ECONOMIC COSTS OF TUBERCULOSIS SCREENING BY PATIENTS IN MAHOSOT HOSPITAL, LAO PDR.

BY

MISS SENGMONTHA OUPENGVONG

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH

HEALTH SERVICE MANAGEMENT

FACULTY OF PUBLIC HEALTH

THAMMASAT UNIVERSITY

ACADEMIC YEAR 2017

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ENTITLED

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was approved as partial fulfillment of the requirements for
the degree of Master of Public Health

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ABSTRACT

This study was a descriptive study, to analyze the direct and indirect costs of tuberculosis screening by patients in Mahosot hospital, Lao PDR.

In this study we found 50 patients, there were 56% of male, 76% were married. There were 28% of patients aged 60 years and above, 36% completed secondary school. Regarding economic status, average income of the samples was 1,624,000 LAK. More than half (58%) of all samples went to hospital twice. Prior to being diagnosis as TB patient, 76% got X-rays once, 12% got X-rays twice times, 4% got X-rays three times, 56% got Echo once times, and 58% got other checkup twice times. The average of patient travelling cost was 33,720 LAK, patient other cost was 79,520 LAK and administration cost (not included cost of medicine) of the samples was 350,080 LAK. Primary income in the household are patient 46%.The average of household income is 2,615,000LAK.

There were 31 patients who has persons accompanied the patient to hospital revealed the following; partner or spouse 32%, relative 32%, other 23%, parents 13%. Their occupational were 39% labor. The average income of accompanying person for

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visiting hospital was 1,329,000 LAK. The average expenditure of the accompanying person for visiting hospital was 79,000 LAK.

According to the result in chapter 4, this study founded the total unit cost of TB screening by Gene X-pert service in National Reference Laboratory was 139,601 LAK. We found total unit cost of material cost was 105,652LAK, capital cost 26,887 LAK and labor cost was 7,062 LAK. The highest cost of this study was material cost, the capital cost was the second and labor cost was the third. Reason, material cost might do to highest cost of screening TB by Gene Xpert, because some items were not reusable.

Keywords: Economic cost, TB screening

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Miss sengmontha OUPENGVONG

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ABBREVIATION

WHO	World health organization
TB	Tuberculosis
NRL	National Reference Laboratory
MDR-TB	Multidrug-resistant Tuberculosis
NTP	National Tuberculosis Program
NPC	National pulmonary center.

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CHAPTER 1
INTRODUCTION

1.1 General Introduction

1.1.1 Background of Tuberculosis

Tuberculosis remains an enormous problem in the world. In 1993, World Health Organization (WHO) declared tuberculosis (TB) as ”global emergency(1). TB is heaviest burden in the world most of the people who get the TB is poor, due to TB, people suffer income loss. In 2014, worldwide nine million people fell ill with TB, one million men, women and children may die due to TB, one million people living with HIV developed TB and more than four hundred thousand people developed MDR-TB (multidrug-resistant TB).There is the global TB strategy for the “post-2015 era” aimed at “ending the global TB epidemic” by 2035. Target in 2035 will decrease 95% in Tuberculosis deaths compare with 2015, 90% reduction incidence rate (less than 10 tuberculosis cases per 100 000 population). This strategy is based on the three pillars that emphasize patient-centered TB care and prevention, bold policies and supportive systems, and intensified research and innovation (2).

The early, rapid and accurate detection of TB and drug resistance relies on a well-mange and equipped laboratory network. Laboratory confirmation of TB and drug resistance is critical to ensure that people with TB signs and symptoms are correctly diagnosed and have access to the correct treatment as soon as possible(3). The conventional laboratory tests for the diagnosis of TB, which have been used decades are sputum smear microscopy and bacterial culture. Diagnosis based on cultured specimens is the reference standard but results take weeks to obtain. Drug susceptibility testing on cultures is used to detected resistance to first and second line TB drug. In 2010, WHO endorsed the first rapid molecular test that can be used to simultaneously test for pulmonary TB and rifampicin resistance, Xpert®MTB/RIF. The sensitively of the test is much better than smear microscopy and is comparable to solid culture. Xpert MTB/RIF is being rapidly adopted by countries. South Africa is the first country to

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adopt Xpert MTB/RIF as the primary diagnostic test for TB replacing smear microscopy(3)".

Following increased investments in TB research and development in the past decade, there have been important breakthroughs in TB diagnostics. In 2008, rapid molecular tests for detection Rifampicin Resistance Tuberculosis (RR-TB) and Multi Drugs Resistance Tuberculosis (MDR-TB) using positive sputum specimens or cultures were recommended by WHO. The first rapid molecular test that can be used to simultaneously test for TB and rifampicin resistance, Xpert®MTB/RIF was recommended for diagnosis of pulmonary TB and rifampicin resistance in adults. The sensitive of the test is much better than smear microscopy and similar to solid culture(4).

1.1.2 Screening Tuberculosis

Active TB screening can improve tertiary prevention by early treatment. It can reducing the risk of poor treatment outcomes, and the risk of long-term squeal and the adverse socioeconomic consequences of TB. If screening for active TB reduces the delay in diagnosis, for which there is some premise, it is feasible that it should early enable to start treatment and thereby deduct the risk of poor outcomes. Moreover, the available evidence guide that screening, if done in the right way and targeting the right people, may reduce painfulness and death.

Options for the first step of screening include screening for symptoms, such as screening either for a cough lasting for longer than 2 weeks, or screening for any symptom corresponding with TB, including cough of any duration, haemoptysis, weight loss, fever or night sweats or screening with chest radiography. If symptom screening is used initially, then chest radiography can be used as a second screen to improve the pre-test probability of the subsequent diagnostic test, and to reduce the number of people who need to undergo further diagnostic evaluation.

Detecting early active TB, it can support two goals. The first, deducting the risk of poor treatment outcomes, health squeal, and the adverse social and economic consequences due to TB. This reduces painfulness, the prevalence of TB, and death from TB. Second, deducting TB transmission by shortening of the duration of infectiousness. This reduces the incidence of TB infection and consequently contributes to the deducted incidence of TB disease(5).

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1.1.3. Xpert MTB/RIF for the rapid diagnosis of TB and drug resistant TB

Conventional diagnostic tests for tuberculosis (TB), including those for the detection of drug-resistant forms of TB and the diagnosis of TB in people living with the human immunodeficiency virus (HIV) infection, have limitations that are major constraints to progress in global TB care and control. Sputum smear microscopy, the most widely used test, has relatively low sensitivity in field conditions (typically in the range 50%–70%), and cannot be used to identify paucibacillary TB, extra pulmonary TB or drug resistance (6). Diagnosis using culture methods - the current reference standard - requires laboratory infrastructure that is not widely available in most countries with a high burden of TB, and test results take up to 3 months to obtain.

In December 2010, WHO endorsed a new rapid molecular test, called Xpert MTB/RIF® (Cepheid, Sunnyvale, USA). The test can simultaneously diagnose pulmonary TB and identify resistance to the most powerful first-line anti-TB drug, rifampicin. In five demonstration sites, the sensitivity of the test (compared with culture) for TB was 91% and specificity 99%; for rifampicin resistance, sensitivity was 95% and specificity 98% (7). The test takes less than 2 hours with minimal handson time (8, 9). In May 2011, WHO published policy guidance with a strong recommendation that Xpert MTB/RIF should be used as the initial diagnostic test in two groups of people: individuals suspected of multidrug-resistant tuberculosis (MDR-TB), and those living with HIV who are suspected of having TB (10). MDRTB is defined as resistance to at least rifampicin and isoniazid, the two most effective anti-TB drugs (11).

1.2. Tuberculosis in Laos.

The National TB Program (NTP) started in 1995 and integrated TB control services in 5 central, 18 provincial and 142 district public hospitals and in 912 of 954 (95%) heath centres. 160 basic TB units in central, province and district hospitals perform quality assured microscopy laboratory and can treat TB patients. Nearly all health centres (village level) have been trained to identify TB symptoms and to collect and send sputum specimens to district TB laboratories.

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The Global Fund allocation will contribute to attain the National TB Strategic Plan 2017-2020 targets to decrease the incidence of TB by 20%, and the mortality due to TB by 35% and to achieve 0 catastrophic cost for TB patients by 2020, in line with WHO's End TB strategy and Regional Framework for Action on Implementation of the End TB Strategy in the Western Pacific, 2016-20205

Lao TB targets assumptions were modelled as follows : (i) Targeted 20% TB incidence decline (146/100,000) in 2020 compared to 2015, (ii) the countrywide TB laboratory network will screen 42,000 presumptive TB patients in 2018 (70% tested by Xpert), 43500 in 2019 (80% tested by Xpert) and 45,000 in 2020 (90% tested by Xpert); (iii) OPDs and IPDs physicians will increase clinical diagnosis capacity (using chest X-ray) for adults and children including persons living with HIV and other comorbidities; (iv) mobile active case finding in prisons and other high risk remote/isolated populations groups in selected high burden districts/villages will continue (ACF contributed of the new and relapse pulmonary TB cases in 2016)(12).

1.2.1. Patient visit in Mahosot hospital.

When patients visit Mahosot hospital. The first step, they will buying the book (for new patient) and register, then they pay fee for service. The second step, they will had screening by nurse if the symptom related to TB, nurse will send patient to had consulting with TB's doctor room. Next, they will waiting queue to consulting with doctor, after they had consulting with doctor, if doctor need more check up to identify the symptom such as X-ray, Echo, other checkup. The patients will take them and bring the result of check up to doctor, after that if patients who is suspect have TB, they will go to NRL for screening TB and if patients got positive TB, the NRL will send the patients to have treatment in TB unit in Mahost hospital, and patients who get negative TB, NRL will send patients to consult with doctor again. If who is not suspect the TB, they will take some medicine and go home. The figure will show below:

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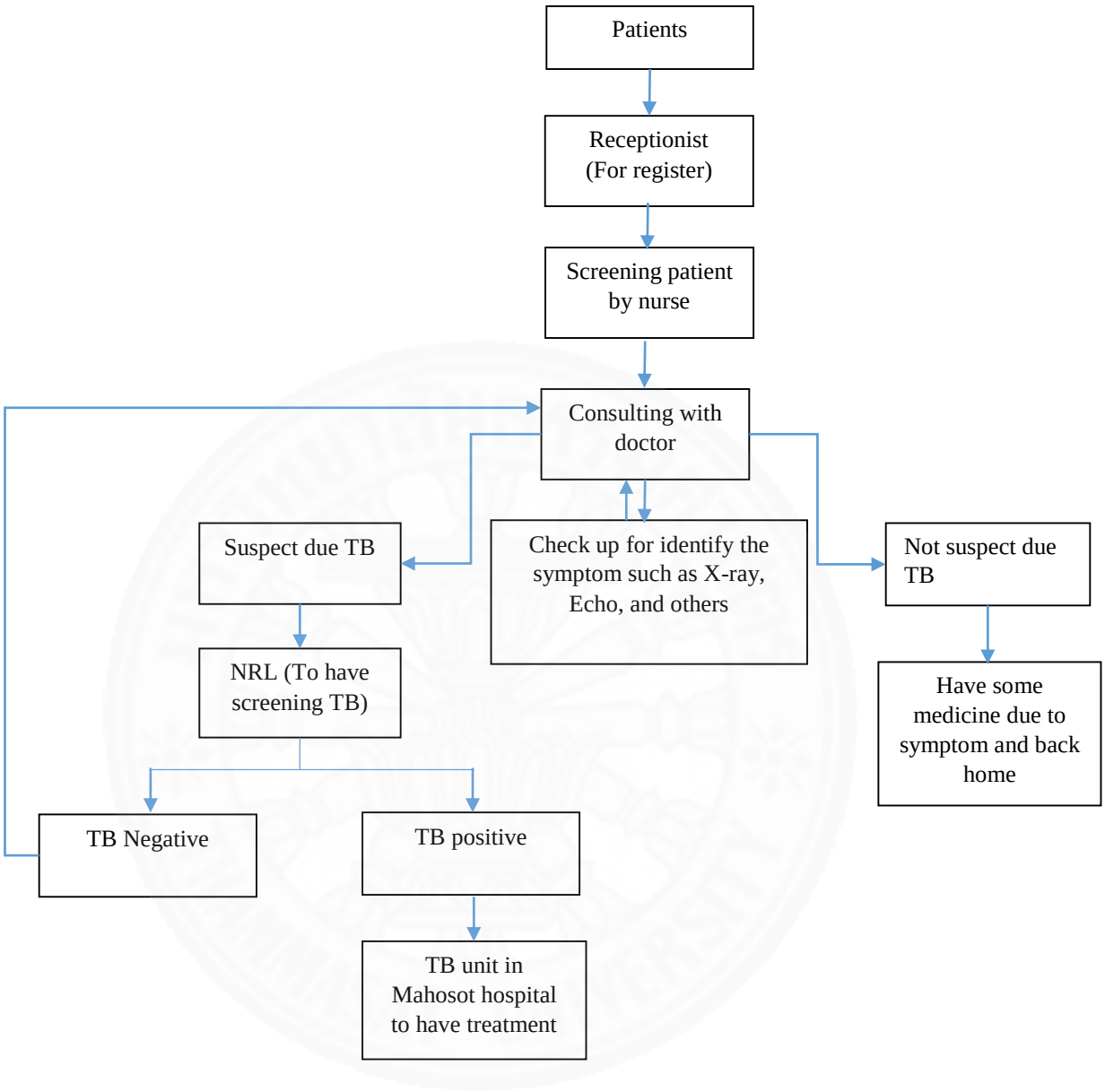


Figure 1.1 Patients TB diagram in Mahosot hospital.

1.3 Rationale

The National TB Strategic Plan 2017-2020 targets to decrease the incidence of TB by 20% in 2020 compared to 2015. To reduce incidence of TB, they should detecting early active TB and early treatment. It can reducing the risk of poor treatment outcomes, and the risk of long-term squeal and the adverse socioeconomic

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consequences of TB. So, accessing to quality of screening TB, it is important thing for patient who got the TB. Mahosot hopital is the biggest general hospital of Laos. Therefore, most of people in Vientiane capital go there for checkup when feel sick. So, we study the economic cost of patients in Mahosot hospital. For the providing cost of TB screening by GeneXpert, There is National Referance Laboratory (NRL) of Laos located in the Mahosot hospital area, if the patients who were suspect to TB in Mahosot hospital, they will had screening TB in that. The NRL were received all examination of TB from all provinces not only in Vientiane capital.so, the number of screening TB by GeneXpert in NRL is quite high compare to other facility.

The Mahosot hospital, Lao PDR never analyzed the economic cost and National Referance Laboratory of Laos never analyzed the unit cost of Tuberculosis screening. This causes the administrations lack of information to assist in decision making for the management of organization.

1.4. Objective

1. To analyse economic costs before diagnosis to tuberculosis screening by patients in Mahosot hospital, Lao PDR.
2. To analyse the unit cost of tuberculosis screening by Gene Xpert in National Reference Laboratory, Lao PDR.

1.5. Benefit of the study

1. Decision makers of Ministry of Health Lao can use the research result to support their decisions for efficiency healthcare service design in Mahosot hospital.
2. Provide baseline financial data to be compared with total and unit costs, and cost reduction measures in the future.
3. This study is guide to calculate unit cost of TB screening by GeneXpert to other facilities.

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CHAPTER 2
LITERATURE REVIEW

2.1 Economic Burden of Tuberculosis.

The diagnosis and treatment of tuberculosis has an economically important burden on health and patients. This concerns prevalence of tuberculosis in resource-constrained countries, particularly countries with a large impoverished population. The economic burden of MDR-TB is especially severe considering the duration and intensity of treatment. Even with free treatment, patients confront substantial direct and indirect costs when receiving tuberculosis services (13). While many countries are committed to offering "free" tuberculosis treatment to their patients, this free treatment may only cover diagnostic tests and anti-mycobacterial medications. However, patients and their families may have hidden costs, such as "out of pocket" costs, such as transportation, allowance, or indirect costs associated with loss of income(14). In addition, patients and other household members who are involved in taking care of tuberculosis patients face reduced income due to lower productivity and / or loss of employment opportunities, and may experience intangible costs related to the social stigma associated with the illnesses and the potential breakdown of the family unit(15).

2.2 Accounting Cost vs. Economic Cost

Cost is measured the economic sacrifice made to achieved an organization’s goal. For a product, cost represents the monetary measurement of resources used, such as material, labor and overhead. For a service, cost is the monetary sacrifice made to provide service. Accountants generally use cost with other descriptive terms defines some characteristics of the cost measurement process or an aspect of the object being measured(16).

2.2.1 Accounting Cost

Accounting cost that is broad and extends beyond calculating product costs for inventory valuation, which government reporting requirements largely

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dictated. However, accountants do not allow external reporting requirements to determine how they measure and control internal organizational activities. In fact, cost accounting's focus is shifting from inventory valuation for financial reporting to costing for decision making. The main objective of cost accounting is communicating financial information to management for planning, controlling, and evaluation resources(16).

Accounting cost are costs that are incurred to acquire resources (17). It can also referred as the monetary values of actual expenditure for acquisition of goods and services (18) It is concern with measuring cost for financial planning, assessing decisions and reporting purposes from a particular organizational perspective (17).

Cost accounting procedures are used to accumulate and allocate all elements of manufacturing cost in manner that will produce meaningful data for the internal used of management and for the preparation of external financial statements (Vanderbeck and Edward,2005). In the theory of cost accounting Vanderbeck and Edward (2005) mentioned that costs were accumulated for one month. At the end of month, costs were divided by the total unit produced to determine the unit cost. The accomplished of cost accounting: the determination of product costs (both the total cost for the period and cost per unit).

2.2.2 Economic Cost

Economic cost is the cost of an event is the highest valued opportunity necessarily forsaken. The usefulness of the concept of cost is a logical implication of choice among available options. Only if there were no scarcity of resources or no alternatives to choose between, would "cost" and "choice" be irrelevant. As a result, the value of an amount of available resources in a particular class of use is described by demand, in contrast to supply, which represents the value of the resources if they would have been used for other purposes(19)

Economic cost/ Opportunity cost is the total value of benefit foregone because of the alternative use of resources (including money) or the sacrifice of best alternative use of resources. Therefore, measurement of opportunity cost or true cost could be difficult as it includes implicit cost such as cost of time and capital. It should not be taken as special type of cost accounting or costing system, but rather as a particular approach to decision making under resource scarcity (17).

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2.3 Cost Category

Cost is an essential ingredient to guide policy as well as manage hospitals; it plays an important role in allocation of effective resources across hospitals. It is an input for assessing various type of treatment and treatment compared to prevention (20).

Cost refers to the value of resources used final products or output or service. The cost will not equal to the service charge, as the service is always lower than the cost in the public organizations. On the contrary, providing service in the private sector is aimed to make the profit. This result the service charge is always more expensive than its cost. Cost can be classified in to produce the final products or outputs or service. On the contrary providing service in the private sector is aimed to make the profit. This result the service charge is always more expensive than its cost. Cost can be classified into two types that is financial and economic cost. Cost in economic standpoint consists of three distinguish characteristics. First is the usage of real source "such as usage of land, labor or asset. These resources have alternative use" in economic system. When being used in one activity, another benefit will be lost (benefit gone). Therefore, the economic cost often refers to what known as opportunity cost in using the resource.

According to Lucey (2002) cite in Mogyorosy and Smith (2005, p.190) cost can be defined as the amount of expenditure (Actual or nominal) incurred on or attributable to a particular good or activity. In order words it can be defined as resources (cash or other assets) that must be surrendered in order to achieve particular objective. The cost always relates to past activities (17).

Another definition refer to cost as the cost of goods and services as the value of resources spent for acquisition of those goods or services that maybe expressed in monetary on monetary values (17). As economist always distinguish between accounting cost and opportunity cost or social cost (18).

2.3.1 Direct and indirect cost

The cost of hospital services can be classified into "direct cost" and "indirect cost". Direct cot are directly linked to use of particular resources or cost objects (17). Carrin ad Eclo (1995) declared that direct cost can be defined in relation to a given activity, a medical services or department of hospital. They also define indirect cost as cost of goods and services used jointly by several activities or several

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departments, therefore the totality of the cost cannot be attributed to one particular department, service or activity.

Direct cost refers to material cost and labor cost that is directly associated with the production or services. It can be clearly identified which product or service it belong to. Direct will vanish only when the product or service is written of.

Indirect cost refer to cost that cannot be identified which product or service it belongs to specifically since they are associated with various production processes and services. For example, utility cost, depreciation cost, office rent or equipment cost. In management perspective there is a consideration whether indirect cost should be included into the product or service price. In case there is no region between indirect cost and product or service, such as, how the utility expense should be included in the service charge. In other word, how to calculate the cost product or service need to find the suitable method to distribute indirect cost to the product and service appropriately.

2.3.2 Capital Costs

Capital cost are inputs that last for more than one year(21), including the cost of depreciation of all major equipment, machineries, buildings and other fixed assets (22). Estimation of capital cost employs the number of useful life years of the particular equipment, building, or assets. The item of medical equipment purchase and used more than 10 years and the building constructed and used more than 30 years will not include in the capital cost estimates, even though they are still in the services(22).

The capital costs that was the cost of resources used over a specific period, rather than at the time they are purchased. That the resources bought in one year and used for several years. A way of spreading out the cost over the study period is to divide the total capital cost by the number of years of the item's expected life, to give a kind of depreciation referred to as straight line depreciation. Cost of building space is probably better achieved by estimates based on the rental value(23).

Rayburn, L.G. mentioned cost of capital that is a composite of the cost of various sources of funds from debt and equity that make up a firm's capital structure. It is a weighted average found by determining the costs of the individual types of capital and multiplying the costs of each by its proportion in the firm's total capital structure(16).

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2.3.2.1 Depreciation Cost

The depreciation cost means the building, the structure and articles have limit of work life so condition and value of them will decrease every year. There are many calculated method for depreciation cost but Public Health Organization suggested using Straight line method or average annual cost. The formula is as follow:

$$Average\ annual\ cost = \frac{Cost\ of\ purchase}{Working\ life\ (\ years)}$$

There are a number of methods commonly used to spread the cost of capital investment over its years of use (that is, to determine its annual cost). The most commonly used method is "straight" line "depreciation" in which the total cost is spread evenly over the life of equipment by simply dividing the cost by the expected years of life and allocating this cost to the annual cost of the activities.

$$Annual\ cost = \frac{Total\ cost}{Useful\ life}$$

There may be differences depending on where the input is used: for example, vehicles used in rural areas may last only 3 years, while in urban areas their useful life may be 5 years more. Some common useful life estimation are as follow:

- Building: 20-30 years.
- Furniture: 10 years.
- Equipment: 5-10 years.
- Vehicles: 3-5 years.
- Linen: 2 years.
- Calculate the area of each room: area = length x width.

2.3.3 Recurrent costs

The recurrent costs that are used up in the course of a year and are usually purchased regularly.

- Personnel (all types): supervisors, health workers, administrations, technicians, consultants, casual labour;
- Supplies: drugs, vaccines, syringes, small equipment (unit cost of under $100);
- Building, operation and maintenance: electricity, water, heating, fuel, telephone, telex, insurance, cleaning, painting, repairs of electricity, plumbing, roofing, and heating;

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- Training, recurrent (e.g. short, in –service courses);
- Social Mobilization, operation costs;
- Other operating costs not included in above.

2.3.3.1 Labor cost

The labor cost means all benefits which the workers gained from their working place such as salaries, wages, overtime payment, training expenses, medical care cost of officer, rental house expense, child assistance payment, children education fee etc. After summarizing all labor costs, then one department so searching allocation method for allocate labor cost to those cost center and conclude each cost center's labor cost.

2.3.3.2 Material cost

Supplies are materials used in the course of the year, as direct inputs to the principle activities performed by the program and other small items purchased during the year such as drugs, regents for tests, needles, slides and stationery, etc. supplies comprise a fairly large cost category for the program equipment is categorized separately. The difference between supplies and equipment lies largely in cost. For example if the unit price of an items is less than 100$ in spite of its utility is lasts for longer than one year, it would be simpler to allocate it in the recurrent input category for supplies. If the price of item is 100$ or higher than the capital cost category-equipment would be more appropriate to uses(21).

2.4. Related Research

Part 1 Economic cost before diagnosis TB

The first national tuberculosis prevalence survey of Lao PDR (2010–2011) was to measure the prevalence of bacteriologically confirmed pulmonary tuberculosis (TB) in Lao PDR in 2010–2011. Of 39 212 eligible participants from 50 clusters, 6,290 participants provided at least one sputum sample for smear and culture. There were 237 bacteriologically confirmed pulmonary TB cases, 107 of which were smear-positive. Chest X-ray screening alone identified 230 (97.0%) cases compared with 118 (49.8%) by symptom screening alone. The estimated prevalence of smear-positive and bacteriologically confirmed TB in those ≥15 years was 278 per 100 000 (95%C.I. 199–

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356) and 595 per 100 000 (95%C.I. 457–733), respectively. Prevalence significantly increased with age and was higher in men than women. The prevalence of TB in Lao PDR is almost twice as high than previous estimates, with the greatest burden in the older population. Case detection efforts remain the primary goal of the national TB programmed with case notifications being very low in comparison with the estimated number of prevalent cases. The survey observed major limitations with the diagnostic strategy of passive (symptom based) case finding that uses only direct smear microscopy for confirmation(24).

Chest radiology is often used for suspect TB patients, where and when available, as evidence of TB disease. Although X-ray examination can provide supporting evidence in a typical case of TB with unilateral lymphadenopathy and/or shadows in the lung fields indicating infiltration, its low sensitivity and specificity render it unreliable. With the advent and increase of HIV, increasing numbers of suspects present with atypical X-rays, further reducing the usefulness of radiology(25). HIV-infected individuals are less likely to have cavitary lesions, are more likely to have shadows in the lung fields other than the upper zones, and are more susceptible to pleural effusions and intrathoracic adenopathy. This problem is magnified in sub Saharan Africa, where between 20% and 67% of TB patients may be HIV-infected(26). The full cost of an X-ray is between US$3.08 and $5.95 (1999 prices)(27).

Part2 Unit cost analysis

Collection and analysis of data on program costs and provide considerable useful information on primary health service of all kind. In addition to indicate the amount of funds (from all resources) likely to be require to continue programs, they can help to access the use of personnel in delivering health service and the efficiency of putting supply, transport resource and other inputs to work (21)

According to Adam et al. (2003), information on hospital unit costs is valuable to health decision makers and researchers for the assessment of hospital efficiency and the assessment, by means of either cost-benefit or cost-effectiveness analysis, of the efficiency different health interventions. Hospital costs are an example. They are a key requirement for many types of policy decisions and are used, for example, as an input to accessing the relative efficiency of various types of treatment,

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and of treatment compared to prevention. They are also essential for budgeting and planning exercises, to identify the resources necessary to undertake or sustain or scale up(20). WHO also mention about the cost and unit cost analyze of inpatient about patients visit of the Disease Control Priority Project (DCPP) by regional classification, such as East Asia and Pacific. In addition, as part of the project, WHO has a set of standardized regional unit costs have been estimated for a range of health care resource inputs and to extend the program to other low and middle income country.

The study of unit cost of Puainoi hospital, khon kean province in provider perception. The study design was prospective study the expenditure between 1st of June in 2011. Analyze the direct cost of each cost center and indirect cost from support cost center and calculate the unit cost of patient services. The study found that cost component of laboratory were labor cost, capital cost and material cost. The percentage of each are 61%, 10% and 28%, respectively(28).

Laekawipat analyze the cost and unit cost of Rongkwang hospital, Phrae province for fiscal year 2003. She analyze unit cost by using Simultaneous equation method. Her study revealed that the total direct cost of all operations was 36,823,964.50 Baht and the percentage of labor cost was 36.86%, material cost was 25.75% and capital cost was 10.39% respectively. This study recommends decreasing hospital cost through awareness, thus improving efficiency and promoting community health care(29).

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CHAPTER 3
MATERIALS AND METHODS

3.1 Conceptual framework

The conceptual framework for this study is aimed at analyzing the economic cost of tuberculosis screening. Based on the literature review, the economic cost consists of two parts. First, there are direct costs associated with tuberculosis screening. These direct costs are borne mostly by health service providers, and have four sub-categories: capital cost which is depreciation cost, recurrent cost which is labor cost and material cost. For the indirect costs which are borne mostly by patients, there are cost of transportation to the screening center when TB patients go to receive the screening service, and other expenditure before diagnosis to screening TB.

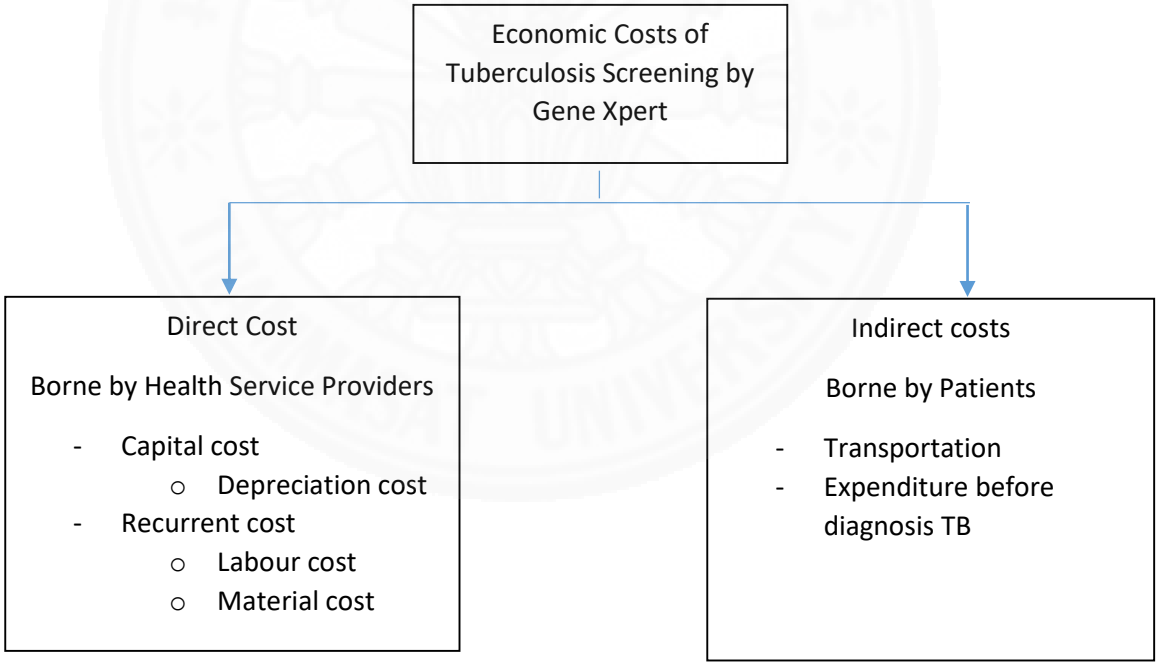


Figure 3.2 Conceptual framework

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3.2 Study design

This study is a descriptive study. There are two types of data included:

1. Primary data by using questionnaire to interview patients such as patient's income, patients' expenditure, occupational, who were screening TB in Mahosot hospital.
2. Secondary data which was recorded from National Reference Laboratory (NRL) in year 2017 include: capital cost, labor cost, material cost.

3.3 Study site and population

This study to analysis economic costs of Tuberculosis Screening: A case of Mahosot Hospital Patients, Lao PDR.

The target of population are screening TB in Mahosot hospital in April 2018.

1) Inclusion criteria
   - The patients who are screening with Gene Xpert.
   - The patients who are live in Vientiane.
2) Exclusion criteria
   - The patients who are foreigner.

3.4 Instruments.

The instruments were comprised of 2 main parts.

Part 1. The questionnaire and record about the patient and their relative were included the following information.

- Occupational
- Income of patient and relative who come with.
- Expenditures of transportation, service in hospital.
- Time spent for travelling.
- Who is take patient to hospital
- Who is take sputum to hospital.

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- How many time do you go to hospital that doctor diagnosis suspect symptom with TB.

Part 2. The cost was comprised of 3 different forms.

1. Capital cost form intern of depreciation cost.
2. Material cost form.
3. Labour cost form.

Applications for data collection and analysis: Microsoft Excel for unit cost of TB screening and use SPSS to analysis data of patients.

3.5 Data collection

Part 1: Indirect cost born by patients.

1) Preparation phased:
   - Informed the sampled to hospitals about the study and schedule for hospital visits.
   - Questionnaire printing and numbered.
   - Study team meeting and finalize schedules and time table.
2) Implementation phase.
   - Interview was complete by trained research assistants.
   - Interview topics were according to questionnaire.
   - Interview duration took about 5-10 minutes.
3) Interview patients and their relatives about occupational, income of patient and relative who come with, expenditures of transportation, service in hospital, time spent for travelling, who take patient to hospital, who take sputum to hospital, how many time do you go to hospital that doctor diagnosis suspect symptom with TB

Part 2 Direct cost born by provider.

1) Preparation phased:
   - Inform the National Reference Laboratory about the study and schedule for visit NRL.
   - Visit NRL and interview the staff about Gene Xpert service for prepare the collect form to collect data.

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2) Implementation phase.

- Material cost were collected from national pulmonary centre financial report.
- Data verification by quality data processing, both by data collector and by computerized system such as standard data recording form, data collector or research assistant training, using computerized system. In case of any doubt, research assistants will reconfirm with corresponding hospital official.

2.1) Capital cost includes depreciation cost of durable articles and building. These cost were separately collected, particularly durable articles and building that the useful life is not expire. The useful life determination includes:

A. All kind of durable articles was determined to have the useful life of 5 years.
B. Building was determined to have useful life of 20 years.

2.2) Recurrent cost is the cost for running screening TB. The line items under recurrent cost of this study are labour cost and material cost.

A. **Labour cost** was the most significant expense of the screening TB. The researcher collect all expenses of the labour cost that was include salary, wage, and remuneration of high position. The labour cost was directly allocated to the cost of activity needed to the steps to calculate the labour cost.
B. **Material cost** include screening TB instruments, utility and maintenance. All expenses were based on the price of those materials and amount use, as well as the real reimbursement. Source of the data were collected from National pulmonary centre (NPC).

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3.6 Data Analysis

Part 1: Indirect cost born by patients.

Descriptive Analysis: Mean, standard deviation to describe the characteristics of respondents. Patients' information were collect and key data on EPI data entry program.

Part 2 Direct cost born by provider.

Cost analysis: Analysis cost by category, to allocate labor cost of staff of NRL to TB screening the percentage share of TB screening by GeneXpert was used. This study assumed that the proportion of each activities was allocation criteria. In NRL has seven activities, there are nine staff. We will collect data by using number of patients in each activity, then sum all of number of patient, after that using number in each activity divided by the total number of all activities.

3.7. Calculate Cost

3.7.1 Calculation Capital Cost

The capital cost is the depreciation cost of resources which have a useful life of one year or more. These include the cost of building and equipment. Capital costs were collected in terms of each cost center and were checked to equipment register of each centers.

The cost of equipment and building were calculated from purchases prices to be the cost in the present year or assessed from the price list which could be purchased in that year.

The straight line method was used to calculate the depreciation capital cost. It was calculated from the purchased price in year t divide by useful life by the following formula.

$$Annual\ cost = \frac{Total\ cost}{Useful\ life}$$

This study was assume curtain life of equipment will be five years for office equipment, medical equipment (for some asset have useful life are eight years, this research still assume that the useful life of them was five years because those assets

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have broken but still used in reality and also some of assets have the low original price because those assets was support from equipment companies) and building will estimated the useful life 20 years.

After we get the annual depreciation cost of building and equipment, we will find the cost per month by formula below:

$$Capital\ cost\ per\ month = \frac{Annual\ cost}{12}$$

In this study we will calculate cost only TB screening by Gene Xpert, so we will find the estimated capital cost only the TB screening by Gene Xpert by formula below:

$$\text{Unit cost of CC Gene Xpert} = \frac{\text{Proportion of Gene Xpert x capital cost per month}}{Number\ of\ patients\ in\ April\ 2018}$$

3.7.2 Calculation of recurrent cost

Cost of personnel or labor cost (LC) was calculated by

Salary of staff per month = Basic salaries + Allowances based on designation + Allowances for public servicing years + Allowances based on specializing + Allowances for hard work and toxic environment + Family allowances

After we get total salary per month then we find the total salary for doing Gene Xpert per month by formula below:

$$\text{Unit cost labor cost for doing Gene Xpert} = \frac{\text{Proportion of Gene Xpert x salary of staff per month.}}{Number\ of\ patients\ in\ April\ 2018}$$

3.7.2.1 Material cost

This study we collect information by interview staff for how many items do they use for TB screening by Gene Xpert per person and purchasing price of each items. Some items are used for doing Gene Xpert, but some items use for many work. If material use for only TB screen by Gene Xpert we will take it, and If they were used for multi propose but including with TB screen Gene Xpert we will use the percentage share to calculate the cost of material that use for TB screening Gene Xpert, and some material will use once time but not for one patient such as mask, gloves, shoes cover bag, arms cover bag, cuffed gown, so we estimated of these cost by

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using number patients in April 2018 divide by 20 of work days, after that we find the proportion of these material use for one patient. Finale we sum all of items, and we will get the unit cost of material cost.

3.7.2.2 Utility cost

The utility cost included electricity, telephone and water. We will use Mahosot hospital's expenditure in April 2018. NRL located in Mahosot area, so their utility cost of NRL expense by Mahosot hospital. We will estimate the utility cost of Gene Xpert service by formula below:

$$\text{Utility cost of NRL} = \frac{(\text{Total cost utility in April x Number of staff in NRL})}{\text{Number of staff in Mahosot}}$$

Utility cost of Gene Xpert service = Utility cost of NRL x proportion of Gene Xpert

3.8. Total cost

In the total cost of Tb screening Gene Xpert by adding up recurrent cost (Labor cost and material cost) plus capital cost. To facilitate the data collection process and analyze the result of total cost. The summary of data and its sources collected is shown in the following diagram.

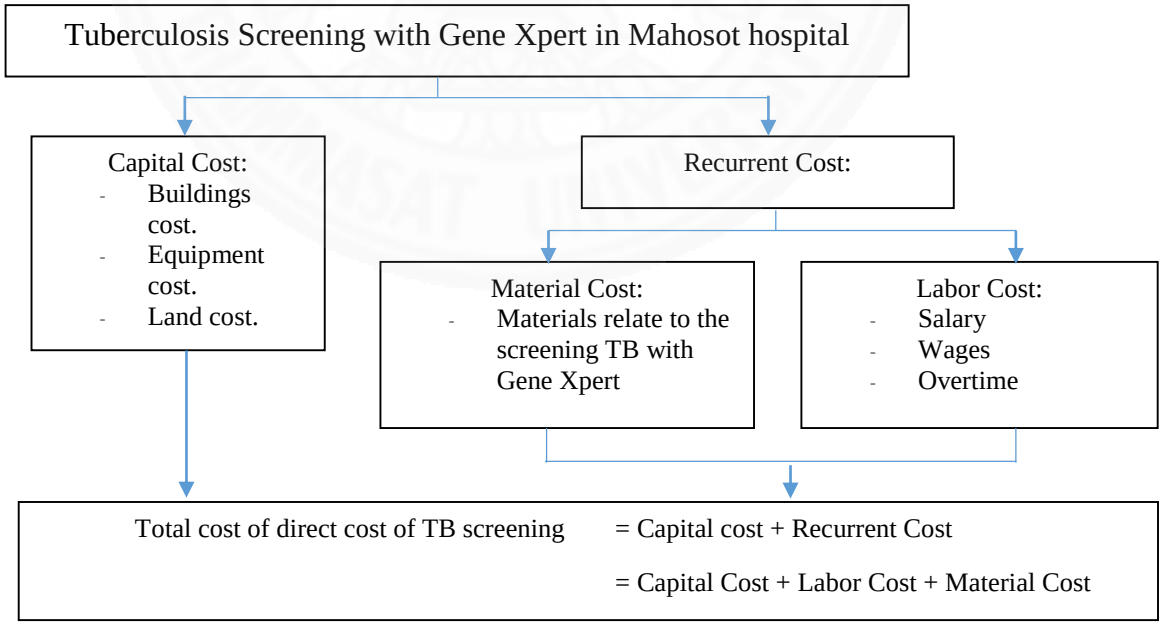


Figure 3.3 Total cost

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3.9 Ethical consideration

Endorsement of ethical clearance by the Institute of Public Health of LAO PDR as the research will be submitted all related documents to Ethic Committee of Health Science University in Vientiane the capital of Lao PDR.

The participant's decision whether the sample population will accept or not, the researcher will respect for respondent's decision and could stop at any time during the data collection. Furthermore, the respondents are able to skip the question which they do not want to reply as well as they could freely ask what are not clear in questions and stop at any time that they want to.

All participates will not identify and keep confidential. The link with their name of respondent will not be presented. Representative by number are used to identify the data collection form. All questionnaire will keep safety. Only researcher could access to the questionnaire, after the data are analyzed, all questionnaire will be ruined. The addition, those information will be applied and reference in any report.

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CHAPTER 4
RESULT AND DISCUSSION

In this study is the economic cost of TB screening at Mahosot hospital, Vientaine, Lao PDR. First step of this study is due to the information of patients. In this step, it can be categorized in to five categories, i.e., general characteristic, information of patient before diagnosis TB, patient's expenditure, household information, persons accompanied the patient to hospital. The second part was cost analysis including four parts i.e., the total cost, capital cost, labor cost and material cost of TB screening

4.1 Patients information

4.1.1 General characteristic

As can be seen in table 1, of all 50 patients, there were 56% of male, and 46% female.

Regarding marital status, 76% were married, 20% single, 2% divorced. Mean age of the samples was 45 years old. There were 28% of patients aged 60 years and above, and there were 22%, 18%, 18%, and 14% were among 20-29, 30-39, 40-49, 50-59, age group respectively. Minimum age was 20 and maximum of age was 75 years old.

In relation to education, there were 30% of the samples finished primary education, 36% completed secondary school, and 24% were graduated higher education. It was noteworthy that there were 10% of samples were no schooling. With reference to occupation, 32% were labor, 18% trading, 12% government officials or state enterprises, and 8% were farmers.

Regarding economic status, average income of the samples was 1,624,000 LAK. There were 40% reported their monthly income were lower than 1,000,000 LAK. Maximum monthly income was 6,000,000 LAK.

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Table 4.1 General Characteristic

1 US$ = 8,451 LAK

General Characteristics	Number	Percent
Total	50	
Gender		
Male	28	56%
Female	22	44%
Marital Status		
single	10	20%
married	38	76%
divorced	2	4%
Age		
20-29	11	22%
30-39	9	18%
40-49	9	18%
50-59	7	14%
more than 60	14	28%
Mean±S.D. =45±16, Min-Max= 20-75		
Education		
not attended/illiterate	5	10%
primary	15	30%
secondary	18	36%
graduate/certificate	12	24%
Occupational		
government official or enterprise	6	12%
labor	16	32%
agriculture	4	8%
commerce	9	18%
others	15	30%
Income per month (LAK)		
less than 1000,000	20	40%
1,000,000-1,999,999	9	18%
2,00,000-2,999,999	9	18%
3,000,000-3,999,999	9	18%
more than 3,999,999	3	6%
Mean±S.D. =1,624,000±1,380,744, Min-Max= 0-6,000,000		

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4.1.2. Background information of samples prior to their visited to TB clinic.

Table 2 shown numbers of visit to hospital prior to being diagnosed as TB patient. More than half (58%) of all samples went to hospital twice, where as one patient went to hospital 4 times. Half of the samples reported they spent time for traveling to and waiting for the hospital services les then one hour, 36% approximately one hour and there were 14% (7 cases) reported more than two hours. There were 48% reported that they went to the hospital by private car, 10% went by bus and it was interestedly that there was one case went to hospital by ambulance. Majority of our samples indicated that they received X-rays services.

Prior to being diagnosis as TB patient, different medical checkup procedures were undertaken, i.e., 40% got an Electrocardiogram checkup, 76% got X-rays once, 12% got X-rays twice times, 4% got X-rays three times, 56% got Echo once times, and 58% got other checkup twice times.

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Table 4.2 Information of patient before diagnosis TB

1 US$ = 8,451 LAK

Information of patient before diagnosis TB		Number	Percent
Times to go to hospital	One times	13	26%
	Two times	29	58%
	Three times	7	14%
	Four times	1	2%
Patient spent time for traveling and wait in hospital			
	Less than one hours	25	50%
	One hour	18	36%
	More than two hours	7	14%
Patient go to hospital by			
	Cycle	1	2%
	Bus	10	20%
	Taxi	3	6%
	Private car	24	48%
	Motorbike	11	22%
	Ambulance	1	2%
Check up before diagnosis to TB			
	Electrocardiogram (Times)		
	1	20	40%
	2	1	2%
	X-ray (Times)		
	1	38	76%
	2	6	12%
	3	2	4%
	Echo (Times)		
	1	28	56%
	2	4	8%
	3	1	2%
	Others (Times)		
	1	13	26%
	2	29	58%
	3	4	8%

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4.1.3 Patient's expenditure

Average administration cost (not included cost of medicine) of the samples was 350,080 LAK, out of all samples, there were 30% paid more than 400,000 LAK while there were 10% paid less than 10,999 LAK.

The average of patient travelling cost was 33,720 LAK, STD was 25,061 LAK, the minimum of travelling cost is 0.00 LAK, and maximum was 100,000 LAK. 40% of the patients expense for traveling was more than 40,000, spent 10,000-19,999 (22%), 20,000-29,999(18%), 30,000-39,999 (14%), and less than 10,000 (6%).

The average of patient other cost was 79,520 LAK, STD was 123,216 LAK, the minimum of patients expenditure was 0.00 LAK, maximum cost was 300,000 LAK. Other expenses including car parking and cost for food, 72% spent less than 10,000 LAK, 20% spent between 100,000-199,999LAK and, 8% spent more than 199,999LAK.

Table 4.3 Patient's Expenditure

1 US$ = 8,451 LAK

Patient's Expenditure	Number	Percent
Patient Admin Cost (pay for checkup such as: X-ray, Echo, but exclude medicine)		
less than 100,000	5	10%
100,000-199,999	7	14%
200,000-299,999	12	24%
300,000-399,999	11	22%
more than 399,999	15	30%
Mean±S.D. =350.080±300.000, Min-Max= 0-1.000.000		
Patient traveling cost		
Less than 10,000	3	6%
10,000-19,999	11	22%
20,000-29,999	9	18%
30,000-39,999	7	14%
more than 39,999	20	40%
Mean±S.D. =33,720±25,061, Min-Max= 0-100,000		
Patient other cost (for food, drink, car parking)		
less than 100,000	36	72%
100,000-199,999	10	20%
more than 199,999	4	8%
Mean±S.D. =79,520±123,216, Min-Max= 0-300,000		

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4.1.4 Household information

The table 4 shows household information include educational level of major income earners and other characteristics of the household head. As can be seen, 30% of major income earner completed higher education level. However, there were 4% or two of the major earners were illiterate. Regarding educational level of household head, three of them or 6% were illiterate whereas 64% completed secondary education or higher. Almost half or 46% of our samples themselves, were the major income earners. Interestingly, 26% of earning came from family members.

Head of household education are secondary 40%, primary 30%, graduate/certificate 24%, not attended or illiterate 6%.

Primary income in the household are patient 46%, extended family 26%, husband or father 22%, wife or mother 4%, son or daughter 2%.

The average of household income is 2,615,000LAK, the minimum of household income are 300,000 LAK, and maximum is 8,000,000 LAK. Level of household income were 2,000,000-2,999,999 LAK (28%), 3,000,000-3,999,999 LAK (26%), 1,000,000-1,999,999 LAK (18%), more than 4,000,000 LAK (16%), less than 999,999 (12%).

Ref. code: 25606017090157EBY

Table 4.4 Household Information

1 US$ = 8,451 LAK

Household information	Number	Percent
Education of major income earner		
Not attended/illiterate	2	4%
primary	14	28%
secondary	19	38%
graduate/certificate	15	30%
Head of household education		
Not attended/illiterate	3	6%
primary	15	30%
secondary	20	40%
graduate/certificate	12	24%
Source of household income		
Patient	23	46%
Wife/mother	2	4%
Husband/father	11	22%
Extended family	13	26%
Son/daughter	1	2%
Estimated household income		
less than 1,000,000	6	12%
1,000,000-1,999,999	9	18%
2,000,000-2,999,999	14	28%
3,000,000-3,999,999	13	26%
more than 3,999,999	8	16%
Mean±S.D. =2,615,000±1,576,946, Min-Max= 300,000-8,000,000		

4.1.5 Persons accompanied the patient to hospital information

Table 5 showed persons accompanied the patient to hospital revealed the following; partner or spouse 32%, relative 32%, other 23%, parents 13%.

Their occupational were 39%, labor seller 29%, government official or enterprise 19%, others 10%, agriculture 3%. Means of transportation, more than half of the samples went to hospital by private car 58%, 16%, went by bus 13%, by motorbike

The average income of accompanying person for visiting hospital was 1,329,000 LAK, the minimum was 0.00 LAK, and maximum was 7,000,000 LAK.

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Their income ranged from 1,000,000-1,999,999 (35%), 2,000,000-2,999,999(23%), 3,000,000-3,999,999(16%), less than 1,000,000 (16%), and more than 3,999,999(10%).

The average expenditure of the accompanying person for visiting hospital was 79,000 LAK, the minimum of expenditure are 0.00 LAK, and maximum is 750,000 LAK. Their expenditure less than 100,000 (55%), 100,000-199,999(32%), 200,000-299,999(6%), 300,000-399,999(6%).

Ref. code: 25606017090157EBY

Table 4.5 Background information of accompanying person to hospital.

1 US$ = 8.451 LAK

Background information of accompanying person to hospital	Number	Percent
Total	31	
Accompanying person		
Parents		13%
Partner/spouse		32%
relative		32%
Other		23%
Occupational		
government official/enterprise	6	19%
labor	12	39%
agriculture	1	3%
commerce	9	29%
others	3	10%
Time use		
30 minutes	6	19%
One hours	16	52%
more than one hours	9	29%
Accompanying person go to hospital by		
Bicycle	1	3%
Bus	5	16%
Taxi	2	6%
Private car	18	58%
Motorbike	4	13%
Ambulance	1	3%
Accompanying person income		
less than 100,000	5	16%
1,000,000-1,999,999	11	35%
2,000,000-2,999,999	7	23%
3,000,000-3,999,999	5	16%
more than 3,999,999	3	10%
Mean±S.D. =1,329,000±1,633,204, Min-Max= 0-7,000,000		
Expense of a accompanying person		
Less than 100,000	17	55%
100,000-199,999	10	32%
200,000-299,999	2	6%
300,000-399,999	2	6%
Mean±S.D. =79,000±150,037, Min-Max= 0-750,000		

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4.2 Cost analysis

4.2.1 Proportion of Gene X-pert use in detecting TB.

The framework of cost analysis including eight perspectives of National Reference Laboratory (NRL) services, i.e., microscopy, Gene X-pert, culture, reporting, reception, laboratory quality management system, bio safety, and drug susceptibility testing. However our study on cost analysis of NRL services focused on the use of GeneXpert as table 6 showed that GeneXpert hold 0.18 of all perspectives of cost analysis for TB screening.

Estimate the proportion of screening TB by GeneXpert. The proportion was 0.18.

Table 4.6 Finding proportion of Gene X-pert

Detail	Number of patients	Proportion
Detecting TB by Microscopy	27	0.01
Detecting TB by Gene Expert	420	0.18
Culture	31	0.01
Report	478	0.20
Receptionist	478	0.20
Laboratory Quality Management System	478	0.20
Bio safety	478	0.20
Drug Susceptibility Testing	0	0.00
Total=	2,390	1

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4.2.2 Capital Cost

The capital cost for National Reference Laboratory (NRL) for GeneXpert service came from the depreciation of building and equipment calculated with reference to monthly costing as presented in table 7 and 8. The building cost for GeneXpert service was 2,568,800 LAK per month, the equipment cost for GeneXpert was 2,477,799 LAK per month. The total unit cost of capital cost was 26,887 LAK as showed in table 9.

Table 4.7 Building cost per month (LAK)

1 US$ = 8,451 LAK

Detail	Cost	Estimated Useful life (month)	Total cost per month	Proportion	Total cost of Gene Xpert use
1	2	3	4=2/3	5	6 =4 x 5
Building cost(build in 2005 and renovate 2008)	3,508,247,500	240	14,617,698	0.18	2,568,800
				Total building cost=	**2,568,800**

Ref. code: 25606017090157EBY

Table 4.8 Equipment cost per month

1 US$ = 8,451 LAK

Detail	Purchasing price (LAK)	Date of buying	Estimated Useful life	Total cost per month	Proportion of Gene Xpert use	Total cost of Gene X-pert use per month
1	2	3	4	5=2/4	6	7=5*6
Communication group						
Computer	4,740,875	27/12/2012	over 60 months	-	0.18	-
Printer	2,473,500	18/8/2009	over 60 months	-	0.18	-
Printer	2,473,500	27/12/2012	over 60 months	-	0.18	-
Telephone	469,965	28/4/2010	over 60 months	-	0.18	-
Table	2,720,850	7/1/2009	over 60 months	-	0.18	-
Table	2,720,850	7/1/2009	over 60 months	-	0.18	-
Autoclave	16,490,000	4/8/2009	over 60 months	-	0.18	-
UPS	618,375	27/12/2012	over 60 months	-	0.18	-
UPS	426,679	2/10/2014	60	7,111	0.18	1,280
Water Pump	1,582,380	22/8/2012	over 60 months	-	0.18	-
Computer	7,082,455	1/7/2009	over 60 months	-	0.18	-
Computer	4,740,875	12/27/2012	over 60 months	-	0.18	-
Computer	6,571,925	1/8/2016	60	109,532	0.18	19,248
Locker	3,417,305	6/26/2013	60	56,955	0.18	10,252
Refrigerator	7,626,625	15/6/2009	over 60 months	-	0.18	-
Gene Xpert room						
Table	2,720,850	4/8/2009	over 60 months	-	1	-
Table	2,720,850	4/8/2009	over 60 months	-	1	-
Module	2,550,000	2/10/2015	60	42,500	1	42,500
Gene Expert	144,287,500	2/10/2015	60	2,404,792	1	2,404,792
			Total cost of equipment per month=			**2,477,799**

Ref. code: 25606017090157EBY

Table 4.9 Total unit cost of Capital cost

1 US$ = 8,451 LAK

Items	Building cost	Equipment cost	Number of patient	Total Unit cost of capital cost
1	2	3	4	5=(2+3)/4
Unit cost of Capital cost	2,568,800	2,477,799	420	26,887

4.2.3 Material Cost

Material cost for GeneXpert service came from direct and indirect items use of GeneXpert. The unit cost of material was 105,652 LAK.

Table 4.10 Utility cost for Gene Xpert service

1 US$ = 8,451 LAK

Detail	Total cost in Mahosot hospital	Total cost in NRL	Proportion	Total cost for Gene Xpert service
1	2	3	4	5 = 3 x 4
Electricity	279,507,245	3,030,801	0.18	532,609
Water	36,966,512	400,842	0.18	70,441
Telephone	1,894,250	20,540	0.18	3,610
			Total of Utility cost=	**606,660**

$$\text{Total cost in NRL} = \frac{(\text{Total cost in Mahosot hospital x number of staff in NRL})}{\text{Number all of staff in Mahosot}}$$

Ref. code: 25606017090157EBY

Table 4.11 Unit cost of utility

1 US$ = 8,451 LAK

Items	Utility cost	Number of patient	Total Unit cost of utility cost
1	2	3	4=2/3
Total of Utility cost	606,660	420	1,444

Finding the number of patients per day

Some material will use once time but not for one patient such as mask, gloves, shoes cover bag, arms cover bag, cuffed gown, so we estimated of these cost by using number patients in April 2018 divide by 20 of work days.

$$\text{Estimate patient per day} = \frac{420}{20} = 21$$

Table 4.12 Total unit cost of patient use.

1 US$ = 8,451 LAK

Detail	cost per unit	number patient per day	Total unit cost of patient use
1	2	3	4=2/3
Mask N95	8,500	21	405
Cap	5,000	21	238
Shoes cover bag	3,000	21	143
Arm cover bag	3,000	21	143
Cuffed gowns	10,000	21	476

Ref. code: 25606017090157EBY

Table 4.13 Material Cost for Gene Xpert service. 1 US$ = 8,451 LAK

Items	cost per unit	Proportion of Gene Xpert use	Amount
1	2	3	4=2 x 3
Laboratory prescription	300	1	300
Sputum plastic container	3,000	1	3,000
Sputum plastic container bag	3,000	1	3,000
Disposable gloves	800	1	800
Alcohol 70%	10,000	0.18	1,757
Plastic waste bag	150	0.18	26
Plastic infectious waste bad (small size)	150	0.18	26
Plastic infectious waste bad (large size)	150	0.18	26
Antiseptic hand wash agent	22,000	0.18	3,866
Mask N95	405	1	405
Cap	238	1	238
Shoes cover bag	143	1	143
Arm cover bag	143	1	143
Cuffed gowns	476	1	476
Cartridge	90,000	1	90,000
Total of Utility cost	1,444		1,444
	Total unit cost of Material Cost (LAK)=		**105,652**

4.2.4 Labor Cost

The labor cost analysis was shown in table 14. This information came mainly from financial report for April 2018. There are cost from basic salaries, allowances based on designation, allowances for public servicing years, allowances based on specializing, allowances for hard working and risky environment, family allowances. The total labor cost of GeneXpert service was 2,966,170 LAK.

The table 15 was shown the unit cost of labor cost for GeneXpert service, the cost was 7,062 LAK.

Ref. code: 25606017090157EBY

Table 4.14 Labor cost for GeneXpert service

1 US$ = 8,451 LAK

Name	Basic salaries	Allowances based on designation	Allowances for public servicing years	Allowances based on specializing	Allowances for hard work and risky environment	Family allowances	Total of salary in April/2018	Share (%)	Total labor cost of Gene Xpert
1	2	3	4	5	6	7	8=2+3+4+5+6+7	9	10=8 x 9
A	2,008,800	98,000	177,500	35,280	15,200		2,334,780	0.18	420,260
B	1,944,000	58,800	27,500	35,280	15,200		2,080,780	0.18	374,540
C	2,008,800	0	92,500	35,280	15,200		2,151,780	0.18	387,320
D	1,677,600	0	12,500	0	15,200	37,240	1,742,540	0.18	313,657
E	1,728,000	0	100,000	35,280	15,200	66,640	1,945,120	0.18	350,122
F	1,627,200	0	92,500	35,280	15,200	103,880	1,874,060	0.18	337,331
G	1,440,000	0	32,500	35,280	15,200		1,522,980	0.18	274,136
H	1,404,000	0	17,500	35,280	15,200		1,471,980	0.18	264,956
I	1,332,000	0	7,500	0	15,200		1,354,700	0.18	243,846
								Total=	**2,966,170**

Table 4.15 Unit cost of labor cost for Gene Xpert service

1 US$ = 8,451 LAK

Items	Total labor cost of Gene Xpert service	Number of patients	Unit cost of Labor cost
1	2	3	4=2/3
Unit cost of Labor cost	2,966,170	420	7,062
	Total Unit cost of Labor cost =		**7,062**

Ref. code: 25606017090157EBY

4.3. Total cost of Gene Xpert service.

Table 16 was shown total unit cost of Gene Xpert service including total Unit cost of Labor cost, total unit cost of Material Cost, and total unit cost of Capital cost. The total unit cost of TB screening by Gene Xpert service in Mahosot hospital was 139,601 LAK. We found total unit cost of material cost was 79%, capital cost 17% and labor cost was 4%. Table 17 was shown total cost of TB screening by Gene Xpert service in April 2018. The total cost was 58,632,619 LAK.

Table 4.16 Total percent and unit cost of Gene Xpert service. 1 US$ = 8,451 LAK

Items	Unit cost of Gene Xpert service	Percentage of Unit cost
Total Unit cost of Labor cost	7,062	4%
Total unit cost of Material Cost	105,652	79%
Total unit cost of Capital cost	26,887	17%
Total =	**139,601**	**100%**

Table 4.17 Total cost of Gene Xpert service in April 2018. 1 US$ = 8,451 LAK

Items	Total unit cost of Gene Xpert service	Number of patients	Total unit cost of Gene Xpert service
1	2	3	4=2 x 3
Total unit cost of Gene Xpert service	139,601	420	58,632,619
	Total unit cost of Gene Xpert service =		**58,632,619**

Ref. code: 25606017090157EBY

4.4 Discussion

This study had two part. The first part was patient's information and the second part was cost analysis of TB screening by Gene Xpert in Mahosot hospital.

Part 1 Patients

The first part was patients' information, we were collected data in April 2018, and the patients were interviewed 50 patients. We can found, the most of the patients were man 56%, their age marital status were married 76%, their age were more over 60 years old 28%, their occupational were labor 32%, their income were 40% less than 999,999 LAK. There were 58% of patients had go to hospital at least twice times, maximum was 4 times before diagnose tuberculosis, and the patients had to took at least one times for X-ray 76%, Echo was 56%, Electrocardiogram checkup 40% and other 26%. The patients' expenditure were included administration cost (X-ray, Echo, an Electrocardiogram checkup and other cost) more than 399,9999 LAK (30%), traveling cost was more than 39,999 LAK (40%), other cost was less than 100,000 LAK (72%).

In the first national tuberculosis prevalence survey of Lao PDR (2010–2011) was to measure the prevalence of bacteriologically confirmed pulmonary tuberculosis (TB) in Lao PDR in 2010–2011. The prevalence of TB in Lao PDR is almost twice as high than previous estimates, with the greatest burden in the older population. Case detection efforts remain the primary goal of the national TB programmed with case notifications being very low in comparison with the estimated number of prevalent cases(24).

From the information above that we can see the first national tuberculosis prevalence survey of Lao PDR (2010–2011) was to measure the prevalence of bacteriologically confirmed pulmonary tuberculosis (TB) in Lao PDR in 2010–2011. The prevalence of TB was increase than estimate, and the greatest burden in the older population. And for our research the highest percentage of TB screening is older people too. All of samples in this study more than half had went to hospital two times and, they had to take X-ray, Electronic, and Echo before screening TB. Who were diagnose TB were labor. If they were positive TB that mean they will expose to other people were

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near them. If suspect patients' symptom had to take X-ray, Echo, Electronic, should take TB screening at the first time they came to hospital, because if they positive TB , they will have early treatment and protect to exposure to other people, can reduce their expenditure and their time to came to hospital. Hospitals should improve quality of health care to meet the needs of its citizens. If delay diagnosis TB that mean the TB patient still increase the incident and prevalence.

Part 2 Cost analysis

Cost analysis in this study focus on unit cost of GeneXpert, we found unit cost of labor cost was 7,062 LAK (4%), material cost was 105,652 LAK (79%), and capital cost was 26,887 LAK (17%). The total cost of unit cost TB screening was 139,601 LAK. We found the highest cost was material cost 79% of unit cost for TB screening in NRL Lao PDR. Almost items in the material cost was use only one times. The total cost of TB screening by Gene X-pert in April 2018 was 58,632,619 LAK.

For the previous study different from our study. We found the highest cost of unit cost in of Puainoi hospital, khon kean province, Thailand and Rongkwang hospital, Phrae province, Thailand were labor cost. The labor cost of Puainoi hospital, khon kean province was 61% and labor cost of Rongkwang hospital, Phrae province was 36.86%. But our study the highest cost was material cost. In Lao PDR import all of material that make the material cost was high.

Tuberculosis screening is free program support by Global Fund (GF), in the next several year the GF will not support the budget to this program that mean they will use government budget. You can reduce the budget for TB screening by spending on preventive care should be increased to improve population health and increase efficiency by reducing spending on more expensive curative care services in hospitals.

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CHAPTER 5
CONCLUSION AND RECOMANDATION

5.1 Conclusion

This study was a descriptive study, using the secondary and primary data by focus on patient who screening TB by Gene X-pert and provider. The objective of this study calculate the direct and indirect costs of tuberculosis screening by Gene X-pert in Mahosot hospital, Lao PDR. The result of this study useful for Mahosot hospital to making decisions for efficiency healthcare service design and cost reduction measures in the future.

After study we found 50 patients, there were 56% of male, 76% were married. There were 28% of patients aged 60 years and above, 36% completed secondary school. Regarding economic status, average income of the samples was 1,624,000 LAK. More than half (58%) of all samples went to hospital twice. Prior to being diagnosis as TB patient, 76% got X-rays once, 12% got X-rays twice times, 4% got X-rays three times, 56% got Echo once times, and 58% got other checkup twice times. The average of patient travelling cost was 33,720 LAK, patient other cost was 79,520 LAK and administration cost (not included cost of medicine) of the samples was 350,080 LAK. Primary income in the household are patient 46%.The average of household income is 2,615,000LAK.

There were 31 patients who has persons accompanied the patient to hospital revealed the following; partner or spouse 32%, relative 32%, other 23%, parents 13%. Their occupational were 39% labor. The average income of accompanying person for visiting hospital was 1,329,000 LAK. The average expenditure of the accompanying person for visiting hospital was 79,000 LAK.

According to the result in chapter 4, this study founded the total unit cost of TB screening by Gene X-pert service in NRL was 139,601 LAK. We found total unit cost of material cost was 105,652LAK, capital cost 26,887 LAK and labor cost was 7,062 LAK. The highest cost of this study was material cost, the capital cost was the second and labor cost was the third. Reason, material cost might do to highest cost of screening TB by Gene Xpert, because some items were not reusable.

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5.2 Limitation of the study

Since this study conducted under the timeframe constraint, some data and information were not available as per needed, especially for capital items; some assumption were made for data collection and analysis. There was not much information system record all major equipment. Many assumptions had been applied in order to calculate cost, such as some capital costs and labor cost.

This the first formal study about economic cost TB screening by Gene X-pert in Mahosot hospital Lao PDR since there is no other study regarding the cost analysis of TB screening by Gene X-pert in Mahosot hospital Lao PDR in order to compare the result.

5.3 Recommendation

Economic cost is useful for hospital to improve quality of service, they should have strengthening recording system in the hospital, to improve quality of service because there are patients who got X-ray three times. That mean they had to gone to hospital three times.

Cost analysis is useful for national reference laboratory lab should perform their own cost analysis in order to manage and improve the quality and efficiency of laboratory tests and cost reduction.

5.4 Further study

For the further study, the productivity loss due to screening TB should be calculate because it is the hidden cost of patient due to absence work.

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APPENDIXS

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APPENDIX A
QUESTIONIAR

Questionnaire Number:……

Patients register Number:…….

Date of Interview	Name Village	Name of District	Name of Province	Interviewer Name

1. Gender	( ) male[1] ( ) female[2]
2. Age of patient……year.	
3. Marital status	( ) single[1] ( ) married[2] ( ) Divoced[3] ( ) separated[4]

Introduction to the patient:

This research is interested in the costs that people face when they are seeking health care. Therefore, we would like to inquire how much people spend associate with Tuberculosis screening.

It is important for you to understand that your participation in this study is completely voluntary. We would be really grateful if you would agree to participate in this study, but do feel free to refuse. If you refuse, there will be no consequence for you and you will receive whatever care and treatment you need at the health facility as usual. If you decline to participate you will not lose any benefit that you are entitled to such as receiving care and support that is provided at the hospital.

If you choose to participate in this study you need to know that you may withdraw from the study at any stage without giving any explanation for your withdrawal. Your answers will be kept confidential. At some point I will ask you about your personal income and the income of your household. We will NOT provide this

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information to any tax or welfare authorities, also not after the end of the study. This survey will take 5 to 10 minutes.

Do you have any questions? Do you want to participate? (circle) **Yes / No**

1. *Yes:* Thank you!

2. *No(reason)*

   ( ) Language not good enough ( ) Time constraint

   ( ) Not comfortable ( ) Unspecified

I. *Socioeconomic Information Individual Situation and Income*. Please Tick (✓) most appropriate.

1. Patient's Occupation

( ) government official/enterprise[1] ( ) labour[2] ( ) agriculture[3]

( ) commerce[4] ( ) other[5](specify)……....

2. **Who is the primary income in the household?**

( ) Patient. ( ) Wife/mother ( ) Husband/father

( ) Son/daughter ( ) Other (specify)……

3. **What is the highest level of education of** ...?

   a. ***The patient*?**

   ( ) Not attended/illiterate ( ) primary ( ) secondary

   ( ) graduate/certificate ( ) Other

   b. ***Primary income earner?***

   ( ) Not attended/illiterate ( ) primary ( ) secondary

   ( ) graduate/certificate ( ) Other

   c. Head of household?

   ( ) Not attended/illiterate ( ) primary ( ) secondary

   ( ) graduate/certificate ( ) Other

   d. ***Spouse of head of household?*** *If more than one spouse, choose highest level of education*

   ( ) Not attended/illiterate ( ) primary ( ) secondary

   ( ) graduate/certificate ( ) Other

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4. **What was your estimated personal take home earning per month?** (includes welfare, disability, or other social support) Please write the cost in the box below:

Estimated personal take home earning per month ☐☐☐☐☐☐☐Kip

5. **Patient's income per month** ☐☐☐☐☐☐☐☐Kip

6. **How long have you stopped working/going to school/doing housework due to TB?..**……month……..days

7. **About how much did you spend for each of these visits before you were diagnosed with TB, including the visit when you actually received your diagnosis?**

	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5
Please write the number that best describes how you travelled from your home to the hospital. 1= Walk, 2=Cycle, 3=Bus, 4= Taxi, 5= Private car, 6= Motorbike, 7=Hospital car, 8=Ambulance, 9=Other	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
Total Time Spent per visit**(in hours, includes** travel time)					
Check up before diagnosis to TB	( ) Electrocardiogram ( ) X-Ray ( ) Echo ( ) Other	( ) Electrocardiogram ( ) X-Ray ( ) Echo ( ) Other	( ) Electrocardiogram ( ) X-Ray ( ) Echo ( ) Other	( ) Electrocardiogram ( ) X-Ray ( ) Echo ( ) Other	( ) Electrocardiogram ( ) X-Ray ( ) Echo ( ) Other
Administrative Costs (consultative, registration)					
Travel Costs (return total)					
Other Costs (total)					

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8. Did anyone come with you to the hospital? Please tick (✓) the appropriate answer.

( ) Yes (please continue with question 8.1).

( ) No (The end of question).

8.1. Information who are accompanied you to the hospital? About how much did they accompanied with you for each of these visits before you were diagnosed with TB, including the visit when you actually received your diagnosis?

	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5
Please write the number that best describes. Who accompanied you to the hospital? Please circle number. 1= Partner/spouse, 2= Child/children under 16 years, 3= relative, 4= Other (please specify)	**1** **2** **3** **4**	**1** **2** **3** **4**	**1** **2** **3** **4**	**1** **2** **3** **4**	**1** **2** **3** **4**
Their Occupational 1= government official/enterprise 2= labour 3= agriculture 4= commerce 5= other[5].....	**1** **2** **3** **4** **5**	**1** **2** **3** **4** **5**	**1** **2** **3** **4** **5**	**1** **2** **3** **4** **5**	**1** **2** **3** **4** **5**
Their Income Please write income in the box. 1= Partner/spouse, 2= Child/children under 16 years. 3= relative. 4= Other.	1……..…… 2…..…… 3……..…… 4…….....	1……..…… 2……..…… 3……..…… 4…….....	1……..… 2……..… 3……..… 4…….....	1……..…… 2……..…… 3……..…… 4…….....	1……..… 2……..… 3……..… 4…….....

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	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5
Please write the number that best describes how their travelled from their home to the hospital. 1= Walk, 2=Cycle, 3=Bus, 4= Taxi, 5= Private car, 6= Motorbike, 7=Hospital car, 8=Ambulance, 9=Other	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9
Total Time spent per visit (in hours, includes travel time) 1= Partner/spouse, 2= Child/children under 16 years. 3= relative. 4= Other.	1……..… 2……..… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….
Travel Costs (return total) 1= Partner/spouse, 2= Child/children under 16 years. 3= relative. 4= Other.	1……..… 2…..…… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….
Other Costs 1= Partner/spouse, 2= Child/children under 16 years. 3= relative. 4= Other.	1……..… 2……..… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….	1……..…… 2……..…… 3……..…… 4……..	1……..… 2……..… 3……..… 4…….

Ref. code: 25606017090157EBY

APPENDIX B

DATA COLLECTION FORM FOR LABOR COST

Date of collection……. Data collector……

No.	Code	Salary	Over Time	Total Salary

Ref. code: 25606017090157EBY

APPENDIX C
DATA COLLECTION FORM FOR MATERIAL COST

Date of collection……. Data collector……

No.	Code	Detail	Cost per Unit buying	Unit

Ref. code: 25606017090157EBY

APPENDIX D

DATA COLLECTION FORM FOR CAPITAL COST

Date of collection……. Data collector……

No.	Code	Detail	Received date	Cost per Unit	Useful life	Depreciation

Ref. code: 25606017090157EBY

APPENDIX E

ETHICAL CONSIDERATION

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity
===== 000 =====

Ministry of Health
National Ethics Committee
for Health Research (NECHR)

No 050 /NECHR
Vientiane Capital 26/ 3/ 2018

Approval Notice

Ms.Sengmontha OUPENGVONG
Email: sengmonthaopv@hotmail.com
Tel: +856 20 99777811

RE: Ethical Approval for Health Research

Title: **"Economic cost analysis tuberculosis screening at Mahosot Hospital, Lao PDR" (Submission ID: 2018.58.Vie)**

Dear Ms.Sengmontha OUPENGVONG,

The National Ethics Committee for Health Research of the Lao People's Democratic Republic have reviewed and approved your research.

Please note the following information about your approved research protocol:

Approval period: March 2018 – March 2019
Approved Subject Enrollment: Partients who is screening with Gene X-pert in April 2018. According Exclude criteria, Mahosot Hospital.
Sponsor: ADB
Implementing Panel/Project Investigator: Ms.Sengmontha OUPENGVONG

Please note that the Ethics Committee reserves the right to ask for further questions, seek additional or monitor the conduct of your research and consent process.

Principle Investigator is required to notify the Secretary of the National Ethic Committee for Health Research:

- **Any significant change to the project and the reason for that change, including an indication of ethical implications (if any);**
- **Serious adverse effects on participants and the action taken to address those effects;**
- **Any other unforeseen events or unexpected developments that merit notification;**
- **The inability of the Principal Investigator to continue in that role, or any other change in research personnel involved in the project;**
- **Any expiry of the insurance coverage provided with respect to sponsored clinical trials and proof of re-insurance;**
- **A delay of more than 12 months in the commencement of the project; and,**
- **Termination or closure of the project.**

Additionally, the Principal Investigator is required to submit a progress report on the anniversary of approval and on completion of the project.

President of National Ethics Committee for Health Research

Prof.Dr. Douangdao SOUKALOUN

Ref. code: 25606017090157EBY

BIOGRAPHY

Name	Miss Sengmontha Oupengvong
Date of Birth	March 22, 1989
Educational Attainment	2005 – 2010: Bachelor of Finance-Banking
Work Position	Technical staff
Work Experiences	Work in Health financing policy division, Department of finance. I am in team of National Health Account, Ministry of Health LAO PDR.

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