WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 12, Issue 7, 795-822. Research Article ISSN 2277– 7105

A RETROSPECTIVE ANALYSIS OF PHARMACOECONOMIC OF MANAGEMENT OF PATIENTS OF TUBERCULOSIS AT NODAL CENTRE OF ANANTA INSTITUTE OF MEDICAL SCIENCES AND RESEARCH CENTRE, RAJSAMAND, RAJASTHAN ALONG WITH THE OVERALL ECONOMIC BURDEN ON GOVERNMENT

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Article Received on
14 March 2023,

Revised on 02 April 2023,
Accepted on 23 April 2023

DOI: 10.20959/wjpr20237-27995

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ABSTRACT

Mycobacterium tuberculosis, an Acid-Fast Bacillus, is the causative agent of TB, a chronic granulomatous infectious illness. Intestines, meninges, bones and joints, lymph nodes, skin, eyes, reproductive tract, and other organs may be impacted by extra-pulmonary TB. The typical methods used to diagnose TB include sputum analysis, X-rays, CBNAAT, bronchoscopy, sonography, CT scans, etc. The Directly Observed Treatment Short-Course (DOTS) philosophy and the WHO's global TB control plan are both incorporated into the RNTCP (Revised National Tuberculosis Control Programme). It was changed to the NTEP (National Tuberculosis Elimination Programme) in 2020. With a strategy focus on "Prevent, Detect, Treat and Build" for social protection and universal coverage, this programme aims to create a "TB free India." The NTEP has established the "NIKSHAY" site (Ni = End, Kshay = TB). TB elimination, thus. In addition to the National Informatics Centre (NIC) and the WHO national office of India, it is created and maintained by the Central TB Division (CTD), Ministry of Health and Family Welfare. It serves as the country's national TB monitoring system and makes it possible to send all patient data to the Indian government. Along with malnutrition, poor socioeconomic level and living circumstances are regarded as significant risk factors associated with latent tuberculosis infection. The most widely used vaccination against TB is called BCG. The prevalence of latent TB is likewise growing as the population ages. In India, inadequate

primary healthcare facilities in rural parts of several states, unregulated private healthcare, a lack of political will, and corrupt administration are key obstacles to TB management. By 2050, TB as a public health issue will be eradicated from the planet, according to WHO's **"STOP TB"** policy. The government should launch an instructional series on TB similar to **"Mann Ki Baat"** by the "Prime Minister of India," as one reply suggested. A pharmacoeconomic research assesses a pharmaceutical product's cost (represented in monetary terms) and effects (expressed in monetary terms of effectiveness or improved quality of life). Pharmacoeconomic studies help to determine the most efficient and scientifically sound way to allocate healthcare resources. Pharmaceutical economic evaluation is the focus of pharmacoeconomics, which may include **cost-minimization, cost-benefit, cost-effectiveness, or cost-utility analysis.** There are ten steps in a well-designed pharmacoeconomic analysis: identifying the issue, selecting the study's viewpoint, determining the options, and determining the results (4) choosing the best pharmacoeconomic approach, and (5) assigning monetary values to results (6) Finding study resources, and (7) Calculating the Likelihood of the Results Applying decision analysis, at (8) presenting the findings together with any research limitations and (9) discounting costs or carrying out a sensitivity or additional cost analysis. Connect families and TB patients to the relevant government social programs, and then exploit the government's emphasis on digital payments to send rewards and incentives straight to the patient's bank account. To revolutionize TB control and accomplish the national aim of eliminating TB as a significant public health concern by 2025, an estimated budget of 16649 crores would be needed during the next three years. Additionally, it has a method for coordinating the extension of the program's medicine supply through creative private sector techniques for 2.2 million TB patients. Support for 9 million TB patient culture tests and post-TB therapy monitoring. Additionally, it involves the development of contact centers with the capacity to help all TB patients for ten million minutes, SMS reminders to 4.5 million TB patients, and the distribution of 50,000 PDA devices for digitization.

KEYWORDS: Tuberculosis, RNTCP, NIKSHAY, Cost-minimization, Cost-benefit, Cost-effectiveness, Cost-utility analysis and Pharmacoeconomics.

INTRODUCTION

Mycobacterium tuberculosis, an Acid-Fast Bacillus, is the causative agent of TB, a chronic granulomatous infectious illness. While TB may infect any organ or tissue, pulmonary

tuberculosis is the most prevalent kind. Intestines, meninges, bones and joints, lymph nodes, skin, eyes, reproductive tract, and other organs may be impacted by extra-pulmonary TB. When a person who has an active lung infection coughs or sneezes and inhales the contaminated droplets, the sickness is transmitted.

Treatment for TB comes with a number of significant issues. First off, the lengthy duration and intricacy of the therapy encourage non-compliance, which results in failure or relapse and, more worrisomely, the establishment of drug resistance. Second, frequent side effects from anti-tubercular medications exacerbate the issue of non-adherence.

The main causes of tuberculosis persistence in developing nations are low socioeconomic status, unhygienic living conditions, ignorance, and a careless attitude. Additionally, TB as an opportunistic infection has increased globally due to HIV, Diabetes, other immunocompromised states, and use of large amounts of immunosuppressants.

One of the unfavourable outcomes for patients on the DOTS programme is defaulters to treatment, which continues to be a significant barrier for control programmes.

The symptoms of pulmonary TB might include fever, anorexia, weight loss, coughing, and other symptoms. Though less frequent, extra-pulmonary or EPTB can affect any organ or tissue. It could potentially spread, resulting in miliary TB. One of the unfavourable outcomes for patients on the DOTS programme is defaulters to treatment, which continues to be a significant barrier for control programmes.

The symptoms of pulmonary TB might include fever, anorexia, weight loss, coughing, and other symptoms. Though less frequent, extra-pulmonary or EPTB can affect any organ or tissue. It could potentially spread, resulting in miliary TB.

The typical methods used to diagnose TB include sputum analysis, X-rays, CBNAAT, bronchoscopy, sonography, CT scans, etc.

A two-month intense phase is followed by a four-month continuous phase in the typical treatment plan.

Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol are the four medications used in the intense phase, and they are all administered in one early morning dose. Pyrazinamide is not

used in the continuous phase since it no longer provides benefits after two months. The length of treatment for extra-pulmonary TB varies by case and is often longer.

Immunocompromised people who have TB require longer treatment courses and additional medications, particularly in those who are HIV positive as it may be an opportunistic infection.

Drug resistance is the issue the world is now experiencing. When there is resistance to both isoniazid and rifampicin, the condition is known as multidrug resistance (MDR-TB). Extended Resistance is the term used when there is resistance to Isoniazid, Rifampicin, and any two more medications from the second line reserve group (XDR-TB). These two types of TB have significantly contributed to treatment failure and the difficulties in containing or eliminating the illness.

To curb this disease our country has initiated several programmes over the years.

The Directly Observed Treatment Short-Course (DOTS) philosophy and the WHO's global TB control plan are both incorporated into the RNTCP (Revised National Tuberculosis Control Programme). With assistance from the World Bank and other development partners, this was started in 1997.

It was changed to NTEP in 2020. (National Tuberculosis Elimination Program).

With a strategic focus on "Prevent, Detect, Treat and Build" for social protection and universal coverage, this initiative aims to create a "TB free India." Via the public health care system, it offers a range of high-quality, no-cost TB diagnostic and treatment services across the nation.

The "NIKSHAY" site has been introduced as part of the NTEP, which stands for the elimination of tuberculosis (TB). It was created and is kept up by Central TB Division (CTD).

The "NIKSHAY" site has been introduced as part of the NTEP, which stands for the elimination of tuberculosis (TB). In addition to the National Informatics Centre (NIC) and the WHO national office of India, it is created and maintained by the Central TB Division (CTD), Ministry of Health and Family Welfare. It serves as the country's national TB monitoring system and makes it possible to send all patient data to the Indian government.

In underdeveloped nations, tuberculosis, a chronic granulomatous illness, is a serious health issue. A third of the world's population has TB, and 10- 15% of those people go on to acquire the illness. According to WHO figures for 2014, there were 9.6 million new cases of TB worldwide, with India accounting for the largest share with 2.2 million cases. Since many years, India has had the unpleasant reputation of having the greatest TB burden; every day, over 600 people in India pass away from TB. Thus, TB is the infectious illness that kills the most adults in India. Since 2012, the Indian government has recognised tuberculosis (TB) to be a condition that must be reported by any clinician who treats a TB patient.

In India, a national programme that offers free treatment to all TB sufferers covers the control and treatment of the disease. Launched in 1997, the Revised National Tuberculosis Control Program (RNTCP) has undergone many revisions, the most recent of which was in 2016.

Because of the development of HIV and the high prevalence of TB, a new component was introduced in the 1980s. There are a lot of HIV-positive people in India (an estimated 2.1 million were living with the virus in 2015), and they have a 10% annual chance of acquiring tuberculosis. Moreover, they are particularly susceptible to serious tubercular / MAC infections. Development of "multidrug resistance" (MDR) TB, which currently represents 3.3% of newly diagnosed cases and 20% of previously treated cases globally, is a significant obstacle to antitubercular treatment. According to a recent survey, MDR-TB affects 12–17% of patients who have already received treatment in India and around 3% of new cases.[1]

In the rapidly urbanising and industrialising nations of Europe and North America throughout the 18th and 19th centuries, TB grew to almost pandemic proportions. Up until the early 20th century, when better health and cleanliness led to a gradual drop in mortality rates, "consumption," as it was known at the time, was the primary cause of death in the western world for all age groups. Since the 1940s, antibiotic medications have made treatment last months rather than years, and drug therapy has eliminated the need for the ancient TB sanatoria where patients were formerly cared for for years as the illness was fought off by their bodies' natural defences. Nowadays, in less developed nations with dense populations and high hygiene standards poor, tuberculosis remains a major fatal disease.

The HIV/AIDS epidemic has increased the incidence of the illness; it is believed that one out of every four fatalities from TB include a person who is also HIV-positive. Also, the emergence of novel strains of the tubercle bacillus that are resistant to common medications

has hindered efforts to successfully eradicate TB as a significant hazard to public health worldwide. Certain types of infections are frequently challenging to treat, necessitating the use of combination medication regimens that, at times, include the use of five or more different medicines.[2]

TUBERCULOSIS TYPES

In contrast to other bacterial illnesses, tuberculosis (TB) typically exhibits delayed onset of symptoms. Even while symptoms don't appear until you're already ill.

progressively and is frequently mistaken for other diseases. The three phases of tuberculosis include primary TB infection, latent TB infection, and active TB illness. Although carrying latent TB germs, millions of people never experience active tuberculosis.

When exposed to Mycobacterium tuberculosis, around 30% of people will get TB, and if untreated, 5–10% of those people might eventually have active tuberculosis illness at some point in their lives. For those with HIV, the figure is far greater. Those who have recently contracted the virus are more prone to go into the active phase of the disease (in the past two years). Moreover, persons with compromised immune systems are more susceptible to experience it.[3]

Active tuberculosis that affects the lungs is known as pulmonary TB. It can be caught by inhaling air that has been breathed by a TB patient. The bacteria might linger in the air for a number of hours. A person with pulmonary TB may additionally have the following symptoms in addition to the standard TB symptoms: a chronic cough lasting three weeks or more, coughing up blood or phlegm, chest discomfort, weight loss, shortness of breath, etc.

The kind of tuberculosis known as extra-pulmonary TB affects the bones, organs, and other tissues of the body besides the lungs. The injured bodily portion determines how the symptoms manifest.

The most prevalent form of extra-pulmonary TB, TB lymphadenitis, affects the lymph nodes. The spread of skeletal or bone TB from the lungs to the bones lymph nodes, etc. Every bone, including the spine and joints, is susceptible.

A kind of tuberculosis known as miliary tuberculosis spreads throughout the body and affects one or more organs. The liver, bone marrow, and lungs are frequently impacted by this kind

of illness. Yet it can also spread to other organs including the heart, brain, and spinal cord. The second most prevalent kind of extra-pulmonary TB is genito-urinary TB. Although any region of the genitalia or urinary system may be affected, the kidneys are the most typical location. Less than 1% of all TB infections are caused by hepatic tuberculosis.[4]

With 43% more cases of TB than the global average, the WHO South-East Asia (SEA) Area is home to 26% of the world's population (WHO Global TB Report 2021). Around 4.3 million individuals are predicted to contract the illness in 2020, and 700,000 are predicted to pass away from it (excluding HIV+TB mortality). This is more than half of the 1.3 million total expected worldwide TB fatalities for the year. 85% of new and relapsed TB patients responded to treatment (2019 cohort). Bangladesh, Democratic People's Republic of Korea, India, Indonesia, Myanmar, and Thailand are six of the nations with the highest TB burdens in the world. Nepal replaces Thailand on the list of countries with the highest RR/MDR-TB burdens in the SEA region.[5]

First line drugs for treatment are Isonicotinic acid hydrazide (H), Rifampicin (R), Pyrazinamide (Z) and Ethambutol (E). Second line drugs are Fluoroquinolones (FQ-Levofloxacin: LFX and Moxifloxacin; MFX); Injectables eg. Amikacin (Am), Streptomycin (S), Capreomycin (Cm) Kanamycin (K), Ethionamide (Et), Cycloserine (C), Terizidone (Trd), Clofazimine (CFz) and Linezolid (Lzd). Third line drugs; kept in reserve are Bedaquiline (Bdq), Delamide (Dim), Imipenem plus Cilastatin (Ipm-Cln), Meropenem (Mpm), Thiacetazone (T), Paramino salicylic acid (PAS).

The second and third-line drugs are used for multidrug resistance (MDR) and extensively drug resistant (XDR) TB. A single drug should never be used to treat TB,as this leads to the rapid development of drug-resistant tubercle bacilli.[6]

Isoniazid (ideally given daily or twice weekly for 9 months), Rifampin (daily for 4 months), or Isoniazid plus Rifapentine are used to treat latent TB infection (LTBI) (weekly for 3 months). Clinical considerations, such as HIV co-infection, symptom persistence, radiographic appearance, and public health worries about TB transmission, direct diagnostic testing and treatment start-up for active or suspected TB illness. The treatment of TB illness involves the use of many medication regimens. An intensive phase of four medications—Isoniazid, Rifampin, Pyrazinamide, and Ethambutol—given for the first two months of therapy is followed by a continuation phase of Isoniazid and Rifampin for the next four

months, for a total of six months of treatment. For a total treatment time of nine months, the continuation phase is prolonged to seven months if the Pyrazinamide's 2-month course is not finished, or if sputum is present in a patient with cavitary pulmonary TB, cultures continue to be positive after two months of therapy (delayed culture conversion).

Many obstacles must be overcome for co-infected people with TB to get effective treatment, although considerable progress is being made. Current research indicates that early initiation of antiretroviral medication (ART) during TB treatment improves survival.

In order to successfully treat a patient with anti-mycobacterial treatment, medication compliance is essential. In order to ensure adherence, Direct Observed Therapy Short-Course (DOTS) by qualified professionals is advised, either in the clinic or at home. Moreover, monthly dispensation of TB drugs is advised since all patients must undergo monthly clinical monitoring for hepatotoxicity caused by these treatments.[7]

PROBLEMS IN TREATMENT OF TUBERCULOSIS

Together with malnutrition, poor socioeconomic level and living circumstances are regarded as significant risk factors associated with latent tuberculosis infection. The most widely used vaccination against TB is called BCG. While children are young, it does provide some protection against major TB infections, but as they become older, that protection decreases. The prevalence of latent TB is likewise growing as the population ages.

Missing visits for two consecutive months or more while receiving TB treatment is a severe issue for both people and society as well as health care institutions. In India, inadequate primary healthcare facilities in rural parts of several states, unregulated private healthcare, a lack of political will, and corrupt administration are key obstacles to TB management. WHO's "STOP TB" campaign has provide a goal to eradicate tuberculosis (TB) as a public health issue entirely by 2050.

The government's numerous initiatives fall short of addressing the issue's underlying causes. However, the health care system's corruption prevents the policies from reaching the populace. Proper management is required for government policies. The primary health programme will determine whether the government's TB programme succeeds or fails. The main causes include societal issues including overpopulation, urbanisation creating crowded cities, social issues like smoking and drinking, bad living conditions, unhealthy behaviours,

and inadequate nutrition. Schools and universities should host awareness events to educate the next generation about the illness.

As one respondent mentioned, "The government should start an educational series on TB along the lines of **"Mann Ki Baat"** by the **"Prime Minister Of India".**[8]

DIAGNOSIS

Chest X-ray, acid-fast stain and sputum culture, tuberculin skin test (TST) or interferon-gamma release assay (IGRA), and, if available, nucleic acid-based tests are all used to diagnose pulmonary TB.

Those with fever, a cough that lasts longer than two weeks, night sweats, weight loss, lymphadenopathy, and those who may have been exposed to TB are more likely to be suspected of having the disease.

(For instance, through contact with infected family members, friends, or other acquaintances; institutional exposure; or travel to regions where tuberculosis is widespread.)

Patients should be tested for HIV when TB is identified, and those who have hepatitis B and C risk factors should also be tested. Hepatic and renal function baseline testing should normally be performed.[9]

Diagnosis of extra-pulmonary tuberculosis[10]

• Mycobacterium stain and culture - Only by cultivating the Mycobacterium tuberculosis organism from a specimen taken from the patients can a conclusive diagnosis of TB be made.

• Biopsy - Standard AFB smears are not very sensitive, and Mycobacterium tuberculosis takes a very long time to show up in a culture. As a result, histological evidence is primarily used in the diagnosis of EPTB.

• Body fluid analysis - While tissue biopsy is the most reliable way to diagnose EPTB, it is invasive and occasionally difficult to perform. As a result, in individuals with EPTB, more readily available bodily fluids, such pleural, peritoneal, and pericardial fluids, can frequently give crucial diagnostic hints.

• Nucleic acid amplification test - Rapid diagnosis is the main benefit of nucleic acid amplification tests (NAAT), such as PCR.

• Immunological tests, such as the TB skin test (TST) and IFN-gamma releasing assay (IGRA), may be used in conjunction with other diagnostic techniques to help identify EPTB, although their diagnostic utility is limited. factors such as HIV infection, inadequate nutrition,

Recent bacterial or viral infections or live virus vaccinations can lower TST response.[11]

Endogenous reactivation describes incident instances of tuberculosis (TB)—both new and recurrent—that arise as a result of the reactivation or re-emergence of a prior infection that the host immune system was able to control.

Recurrent tuberculosis, also known as relapse or reinfection, is the term used to describe a patient's repeated episodes (second, third, or subsequent episodes) of the TB illness.

Re-infection, in which a patient contracts the disease after being exogenously infected with a strain of Mycobacterium tuberculosis different from the one that caused the first infection, is another cause of recurrent tuberculosis.[12]

CONTROL PROGRAMMES

The Revised National Tuberculosis Control Program (RNTCP) is a comprehensive TB control plan.

India is responsible for around one-third of the world's TB burden. Almost 20,000 individuals are infected each day, of whom 5,000 get TB, and over 1,000 pass away from the disease. More than 80% of TB patients are within the 15–54 age range, which is a time period of economic productivity.

The National Tuberculosis Institute (NTI) created the National TB Control Program in 1962, dividing the costs 50:50 between the centre and **state.**[13]

National strategic plan for tuberculosis elimination 2017-2025

A National Strategic Plan for Tuberculosis (NSP) for the control and eradication of the disease has been published by RNTCP. This has been incorporated into the "Detect-Treat-Prevent-Build" framework's four strategic pillars (DTPB).

Detect - Finding all drug-sensitive TB cases (DS-TB) and drug-resistant TB cases (DRTB) is the first goal of NSP, with a focus on getting in touch with TB patients seeking care from private providers and undiagnosed TB cases in high-risk populations (such as prisoners, migrant workers, people living with HIV/AIDS, etc.). A crucial step in the eradication of TB is the prompt detection and treatment of community-based TB patients.

Treat - The program's next phase is to start and keep all TB patients on the proper anti-TB medication wherever they seek medical attention, with patient-friendlysocial and institutional assistance.

All TB sufferers should get free TB medications in the form of daily fixed dosage combinations (FDCs), which is recommended with the assistance of directly monitored treatment short-course (DOTS).

Prevent - Many actions are suggested with the aim of preventing the establishment of TB in susceptible populations, such as: expanding airborne infection control procedures at medical institutions. Therapy for contacts of individuals with bacteriological confirmation who have latent tuberculosis. Use an interdisciplinary approach to address the socioeconomic determinants of TB.

Build -The National Strategy Plan 2017–2025 recommends creating and enhancing enabling policies, empowering institutions, and equipping human resources with improved capacities in order to strengthen the health system for the control of tuberculosis.

NIKSHAY PORTAL

In order to make TB notification easier, RNTCP has created a case-based web-based TB monitoring system named 'NIKSHAY' (https://nikshay.gov.in) for both public and private healthcare facilities. Future improvements under NIKSHAY include help for patients, logistical management, direct data transmission, support for adherence, and support for interface organisations who are assisting programming to broaden their reach. A cash incentive of Rs. 500 per month is given to each notified TB patient under the National Health Mission (NHM)'s NIKSHAY poshak yojana for nutritional assistance for the full time the patient is receiving anti-TB medication. Through the Direct Benefit Transfer (DBT) program, incentives are sent to the beneficiary's bank accounts.[14]

The National Tuberculosis Elimination Programme (NTEP)'s web-enabled patient management system for TB control is called NI-KSHAY (Ni = End, Kshay = TB). In partnership with the National Informatics Centre (NIC) and the World Health Organization national office for India, it is created and managed by the Central TB Division (CTD), Ministry of Health and Family Welfare, Government of India. Health professionals at various levels use NIKSHAY to register cases under their care, order different types of tests from labs across the nation, record treatment details, monitor treatment adherence, and transfer cases between care providers. It also serves as the country's national TB monitoring system and makes it possible to provide the Indian government with a variety of surveillance data.[15]

PHARMACOECONOMICS

The scientific field of pharmacoeconomics evaluates the relative costs of various pharmacological treatments.[16]

It belongs to the field of health economics. A pharmacoeconomic research assesses a pharmaceutical product's cost (represented in monetary terms) and effects (expressed in monetary terms of effectiveness or improved quality of life). Pharmacoeconomic studies help to determine the most efficient and scientifically sound way to allocate healthcare resources. Pharmaceutical economic evaluation is the focus of pharmacoeconomics, which may include cost-minimization, cost-benefit, cost-effectiveness, or cost-utility analysis.

Pharmacoeconomics is a practical tool for assessing the cost-effectiveness of various treatment choices. Applying the pharmacoeconomics principles to different drugs and treatment options has become crucial, especially in the context of developing countries where resources are limited, in order to achieve the greatest improvement in life quality at the lowest possible cost.[17]

A well-designed pharmacoeconomic analysis involves 10 steps: (1) defining the problem (2) determining the study's perspective (3) determining the alternatives and outcomes (4) selecting the appropriate pharmacoeconomic method (5) placing monetary values on outcomes (6) identifying study resources (7) establishing the probabilities of the outcomes (8) applying decision analysis (9) discounting costs or performing a sensitivity or incremental cost analysis and (10) presenting the results, along with any limitations of the study.[18]

TYPES OF ECONOMIC EVALUATION

Several types of economic evaluation are recognized. It is the measurement of outcome that determines what type of economic evaluation has been performed.

COST MINIMISATION ANALYSIS

If the results of the various tactics are shown to be comparable, analysis will just include comparing prices and selecting the least expensive option.

COST EFFECTIVENESS ANALYSIS

The results of the competing tactics are assessed in unidirectional natural units, such as lives saved, change in pain score, or change in peak flow rate, and are not equal for a cost effectiveness analysis. Thus, the outcomes are useful in assessing technical effectiveness.

COST UTILITY ANALYSIS

The results of medical treatments are quantified in terms of health outcomes that integrate quality and quantity of life, allowing them to be compared across various therapies and health issues. The quality adjusted life year, sometimes known as the QALY, is the most well-known illustration of a health utility measure.

COST-BENEFIT ANALYSIS

Despite the fact that the term "cost-benefit" is frequently used to refer to any type of economic research, it has a very particular connotation in the field of health economics. It alludes to economic studies whose conclusions are quantified in monetary terms. Benefits and expenses may be readily compared because they are both quantified in the same units. This is undoubtedly very helpful in aiding decision-making. However, there are significant challenges involved in quantifying advantages in monetary terms. Although cost-benefit analyses have many theoretical appeals for health economists, it is doubtful that they will be commonly used in the literature on medicine.

COST CONSEQUENCES ANALYSIS

Cost-effectiveness analysis in this sense. A primary result from a cost effectiveness study should ideally be able to be utilised to calculate a cost effectiveness ratio. However, It might be challenging to choose the most significant outcome when there are several that are meaningful. For instance, in a study assessing the cost-effectiveness of therapy for a sprained

ankle, the capacity to bear weight, the pain score, or a number of other outcomes could be viewed as equally significant.[19]

PATIENT SUPPORT SYSTEM (ECONOMIC BURDEN ONGOVERNMENT)[20]

TB has disastrous economic implications on both the home of the patient and the patient themselves. Estimates indicate a major influence that will impede national development on national economies. RNTCP offers free diagnosis and treatment to patients who have registered for the program, but many patients incur additional health care costs, such as paying for supplemental medications and additional diagnostic tests, as well as significant non-medical costs, such as spending money on transportation and lodging. Patients and those family members who provide care for them may also endure intangible costs connected to societal stigma associated with their sickness, as well as decreased wages owing to poorer productivity and/or lost career possibilities.

The secret to curing TB is sticking to a regular, comprehensive treatment plan. For all patients, a patient-centered strategy to administering pharmacological therapy will be created, based on the patient's requirements and mutual respect between the patient and the practitioner, to assess and promote adherence.

A strong patient support strategy will be created at the time of treatment beginning and is essential for the success of the process. The following will be part of this assistance.

• Initial and continuing family and patient counselling.
• Treatment oversight by a qualified treatment supporter (a health professional or community volunteer).
• Additional nutritional assistance under local management,
• Getting treatment interrupters back,
• Checking for negative responses,
• A suitable social support system,
• Psychosocial assistance,

Co-morbidity control and
• Subsequent laboratory analyses.

The NSP's efforts are aimed at lowering the financial burden that TB has on patients and their households in addition to treating the morbidity and mortality associated with the disease.

The main goals of the support systems are to improve treatment compliance and reduce TB patients' catastrophic spending.

Strategic interventions connect families and TB patients to the relevant government social programs, and then exploit the government's emphasis on digital payments to send rewards and incentives straight to the patient's bank account.

Linking Pradhan Mantri Jan-Dhan Yojana11, AADHAR and NIKSHAY (JAN)for direct cash benefits to patients.

a. move towards digital treatment assistance through Direct Benefits Transfer (DBT).

b. Central Tuberculosis Division: CTD will determine the financial assistance needs and supply funding.

c. The Pradhan Mantri Jan-Dhan Yojana (PMJDY) has increased access to financial services throughout the country.

d. AADHAR: AADHAR serves as the special identification number for individuals receiving therapy.

e. Social welfare programmes: Refer patients to current social welfare programmes to get help.

f. NIKSHAY: Nikshay will give CTD and other social service programmes patient information.

Reducing the out of pocket expenditure for TB patients.

The plan works to reduce and ultimately get rid of patients' catastrophic out-of-pocket expenses. Accordingly, the main expenses suffered by the patient and their means of compensation are the price of diagnosis, the price of travel, the price of food, the price of treatment, and the price of lost wages.

Providing financial support for nutritional support to the TB patients.

As with many other infectious illnesses, TB has a bidirectional relationship between active illness and dietary condition. A vicious cycle that can result in unfavourable outcomes (during and after therapy) for patients with active tuberculosis, particularly those with multi-drug resistant TB, is created when undernutrition, a risk factor for tuberculosis, lowers nutritional status. This connection is particularly significant in the context of India, where there is a high prevalence of TB together with food poverty and undernutrition. It was suggested to start a

programme to provide every TB patient a monthly monetary incentive through DBT in order to solve this problem. All those with active TB will get the following:

• An evaluation of their nutritional condition.

At the time of diagnosis and during treatment, patients will get appropriate counselling depending on their nutritional condition. If undernutrition is found, it will be treated in accordance with programme guidelines. Links to other government programmes like the public distribution system (PDS) or appropriate food security programmes will be expanded in order to provide TB patients and/or his contacts on IPT with additional nutritional support.

• Connections to currently used nutrition-related management initiatives, such as nutrition rehabilitation centres (NRCs).

Patient-centred approach to treatment

The secret to a relapse-free recovery from TB is frequent and thorough treatment compliance. A patient-centered strategy to administering pharmacological therapy, based on the patient's requirements and mutual respect between the patient and the physician, will be created for all patients in order to assess and promote adherence.

A support strategy will be created when therapy first begins. This treatment strategy will include initial and ongoing follow-up counselling for the patient and their families, treatment monitoring by a trained treatment supporter (a health worker or community volunteer), locally managed additional nutritional support, the recovery of treatment interrupters, screening for adverse reactions, psycho-social support, co-morbidity management, and follow-up laboratory investigations.

A family member can be given the duty of overseeing therapy when it is suitable. These circumstances could occur with sick or bedridden patients, kids, long-day laborers, etc. In such cases, a health professional would provide thorough training and ongoing support by making regular house visits to the family member who has been given the duty to monitor treatment.

To stop abusing substances, counselling may be necessary. Other needs include nutritional assessment and assistance, supplementary medications, co-morbidity treatment, reimbursement for missed pay, etc.

COSTING AND FINANCING THE NSP[21]

Budget & Funding for National Strategic Plan for TB

The National TB programme needed a larger budget to guarantee the operations of the programme were carried out continuously and on schedule in order to meet the ambitious goals of the Government of India to eradicate tuberculosis.

To revolutionise TB control and accomplish the national aim of eliminating TB as a significant public health concern by 2025, an estimated budget of 16649 crores would be needed during the next three years. As described in the earlier chapters, this resource envelope is intended to encompass the following activities.

1. Significantly enhancing the current programme activities
2. The launch of fresh initiatives to connect with patients looking for treatment from private providers.
3. Boost case detection by routinely screening important groups.
4. Establish a top-notch nationwide system for TB patient monitoring and tracking.
5. Use DBT to help patients in order to reduce catastrophic expenses and enhance nutrition.
6. Using ICT technologies, supply chain management and finance management systems will be further strengthened.

It will be necessary to widely utilise modern diagnostic technologies, newer treatment regimens, and creative approaches to manage TB patients utilising information technology in order to identify and treat all TB and MDR-TB patients. This will necessitate large financial commitments.

NEW ACTIVITIES

Includes treatment assistance for 4.5 million TB patients as well as coverage of patients from the private sector through diagnostics reimbursement, notification by the private providers, distribution of FLD medications, and provision of incentive for treatment support. Additionally, it has a method for coordinating the extension of the programme's medicine supply through creative private sector approaches for 2.2 million TB patients. Support for 9 million TB patient culture tests and post-TB therapy monitoring. Additionally, it involves the development of contact centres with the capacity to help all TB patients for ten million minutes, SMS reminders to 4.5 million TB patients, and the distribution of 50,000 PDA devices for digitization.

AIM

A retrospective analysis of pharmacoeconomic of management of patients of TB at Nodal Centre of Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan along with the overall economic burden on Government.

OBJECTIVES

- To study the pharmacoeconomic management of patients of TB reporting at Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan.
- To study the cost of different antitubercular regimen advised to these patients.
- To analyse the all economic burden on Government reporting at Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan.

STUDY DESIGN AND SITE

The study is planned as a retrospective and analytical study from the case records and Nikshay portal data of patients of Tuberculosis reporting at the Nodal TB centre of Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan**.**

STUDY MATERIALS

Data will be collected from old case records, maintained registers for TB patients and Nikshay Portal of the Nodal centre for TB at Ananta Institute of Medical Sciences and Research Centre. Additional data will also be collected from Medicine and Pulmonary Medicine OPD records to find out cases presented with suspected TB who underwent further investigation.

STUDY DURATION

12 months (March 2021 to February 2022)

INCLUSION CRITERIA

Data will be collected of only suspected cases of TB which are later confirmed by investigations.

EXLCUSION CRITERIA

Chronic Obstructive Pulmonary DiseasesOther respiratory diseases.

STUDY PROCEDURE

Study will be retrospective (past 12 months) and analytical. All patients who reported to pulmonary medicine and General Medicine OPDs during the period from March 2021 to February 2022, and had been suspected to suffer from TB will be taken into account.

Then out of total suspected cases, those who were confirmed to suffer from TB by sputum testing and X-ray will be selected for analysis.

Additional investigations done to find out co-morbidities or confirm a doubtful case would also be noted.

Once confirmed of diagnosis of TB, patient's details are recorded in Nikshay Portal, provided by Government of India to keep track and monitor all aspects for NTEP (National TB Eradication Programme).

Hence Nikshay Portal data would be collected for all patients (both pulmonary and extra-pulmonary TB). Which would include their ID number on the portal, their registration, all investigations done, treatment plan, place of collection of monthly medicine, payments made to patients and TB centres, follow-up and finally outcome of treatment.

All the above data would then be compiled and analyzed to arrive at results of the finding.

STATISTICAL ANALYSIS

Data collected and compiled will be entered in MS-Excel, where it will be further cleaned and imported to SPSS version 25.0 for analysis.

RESULTS

Table 1: The following table shows the total suspected cases of TB and initial payment made to Nodal Centre.

Months	Total Suspected Cases	Basic Charges (800 per patient)**			Paid to Nodal Centre
		Registration @200	X-ray chest@200	DM andHIV testing@400	
Mar-21	126	126x200	126*200	126*400	100,800
Apr-21	40	40*200	40*200	40*400	32000
May-21	8	8*200	8*200	8*400	6400
Jun-21	22	22*200	22*200	22*400	17600
Jul-21	117	117*200	117*200	117*400	93600
Aug-21	71	71*200	71*200	71*400	56800

Sep-21	65	65*200	65*200	65*400	52000
Oct-21	44	44*200	44*200	44*400	35200
Nov-21	54	54*200	54*200	54*400	43200
Dec-21	65	65*200	65*200	65*400	52000
Jan-22	69	69*200	69*200	69*400	55200
Feb-22	64	64*200	64*200	64*400	51200
Total	**745**	**1,49,000**	**1,49,000**	**2,98,000**	**5,96,000**

Table 1 shows the initial expenditure by the Government. All patients suspected tohave tuberculosis are registered with a charge of 200 per patient. Some basic investigations are done to confirm the diagnosis, expenses are 200 for X-ray chest, 400 for screening of DM and HIV. Thus, at an initial phase, even before confirmation of the disease, 800 is spent on each suspected case. This payment is made by Government to the NTC (Nodal Tuberculosis Centre).

**Sputum examination done is free of cost.

Table 2: The following table shows the total TB diagnosed cases, special investigationsand banking charges.

Months	Total cases of TB	Special investigations		Banking charges@300	Paid to Nodal Centre
		CBNAAT @400	FNAC @600		
Mar-21	18	2*400	3*600	18*300	8000
Apr-21	5	1*400	-	5*300	1900
May-21	3	1*400	-	3*300	1300
Jun-21	9	10*400	-	9*300	6700
Jul-21	27	23*400	-	27*300	17300
Aug-21	19	-	-	19*300	5700
Sep-21	13	2*400	-	13*300	4700
Oct-21	7	-	-	7*300	2100
Nov-21	7	2*400	2*600	7*300	4100
Dec-21	11	-	-	11*300	3300
Jan-22	11	10*400	-	11*300	7300
Feb-22	16	9*400	-	16*300	8400
Total	**146**	**24000**	**3000**	**43800**	**70800**

Table 2 shows the special investigations and banking expenditure by the Government. Total number of tuberculosis cases registered are mentioned month wise. Some special investigations are done to confirm the diagnosis, like CBNAAT (Cartridge Based Nucleic Acid Amplification Test) @400 for confirming TB in doubtful cases or FNAC (Fine Needle Aspiration Cytology) @600 to confirm tubercular lymphadenopathy. After this, the

confirmed cases of TB were enrolled for banking services @300. Thus for the confirmation of disease @1300 is spent on each patient for special investigationsand banking charges. This payment is made by Government to the NTC (Nodal Tuberculosis Centre).

Table 3: The following table shows the patient treatment centre, amount paid to patient and their outcome.

Month	Total TB patients	Patients treated at NodalCentre	Patients referred outside	Paid to patient	Paid after completionof treatment
		@50 per month	@50 per month		(Outcome @400perpatient)
Mar-21	18+5 = 33	-	33*50	33*500	
Apr-21	5+15+18 = 38	-	38*50	38*500	
May-21	3+15+18+5 = 41	-	41*50	41*500	
Jun-21	9+15+18+5+3 = 50	-	50*50	50*500	
Jul-21	27+15+18+5+3+9 = 77	-	77*50	77*500	15*400
Aug-21	19+18+5+3+9+27 = 81	3*50	78*50	78*500	18*400
Sep-21	13+5+3+9+27+19 = 76	3*50	73*50	76*500	5*400
Oct-21	7+3+9+27+19+13 = 78	3*50	75*50	78*500	3*400
Nov-21	7+9+27+19+13+7 = 82	3+2 = 5*50	77*50	82*500	9*400
Dec-21	11+27+19+13+7+7 = 84	3+1 = 4*50	79*50	84*500	27+1+1 = 29*400
Jan-22	11+19+13+7+7+11 = 68	2+1+3 = 6*50	59*50	68*500	16+2 = 18*400
Feb-22	16+13+7+7+11+11 = 65	1+2 = 4*50	59*50	65*500	13+1 = 14*400
Total		**1400**	**36950**	**385000**	**44400**

Table 3 shows the patients treatment centres, amount paid to patients and their outcome. Total number of tuberculosis cases registered are mentioned month wise. Patients had an option of choosing their centres for collection of medication, as per their convenience. They could collect from the Nodal Centre or any other TB referral centre. At each month, @50 per patient was given to the concerned centre for dispensing medication. Each patient received an amount of @500 permonth for their proper nutrition (mostly 6 months). On completion of the whole treatment (in most cases, six months) a payment of @400 per patient was provided by the Government to monitor and notify the outcome or successful completion of treatment.

Table 4: The following table shows the total payment made by Government.

Month	Amount spent on suspected cases and basic investigations	Amount Paidto Nodal Centre for special investigations and banking	Amount paid to patient @500 per month	Amount paid for distribution of medication @50 per month	Amount paid after completion of Rx @400 per patient
Mar-21	100800	8000	16500	1650	
Apr-21	3200	1900	19000	1900	
May-21	6400	1300	20500	2050	
Jun-21	17600	6700	25000	2500	
Jul-21	93600	17300	38500	3850	6000
Aug-21	56800	5700	39000	4050	7200
Sep-21	52000	4700	38000	3800	2000
Oct-21	35200	2100	39000	3900	1200
Nov-21	43200	4100	41000	4100	3600
Dec-21	52000	3300	42000	4150	11600
Jan-22	55200	7300	34000	3250	7200
Feb-22	51200	8400	32500	3150	5600
Total	**596000**	**70800**	**385000**	**38350**	**44400**

Table 4 shows the total expenditure by the Government. Initial phase, even before confirmation of the disease, @800 is spent on each suspected case and basic investigations. For the confirmation of disease @1300 spent on special investigations and banking charges. Each patient received an amount @500 per month for their proper nutrition (mostly 6 month) after diagnosis of TB. At each month, @50 per patient was given to the concerned centre for dispensing medication. On completion of whole treatment, a payment of @400 per patient was provided by the Government to monitor and notify the outcome or successful completion of treatment. These payments were all made by the Government.

*Anti- tubercular medicines are all supplied by the government free of cost.

DISCUSSION

The present work was undertaken at a tertiary medical centre, namely Ananta Institute of Medical Sciences and Research Centre, Rajsamand. This hospital was chosen as it isa Nodal Tuberculosis Centre (NTC).

All patients who had reported to the General Medicine and Pulmonary Medicine OPDs during the period of March 2021 and February 2022 were taken into consideration for collection of data. Month-wise medical case records were scrutinised and the collective data was compiled for the entire 12-month period.

For each month, collection data included total number of cases of suspected tubercular infection, their registration in Nikshay portal, sputum testing for AFB, X-ray chest, testing for Diabetes and HIV, initially.

After above cases were confirmed as Tuberculosis, they were noted and again classified as Pulmonary and Extra-pulmonary cases of TB. All patients of tuberculosis were provided with banking facilities, where a monthly amount of Rupees 500/- would be deposited for their better nutrition and well - being.

Those who were doubtful, were tested by CBNAAT and FNAC (in lymphadenopathy) for confirmation of tuberculosis.

All cases of confirmed TB were given their quota of monthly anti-tubercular medicine either from the Nodal centre itself or from any other referral centre as per their convenience.

If patients had any complaints, co-morbidities etc, they could report back at their centres. Each patient (unless specified) received 6 months of routine anti-tubercular treatment. After completion, they were again clinically evaluated for eradication of disease.

The outcome of all patients (successful completion, drop-outs or defaulters, death) etc was recorded.

The objective of my study was to collect, compile and analyse the financial aspects of diagnosing and managing the above patients.

After taking stock of all the instances where money was spent on these patients, I accumulated data from maintained records, bank details, Nikshay Portal etc.

All patients, suspected to be having TB, on reporting at the General Medicine and Pulmonary Medicine OPD during the period of 12 months (March 2021 to February 2022) were taken into account.

All these 745 patients were first registered with the Nodal Centre (place of my study), the registration charges being Rupees 200 per patient. This amount is paid by Government to the Nodal Centre for registration.

Thereafter, sputum for AFB testing was done for all patients as a primary screening tool. This needed no extra payment as the funding for the laboratory is done by the Government for approved centres.

At this stage, blood tests were done for detecting Diabetes and HIV, which is a common co-morbidity in TB. The expenses for this (Rs. 400 per patient) was again paid by the Government to the Nodal Centre.

Finally to get a clearer picture of pulmonary TB, X-ray chest was done at an expense of Rs.200 per patient (Government sponsored).

Hence all 745 patients of suspected TB had Rs. 800/- spent on each, for primary screening for confirmation. This amount was sanctioned to the Nodal Centre.

About 60 cases needed additional confirmatory investigations, like CBNAAT (Cartridge Based Nucleic Acid Amplification Test) @ Rs. 400 / patient and about 5 cases needed FNAC(Fine Needle Aspiration Cytology) @Rs. 600 / patient.

This amount was also disbursed to the Nodal Centre.

After this, the confirmed cases (146) were enrolled for banking services @ Rs. 300 per patient. Once their banking accounts were finalised, each patient received an amount of Rs. 500 per month for their proper nutrition, till they were disease free (mostly6 months).

Patients had an option of choosing their centres for collection of medication, as per their convenience. They could collect from the Nodal Centre or any other TB referral centre. At each month, Rs. 50 per patient was given to the concerned centre for dispensing medication. All the anti-tubercular medicines were supplied free of cost by the Government.

On completion of the whole treatment (in most cases, 6 months) a payment of Rs. 400 per patient was provided by the Government to maintain and notify the outcome or successful completion of treatment.

Thus, my observations showed, that about Rs. 800 (200 for registration, 200 for X-ray and 400 for Diabetes and HIV detection) had to be paid for a large number of patients, to the Nodal Centre by the Government. This may seem as a lot of monetary taxation on the Government unnecessarily as majority of these patients did not turn out to be patients of TB.

But, on the positive side, since the goal of our Nation is early detection and management of cases, no risks could be taken in patients whose symptoms were suggestive of a chronic respiratory disease. It is better to screen extra patients than to miss detection of TB. Moreover, while testing for common co-morbidity of TB, like Diabetes and HIV, the expenditure ensured detection of two more diseases (irrespectiveof TB).

Once the cases of TB were diagnosed, some patients needed extra investigations for confirmation. Though expensive, but facilities have been provided at or near the Nodal Centre to conduct these tests. So patients neither have to pay, nor go out anywhere.

This expenditure is justified so that a patient is not unnecessarily labelled and treated for TB.

Banking charges paid by Government, was to ensure that no cash payment is done anywhere (to prevent corruptive methods) and that the patient received the money directly in his/her account to be utilised for better nutrition during disease period. This financial aid kept up the patient's motivation to continue with the treatment.

For dispensing medication, a nominal payment of Rs. 50 per patient per month was made. This not only motivated the centres and health workers to sincerely give the monthly medicines, but also kept a track of the number of patients who did not come to collect. Simply by this information, health and social workers could follow-up the patient and enquire as to the reason of non-compliance and remind or motivate them to compliance. Defaulters can thus be detected early and made to continue treatment.

Lastly, at the completion of successful treatment, an amount of Rs. 400 per patient is made available to the concerned centre. Again this is an incentive, a motivation and a reminder to try and make all patients complete the entire regime.

Thus, if we consider the total economic burden on the Government, we find that initial screening for TB, Diabetes and HIV needs Rs. 800 per suspected case.

Thereafter depending on the confirmed cases of TB (both pulmonary and extra- pulmonary TB) an additional expense of Rs. 1000 per patient is provided for banking, dispensing of medication for 6 months and completion of successful treatment.

In a sub-set of cases, additionally Rs. 400 per patient or Rs. 600 per patient had to be spent for additional investigations.

All above payments are made by the Government of India, mainly to the Nodal Centre and to the referral centres.

Apart from this, an incentive of Rs. 3000 is given directly in the patient's bank account, @ 500 per month, to cover for the extra nutrition he/she requires.

Thus, on an average, approximately Rs. 4800 or Rs. 5000 is spent on each patient of TB, from detection to cure.

Moreover, medications are also provided free by the Government.

So it seems like a lot of expenditure on the Government (as we have a large burden of TB cases) but in the long run, these expenses curtail the burden on the patient and the hospital / TB centres.

This free management of TB, is to motivate more patients to willingly come forward for testing and to undertake the anti-tubercular treatment at the nearest TB referral centre.

Since the disease is more prevalent in the low socio-economic groups, free of cost treatment leads to lesser drop out rates, better compliance, more completed treatments, less spread in societies and thus, an overall better management of the disease.

To make our dream of eradication of TB come true, Government is trying its best to ensure maximum privileges, leading to better adherence to treatment protocols and thus bring about a national decline of this infectious disease.

SUMMARY

Thus, to summarise my study, I have collected retrospective data of 1 year, compiled and analysed them to get an idea of the financial aspect of TB management.

As per NTEP and Government's initiatives, I feel, all measures are being taken to detect early, dispense drugs regularly, provide money for nutritive food and help the TB patients to complete treatment successfully.

No cash payments are made at any stage, preventing corruption and misuse of funds. Sincere efforts are in place to see that a patient of TB does not have to pay anything in order to get detected and complete treatment. Payment is regularly being disbursed to the Nodal Centres and Referral Centres ensuring their sincere participation and motivating them to motivate patients to take advantage of this plan and be free of a dangerous disease.

The Government, by including TB eradication in its Health Budget has takena big step to fulfill its dream of getting India - "TB free".

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