to get to the clinic. As explained by a female, outbound migrant patient, “… to go back to far-away place, [I have] to ride village bus only.”

The migrant TB patients were equally dissatisfied with narrow clinic space, late opening hours and long waiting time. They addressed their feelings as depressed or ignored or anxious.

“Being a teacher, I am unable to visit clinic, because the opening hours of clinic and school hours are coincident” (as addressed by a female, outbound migrant, new patient)

“I have to take a leave if I want to visit the clinic because my work start from 7:30 am early in the morning and end in 8:00 pm in the evening…The opening hours of the clinic are coincident with working hours.” (as expressed by a female, inbound migrant, LTFU)

“The patients have to wait for long hours until they are stiff. It makes them depressed” (as expressed by a male, inbound migrant, new patient)
“Waiting hour at the clinic is very long and the health staffs [do] not call although there is no other patient. They are talking to themselves. They do not give priority to the patient. They are giving priority for their personal affairs” (as expressed by female, mobile worker, new patient)

3.3.1.3 Poor infrastructure

Poor infrastructure was emerged as the third global theme. The TB patient has to walk a long distance on the dirt road to reach the transportation. As a male, outbound migrant, new patient explained, “there are some problems to visit to the clinic because the road is very rough and no car and motorbike are available to rent. [I] have to walk to reach motor road which is very far from the village.”

3.3.1.4 Natural disaster

The natural disaster, such as flood, was the unforeseen barrier to the tuberculosis treatment. As patient said, “[I] cannot inform the clinic, when there is flood.”

3.3.2 Measures to improve the adherence to TB treatment

Four global theme was emerged from the thematic networks analysis of the responses about suggestions to improve the TB treatment adherence (Figure 8). By ranking of the number of coded references, majority of the migrant TB patients addressed the health education (32 aggregated responses), and social support was reported to be necessary, especially for new patients to adhere to TB treatment. Treatment after LTFU patients and their family members mostly suggested on improvements in the health system and the self-management of TB patients themselves.
3.3.2.1 Health education

Majority of the migrant TB patients suggested that TB counseling at the TB department should be improved to give thorough information about TB and clear instruction on sputum testing and DOT to both TB patient and their family members. In addition to this, they wanted to know more about the side effects of anti-TB drugs and the special diet. Another emerging theme was to organize the health education sessions in village. A few suggested, ethnic army group and/or international non-governmental organizations and/or non-governmental organizations to conduct the health education program, so that it would be more efficient.

“It will be better if a family member should accompany with the patient when the drugs are taken out from the TB clinic and the health staffs should explain
the family member about DOTS at the same time” (as suggested by a female, outbound migrant, new patient)

“They did not say anything. They just gave me drugs in red color. I have taken TB treatment for five months [before LTFU due to the advice from a friend]” (as described by a female, outbound, LTFU)

“[about] how to take medication effectively and the bad effect of TB default should be explained carefully when the patient is instructed to start TB treatment” (as suggested by a male, outbound migrant, new patient)

“The health education sessions should be held more in rural villages. To be more efficient for health education on TB, advertisement signboards on health information should be distributed from door to door” (as suggested by a male, outbound migrant, new patient)

3.3.2.2 Social support

As suggested by the respondents, the global theme of social support was emerged from the following organizing themes: nutrition support, travel allowance, and monetary support (Figure 9).

![Figure 9: Sunburst Chart. Suggestions for social support.](image-url)
Majority of the respondents highlighted their need of support on the cost of the food and transportation on the day of follow-up at the TB clinic. In addition to this, some respondent addressed their need of monetary support on purchasing the anti-TB drugs.

“It is heard that rice, quicker oat, eggs, and oil were distributed together with drugs in some villages. It will be better if these things are distributed to the patients like that” (as addressed by a female, outbound migrant, new patient)

“I would not have stopped my TB treatment if I were financially fine or if I could get TB drugs free of charge and if there were family” (as suggested by a male, inbound, LTFU)

“I am not so getting well with my family. I have some difficulties in nutrition. If the money is provided, it will be fine” (as described by a male, inbound LTFU)

“I could not ride the bus because I felt dizzy and it cost 3000 MMK to take motorbike taxi to the clinic from my place. I was also very disappointed, as I could not find food for my children.” (as complained by a female, inbound migrant, LTFU)

3.3.2.3 Health system

The suggestions on health system consists of three organizing themes based on the number of coded references: TB drug distribution, the positive attitude in TB care, and mobile clinic (Figure 10).

Figure 10: Sunburst Chart. Suggestions for health system.
The basic themes under the anti-TB drug distribution are change in guideline and clinic renovation. Following the difficulty of sputum testing, those patients suggested anti-TB drug allowance without any sputum testing results.

“The health staff should continue to provide anti-TB drugs to the patients although enough sputum could not get.” (as suggested by a female, inbound migrant, LTFU)

“There should be a separate section to take out drugs” (as suggested by a male, outbound migrant, new patient)

Some patients requested positive attitude from the health workers at the TB clinic. They mentioned that positive approach would help them to feel that they were warmly welcomed, carefully listened, and encouraged to get better.

“If the health staff comes and encourages me to continue my TB treatment before I stopped, or if the family members or the friends encourage me to continue, I would have continued my TB treatment. Support from them is very important not to have TB default” (as suggested by female, outbound migrant, LTFU)

A few patients suggested mobile clinic activities including delivery of sputum to the hospital and of anti-TB drug to their home by the basic health staff. For instances,

“It will be better if a health staff could take my produced sputum and take it to the hospital” (as suggested by a female, inbound migrant, LTFU)

“If the health volunteer worker comes and delivers drugs, it will be more convenient.” (as expressed by a male, inbound migrant, LTFU)

“I wish I could take the drugs from the local midwife or local health staff nearby.” (as expressed by a female, inbound migrant, LTFU)

“If the health staff visited and take drugs to me daily I would not have stopped my TB treatment.” (as explained by a male, inbound migrant, LTFU)

### 3.3.2.4 Behavior change of TB patients

Some migrant TB patients suggested that the self-efficacy and preventing others to get infected from themselves were important measures for improving the adherence to TB treatment. They were concerned that transmission of TB to others would be
reduced if the patients themselves could practice proper cough etiquette and use separate utensils while strictly following the DOT provider’s instruction. For example,

“It is not shameful if you are infected with TB... Be aware to cover with handkerchief when coughing to prevent the spread of TB disease to the family members and to the public” (as suggested by a female, outbound migrant, new patient)

“[The completion of TB treatment] depends on his decision. If he decides to give up alcohol, it will be fine to continue TB treatment. He used to stop taking TB drugs when his TB symptoms were subsided” (as explained by a family member of a male, inbound migrant, LTFU)
4. Discussion

Migration and mobility pattern has an effect on time to LTFU among TB patients. The risk of LTFU is 6.323 times higher among those who reported to describe their migration pattern as “short stays up to 3 months in working area” as compared those who reported to describe their migration pattern as “long stays more than 3 months in working area,” holding the family/community support constant. This finding supports the hypothesis that migration pattern has an effect on the likelihood of LTFU from TB treatment. However, it does not exclusively differentiate between the migrant categories including inbound and outbound migrants as well as the mobile workers as stated on my hypothesis. The default has been observed starting from the third month of treatment. This finding is concordant with previous studies that the defaulting from treatment have been more common during the transition period from intensive to continuation phases of TB treatment (Geeta Pardeshi, 2010; Vasudevan, Jayakumar, & Gnanasekaran, 2014).

Among the predicted factors associated with TB treatment default, having no family and/or community member support has been found to be a risk factor for getting LTFU from TB treatment, holding the mobility pattern constant. This quantitative finding complements with the organizing theme of “no social support”. As implied by the migrant TB patients, having no social support consists of two basic themes including social stigma and competing risk. More specifically, they carried the social stigma in
terms of getting fired from their job and/or getting neglected by their family and
neighbors. The finding of LTFU from TB treatment due to the stigma associated with TB
is concordant with the previous studies (Comolet, Rakotomalala, & Rajaonarioa, 1998;
Cramm, Finkenflugel, Moller, & Nieboer, 2010; Johansson, Long, Diwan, & Winkvist,
1999; Lienhardt et al., 2005).

Furthermore, some patients explained that they had competing risks against the
adherence to TB treatment. For instance, those who were the head of the household, had
no other family member working. So that they had difficulty in taking sick leave from
their work for follow-up visit at the hospital or they had to choose to spend their money
on food and housing fee rather than transportation cost. Chida et al. (2015) highlighted
the patients’ concern on “the effect of TB treatment on the family members” which is
consistent with the competing risk of financial burden found in this study.

However, the proportion of LTFU in my sample of 146 TB patients is 6.85%, it
was too small to test the statistical significance of other potential predictors found from
the univariate analysis. Therefore, some of the patient and health system factors were
not able to be tested in a meaningful way. A systematic review on pre-treatment LTFU
in low- and lower middle-income countries, and high burden countries identified that
most NTPs did not count those who got LTFU before treatment (MacPherson, Houben,
Glynn, Corbett, & Kranzer, 2014). Glynn et al. (1998) found that the default rate was
higher among those patients who were not registered by the Ministry of Health.
Therefore, it is likely that the findings of this study mainly reflect those who had registered at NTP, rather than those who had not registered at NTP.

The qualitative study findings in terms of the perceived barriers to TB treatment adherence partially supported the aforementioned quantitative study findings. Lack of family and social support was the concordant risk factor associated with TB treatment default. In addition to this, migrant TB patients have a lack of knowledge, but a positive attitude towards TB that predisposes them to look for health education. It is consistent with the previous studies that found lack of knowledge and incorrect perception of TB to be the risk factor for treatment default (Chida et al., 2015; Park et al., 2016; Putera, Pakasi, & Karyadi, 2015). The common pattern among both new and previously treated patients is positive attitude towards TB in terms of learning about the disease, TB treatment and self-management. Main suggestions on health education are improved counseling session at the TB clinic and health education sessions at the village level. These findings align with the current practices of the community-based TB care and control implemented by PPM-DOTS.

However, financial constraint and social stigma of TB reinforces them to get lost to follow up from TB treatment which are also concordant with previous literature (Chida et al., 2015; Cramm et al., 2010; Herrero, Ramos, & Arrossi, 2015; Hill et al., 2005; Johansson et al., 1999). Cramm et al. (2010) have emphasized that the social stigma hinders TB patients to seek TB care and have suggested the patient-centered approach to
reduce the stigma in the community which align with the findings of this study.

Financial and nutritional support suggested by the respondents are currently in practice of MDR-TB care (MOH & WHO, 2012). The findings of the difficulties with the transportation cost is consistent with the previous studies conducted by Herrero et al. (2015) and Hill et al. (2005) in which those who experienced high travel costs to receive the TB treatment at the clinic were more likely to get LTFU from TB treatment. Although this finding is not statistically significant, it highlights the importance of decentralization of TB drug distribution and sputum testing from the Township hospital to the PHCs.

Poor provider-to-patient communication and barriers to accessibility of services are the enabling factors for the delay seeking care and treatment. The previous studies showed the same consistent findings of poor communication between the patient and the health workers (Comolet et al., 1998; Johansson et al., 1999). Another prospective cohort study has found that those who had experienced long travel time were more likely to default from TB treatment (Hill et al., 2005).

Given the qualitative nature and the research question of the study, I would argue that we should carefully interpret the finding of poor provider-to-patient communication. In one hand, as expressed by the patients, the health workers may be less motivated to serve the patients which is also highlighted as a challenge in TB care and control in the report of Ministry of Health (MOH) and World Health Organization (WHO) (2012). On the other hand, the structural system of TB care and control is not
designed for patient-centered care, for example, the shortage of health workers in the health system and funding gap in TB financing as previously introduced in the background. However, I would argue that the current health workers are already motivated given the fact that they are working in the current social situation, further study is necessary to detect the true relationship between the patient and the health care provider as well as timeliness of health care service using a scaled measure.

In addition to this, there may be a language barrier due to the diversity of the population. During the qualitative data collection, I have once encountered the complexity of communicating with a patient from one of the ethnic minority group. His words had to be translated in three different dialects before getting translated into English. It was upsetting for both the patient and the translators, but with careful listening and clarification, we had a successful interview in the end.

4.1 Implications for policy and practice

Adopting the End TB Strategy of WHO under SDG 3 of UN in post-conflict states of Mon and Kayin, National Tuberculosis Program should strengthen the existing multilateral community-based TB care with an integrated referral system inclusive of people on the move. At the clinical point of care, the healthcare providers should practice patient-centered communication. Fostering self-efficacy of TB patients by patient-centered communication and informed decision-making in the clinical setting as
well as in the community will enable the better adherence to TB treatment among the migrant and mobile population.

To achieve the top ten targets of End TB Strategy, such as increasing the treatment coverage rate and success rate of 90% and more, and reducing case fatality rate (CFR) to 5% or below by 2025, the National Tuberculosis Program should incorporate migrants and mobile populations as part of their priority population and take appropriate measures to maintain their adherence of TB treatment (WHO, 2016). One of the best approaches to improve the referral system is adopting health information technology in the health system. This is an enabling factor for improving the care flow, standardization across the different health care providers as well as the accountability and transparency of the health care providers. It also allows information exchange between the health care providers and timely feedback to patients. In addition, adopting WHO recommendation of “Digital health: Scaling up the TB response through information and communication technologies,” will be a feasible strategy to reach the mobile populations and to improve their adherence to TB treatment (WHO, 2015a). Since the population dynamics is expected to be more mobile in the future (Department of Population, 2016b), mobile health approach can be a sustainable and cost-effective tool for TB care and control of the migrant and/or mobile patients in Myanmar.

The establishment of health facilities and providing anti TB/HIV drugs at the focal point near the vulnerable population as well as fostering behavioral change and
cultural competency among the healthcare providers and decision-makers are the evidence-based best practices in improving the adherence to TB treatment. However, I would argue that it would be challenging to adapt and implement aforementioned best practices within the context of Southeast Myanmar. In order to improve the quality of the delivery of community-based TB care in the context of the existing health disparity within the dual health system at these two post-conflict states, it may require unconventional implementation science to build consensus between the major decision-makers, MOHS and ECBHOs as well as the traditional healers.

One approach may be integrating the training of the health staff of both health facilities and traditional healers together as there is a plausible linkage between the reconciliation and the reintegration of factional health staff in fragile and conflict-affected states (Witter et al., 2015). The recent study supports that the effective implementation of clinical practices of all stakeholders is central to the integration process and partnership in the clinical setting (Storeng & Behague, 2016). Furthermore, Uddin (2015) emphasizes the role of education during- and post-conflict reconstruction phases as a significant tool for the peace-building in conflict affected and post-conflict areas in Bangladesh. Building trust between the dueling parties can be achieved through mutual understanding and partnership in clinical space where the global health diplomacy would play key role in “building positive relationships of trust between
oppositional groups within clinical spaces” in addition to “building hospitals and donating medicines” (Carruth, 2016).

At last, given the diversity of ethnicity and the spoken language in the community, the patient-centered counseling sessions at the clinic and community-based health education programs should be conducted in the local language by employing the village health workers. A previous study found that the language discordance between the patient and the health care provider was a significant risk factor for death among foreign born outpatients with TB in Canada (Gardam, Verma, Campbell, Wang, & Khan, 2009). Therefore, in order to improve the quality of TB care and control under the PPM-DOTS, the patient-centered communication should be in concordant language.

4.2 Implications for further research

It is possible to replicate this study in the similar settings, but the adequate sample size will be necessary to detect the effect of all potential patient factors and health system factors on the time to LTFU from TB treatment.

The main finding of this study, the lack of family and/or community member support as a risk factor for TB treatment default, implies that the existing health disparities and health inequities in these post-conflict States pose greater risk for the vulnerable population, especially among those people on the move. The further research should explore the mutual trust issues between the healthcare providers of Ministry of Health, EBCHOs as well as the traditional healers.
Although focusing on the patient-reported outcomes is important for policy change, a systematic measurement is necessary for robustness of the results. In this study, however, the finding of poor provider-to-patient communication was based on the self-report of TB patient, it was not on a scaled measure. The further research focusing on the communication between health care providers and patients in TB care should use a scaled measure, such as “Measure of Patient-Centered Communication (MPCC)” to assess the responsiveness of the health care providers to patient’s concern (Meredith, Stewart, & Brown, 2001). Such assessment will improve the robustness of the findings and help to develop behavioral intervention strategies at the clinical point of TB care and control.

4.3 Study strengths and limitations

The strengths of this study include the mixed methods design and survival analysis method. The concurrent triangulation design cross-validates the findings of the quantitative and qualitative studies and thus enabling the complementary findings that ensures high degree of credibility. Survival analysis have two advantages over linear and logistic regression that it can handle censored observations and time-dependent variables. In addition to this, the Cox regression model can fit any distribution of survival analysis data, if the proportional hazards assumption is valid. In this study, the time dependent co-variates supported the assumption of proportional hazard. By the
goodness of fit test by Cox-Snell residuals, the final model fit the data well except the very large values of time.

In order to improve the reliability of the study, we did pilot testing of the semi-structured questionnaire and adjusted some measures with clear definitions. To ensure the inter-coder reliability for baseline survey data, the measures were pre-coded on the questionnaire form. The data analyst (me) and the data management consultant reached consensus on coding the multiple responses prior to data collection period.

The construct validity was ensured that the measures were created by the assumption of conceptual framework of PRECEDE and two types of measurement instruments (semi-structured questionnaire and in-depth interview guide) were consistent across indicators.

This study has several limitations. First of all, the prospective cohort study cannot establish causal inference and temporality of observed associations. Secondly, the study setting has a unique social and cultural context which may limit the generalizability of the findings to other settings. Thirdly, the purposive sampling method might have imposed investigator bias on the selection of participants based on the operational definition of the migrant category. Taking this into consideration, we had measures for migration pattern category to categorize the migration pattern in the data analysis process. Moreover, with only 10 (6.85%) LTFU cases, the sample size is too
small to test the statistical significance of the effect of other potential predictors on time to LTFU from TB treatment.

However, the hypothesized patterns are not apparent given the small number of event of interest and the qualitative nature of the perceived barriers to TB treatment as well as the possible spurious associations, aforementioned findings should be interpreted cautiously.
5. Conclusion

People on the move who are intended to stay in working area for less than 3 months are the high-risk group for TB treatment default. Having no family and/or community support is a risk factor associated with tuberculosis treatment default among migrant and mobile populations in the post-conflict Mon and Kayin states in Myanmar. Migrant TB patients have a lack of knowledge, but a positive attitude towards TB that predisposes them to look for health education. However, financial constraint and social stigma of TB reinforces them to get lost to follow up from TB treatment. Poor provider-to-patient communication and barriers to accessibility of services are the enabling factors for the delay seeking care and treatment.

Adopting the End TB Strategy under SDG 3 in post-conflict areas in Mon and Kayin States, National Tuberculosis Program should strengthen the existing multilateral community-based TB care with an integrated referral system inclusive of people on the move. Fostering self-efficacy of TB patients by patient-centered communication and informed decision-making in the clinical setting as well as in the community will enable the better adherence to TB treatment among the mobile population. However, the hypothesized patterns are not apparent given the small number of event of interest and the qualitative nature of the perceived barriers to TB treatment as well as the possible spurious associations, aforementioned findings should be interpreted cautiously.
Appendix A

Figure 11: Conceptual framework. The PRECEDE-PROCEED Model for health promotion program planning (Green & Kreuter, 2005; "PRECEDE/PROCEED," 2016).
Appendix B

Figure 12: Modified Conceptual Framework. The PRECEDE-PROCEED Model for health promotion program planning (Green & Kreuter, 2005; "PRECEDE/PROCEED," 2016).
Appendix C

Figure 13: Study design and timeline of data collection.
Appendix D

Figure 14: Mind Map of conceptual framework for coding in NVivo.
Appendix E

Definitions and reporting framework for tuberculosis – 2013 revision (WHO, 2014)

**Bacteriologically confirmed TB case** - A bacteriologically confirmed TB case is one from whom a biological specimen is positive by smear microscopy, culture or WRD (such as Xpert MTB/RIF). All such cases should be notified, regardless of whether TB treatment has started.

**Clinically diagnosed TB case** – A clinically diagnosed TB case is one who does not fulfil the criteria for bacteriological confirmation but has been diagnosed with active TB by a clinician or other medical practitioner who has decided to give the patient a full course of TB treatment. This definition includes cases diagnosed on the basis of X-ray abnormalities or suggestive histology and extrapulmonary cases without laboratory confirmation.

**Cured** – A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion.

**Died** – A TB patient who dies for any reason before starting or during the course of treatment.

**Lost to follow-up** – A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more.
New patients – have never been treated for TB or have taken anti-TB drugs for less than 1 month

Not evaluated – A TB patient for whom no treatment outcome is assigned. This includes cases “transferred out” to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit.

Previously treated patients – have received 1 month or more of anti-TB drugs in the past. They are further classified by the outcome of their most recent course of treatment.

Treatment after loss to follow-up patients – have previously been treated for TB and were declared lost to follow up at the end of their most recent course of treatment. (These were previously known as treatment after default patients.)

Treatment completed – A TB patient who completed treatment without evidence of failure BUT with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable.

Treatment failed – A TB patient whose sputum smear or culture is positive at month 5 or later during treatment.

Treatment success – The sum of cured and treatment completed.
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66


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