





Evaluation of the Tuberculosis Surveillance System in the Southern Region of Iran

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Abstract:

Aim: The aim of this study was the evaluation of Tuberculosis (TB) surveillance system in Southern Iran.

Background: TB is one of the most important infectious diseases that has been common since ancient times.

Methods: This is a cross-sectional descriptive-analytical study that was conducted by the census method using the TB Surveillance System on 77 patients with tuberculosis in the southern region of Kerman province in Iran. The study was conducted over one year, from April 2020 to March 2021. Statistical tests were used by SPSS version 20 to analyze the data.

Results: 90.62% of the patients were cured and the rest experienced treatment failure and absenteeism. The average and standard deviation of the interval between the onset of the first symptom and the diagnosis and discovery of the disease were 88 and 93 days, respectively. Regarding the treatment duration, 95.5% of the cases followed the prescribed duration while the remaining cases did not. Among the affected patients, 34.8% had a history of hospitalization, while the rest had no such history. The average hospitalization duration was 12.92 days, with a standard deviation of 9.94 days. The longest hospital stay was 60 days, while the shortest was 2 days.

Conclusion: We need to have a suitable program for early diagnosis of TB, compliance with the length of treatment, and training of private and public centers to strengthen the care system. Additionally, we should strengthen the process of the directly observed treatment, short-course (DOTS) program to control TB.

Keywords: Evaluation, Tuberculosis, Surveillance system, Infectious diseases, Census method, Patients.

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1. INTRODUCTION

For a long time, infectious diseases have been among the health threatening factors for humans [1]. Tuberculosis (TB) is a long-established and very important infectious disease. It has caused significant economic and social losses to both families and societies, especially the poor [2]. TB is a long-standing bacterial disease caused by a type of bacteria called *Mycobacterium tuberculosis* [3]. Tuberculosis occurs through two distinct pathways: pulmonary tuberculosis and extrapulmonary tuberculosis. Pulmonary tuberculosis accounts for 85% of cases and extrapulmonary tuberculosis accounts for the remaining 15%. In the extrapulmonary form, any organ in the body can be affected. The most frequently affected organs are lymph nodes, pleura, genitourinary system, bone, intestine and meninges [4].

The main symptom of pulmonary tuberculosis is a persistent cough lasting more than 2 weeks, often accompanied by phlegm production. Other respiratory symptoms include shortness of breath, chest or back pain, and bloody phlegm. Common symptoms such as fever, anorexia, weight loss, malaise, night sweats, early malaise and general weakness may also occur [5]. Tuberculosis is the leading cause of death among single infectious diseases, surpassing AIDS, malaria and measles. It ranks 10th in terms of the global burden of disease and is expected to maintain its current position [6].

In 1991, the World Health Organization (WHO) acknowledged the growing worldwide impact of tuberculosis (TB) and declared it a global emergency. In response, the WHO established two objectives to combat TB. These objectives aimed to identify at least 70% of new cases through a positive sputum test and successfully treat 85% of those cases. To accomplish these goals, the WHO introduced the DOTS (Direct Observation Short-Term Treatment) strategy. This strategy included the provision of free diagnostic and treatment services at all levels of health care, the implementation of strict control policies, and testing and evaluation of treatment outcomes. The DOTS strategy consists of five elements. Government support, microscopic examination of sputum swabs to identify inactive disease, DOTS for all patients with positive sputum swabs, regular supply of medicines and laboratory supplies, registration and reporting system for monitoring and evaluation [7, 8].

In 1990, the Iranian Ministry of Health, Treatment and Medical Education (MoHME) issued a circular consolidating tuberculosis (TB) control programs and primary health care networks. This circular has been distributed to all states in the country. In 2002, the Ministry of Health instructed all medical colleges to implement their programs on the basis of international recommendations and the proposals of the National Technical Committee. The ministry also defined three levels of roles and responsibilities to ensure the effectiveness and success of the programme: central, intermediate and peripheral. The country subsequently revised its strategy to combat TB by adopting the DOTS II strategy and adapting it to the new approach [8].

Iran has experienced success in controlling tuberculosis (TB) to some extent, but the disease remains a challenge in the country. According to the Department of TB and Leprosy Control at the Ministry of Health, the incidence of smear-positive TB in Iran was 6.3 per 100,000 people in 2015 [9]. A 12-year population-based study in Iran showed a 34% reduction in the incidence of TB over the course of 23 years, from 32 per 1,000 people in 1995 to 21 per 1,000 people in 2018 [10]. However, the incidence rate of TB in Iran has been changing over time, with a decreasing trend observed in recent years [11].

Elimination of tuberculosis requires a prevalence of less than 1 in 1 million people [12]. The process of achieving this goal includes various actions within the healthcare system, including diagnosis, treatment, screening, and patient education. These measures can be classified as technical, nursing and interpersonal measures, all of which affect service delivery. Process evaluation includes evaluation of staff, beneficiaries and external evaluator performance, plan implementation quality, content, methods, tools and materials required, and media used [13]. According to Donabedian, measuring the process essentially means measuring the quality of care, because the process includes all medical practices. Information about this process can be gleaned from medical records, patient-physician interviews, or direct observation of health visits [14]. This evaluation helps identify strengths and weaknesses in program implementation that affect the final result of the program [15]. It also enables you to identify and fix problems before they affect your program, giving you the opportunity to improve your implementation and make necessary changes. Evaluation also helps determine the reasons for program success or failure [13]. Understanding the strengths and weaknesses of the tuberculosis surveillance system in this specific region is crucial for improving disease control strategies and ensuring timely interventions. By evaluating the existing system, we can identify potential gaps or areas that require improvement, leading to more effective prevention, diagnosis, and treatment of tuberculosis cases. Given the importance of this program to the health system and the higher risk of disease transmission in the southern region compared to other parts of the country, this study was conducted to evaluate the tuberculosis surveillance system in southern Iran.

2. MATERIALS AND METHODS

2.1. Study Design and Setting

The current study is cross-sectional (descriptive-analytical).

2.2. Study Participants and Sampling

The study focuses on the southern region of Kerman province, especially on the cities of Jiroft, Konouji, Ambalabad, Manojan, Ludovar, Faryab and Karaganj. These areas are under the jurisdiction of the Jiroft Medical University (JMU). Kerman province is located in the southeastern part of Iran. According to the JMU Health

Ministry report, the population covered by JMU was 716,143 in 2021. The population of these areas consists of three groups: urban, rural and nomadic.

2.3. Data Collection Tool and Technique

Researchers used questionnaires to collect information for this study. The questionnaire was developed based on research variables, national guidelines, and a literature review. To ensure accuracy, the questionnaire was reviewed and approved by five of their professors in the field. Its reliability is also confirmed by a Cronbach alpha value of 0.7 or higher. This study included all tuberculosis patients treated at a health center. The data used for the analysis were from the Tuberculosis Surveillance System and covered a one-year period from April 2020 to March 2021. Where information was incomplete, attempts were made to correct the deficiencies. This included consultations with doctors about their practice, viewing existing files, and contacting and visiting patients.

The variables examined in this study were nationality, sputum swab outcome at the start of treatment, and treatment outcome (success or failure). Treatment categories were defined according to national guidelines and standard definitions. These categories include: 1. New case: A patient who has never received anti-tuberculosis therapy or has taken anti-tuberculosis drugs in the past for less than 4 weeks.

2. Relapse: Patients who currently have a positive sputum swab test but have previously completed complete treatment for tuberculosis and have been declared recovered or completed treatment by a physician.

3. Treatment after failure: Patients whose sputum test remains positive after more than 5 months of treatment, or who are initially negative and then become positive again within this period. This category also includes cases where a sputum swab was negative at the start of treatment, but became positive after 2 months of treatment. 4. Absent from treatment: Patients who have received antituberculous therapy for at least 1 month, discontinued therapy for at least 2 months, and then returned with a positive sputum swab. These categories were used for data analysis in the study.

According to the World Health Organization (WHO), the standard treatment for tuberculosis (TB) is DOTS therapy lasting 6-8 months. This treatment has proven to be not only effective, but also inexpensive. The duration of treatment for new cases of tuberculosis is 6 months. For the first two months, his four medications are prescribed: isoniazid, rifampin, ethambutol, and pyrazinamide. For the next 4 months, only isoniazid and rifampin will be administered. For other groups, such as relapsed and treatment failure, the treatment regimen lasts 8 months. Five drugs are prescribed for the first three months: isoniazid, rifampin, ethambutol, pyrazinamide, and streptomycin. Only three drugs, isoniazid, rifampin, and esambutol, will be given in the remaining five months.

2.4. Data Analysis

The collected information was entered into SPSS

software version 20 for analysis. Various statistical analyses were performed, including a chi-square test. Statistical significance was determined using a significance level of $P < 0.05$.

3. RESULTS

During the course of one year, a total of 77 cases of tuberculosis were recorded. Out of these cases, 51 (66.2%) were classified as pulmonary cases, while the remaining cases were categorized as extra-pulmonary. Among the pulmonary cases, 32 were found to be smear positive. Additionally, 59.4% of the cases were male, and 49 (63.6%) of the patients resided in rural areas. Additionally, the average age of those infected was 39.09 years, with the youngest being 6 years old and the oldest being 80 years old. Out of all the cases, 90.16% were Iranians and the remaining were Afghan nationals. After two months of treatment, only 8 (27.59%) of the positive smear cases remained positive, while the rest tested negative. The treatment success rate was 90.62%, with 12.3% of patients failing to respond to treatment. Notably, there was a significant difference in treatment outcomes based on nationality ($P = 0.01$), with the Afghan population showing higher treatment success compared to the Iranian population. Regarding hospitalization, 34.8% of the affected patients had a history of being hospitalized, while the remaining cases had no such history. The average hospitalization duration was 12.92 days, with a standard deviation of 9.94 days. The longest hospital stay was 60 days, while the shortest was 2 days. The distribution of patients based on their city of residence and nationality can be found in Table 1.

The most frequently reported cases in the outpatient network system were new cases of tuberculosis (TB) referred to or reported by TB centers. In order to prevent the occurrence of TB in children who had contact with infected individuals, prophylaxis was administered. Fortunately, no children tested positive for TB during the study period. The average time between the onset of the first symptom and the diagnosis of the disease was 88 days, with a standard deviation of 93 days. The longest interval recorded was 516 days, while the shortest was 3 days. This prolonged delay in diagnosis increases the risk of spreading the disease and the potential for drug resistance. It may also be attributed to patients seeking treatment from various unrelated centers and private practices, receiving incorrect diagnoses, and experiencing treatment failure. On the other hand, the average time between diagnosis and the initiation of treatment was 1.46 days, with a standard deviation of 1.75 days. The longest interval observed was 6 days, while the shortest was 0 days. This indicates that doctors at the health centers promptly diagnosed TB and initiated treatment as soon as possible. In all cases of infection, 100% of individuals had access to medication and services. There were no instances where individuals encountered difficulties in accessing medication after their disease was discovered. The main reasons and frequency for hospitalizations with TB can be found in Table 2.

Table 1. Frequency of the patients according to the city of residence and nationality.

Cumulative Frequency Percentage	Frequency Percentage	Frequency	Nationality		City
			Afghan (Total sample of Afghanian patients)	Iranian	
26.0	26.0	20	-	19	Jiroft
39.0	13.0	10		9	Rudbar jonob
58.4	19.5	15		12	Anbar abad
63.6	5.2	4		4	Faryab
74.0	10.4	8		8	Ghale ganj
93.5	19.5	15		14	Kahnuj
100.0	6.5	5		5	Manujan
-	100.0	77		6	71

Table 2. The main reasons and frequency for hospitalizations with TB.

Frequency Percentage	Frequency	Causes of Hospitalization	Frequency Percentage	Frequency	Causes of Hospitalization
1.3	1	Swollen neck lymph nodes	7.8	6	Severity of disease
1.3	1	Neck surgery and gland removal	2.6	2	Fever
1.3	1	Pulmonary hemorrhage	2.6	2	Fever shortness of breath
1.3	1	Stomachache	1.3	1	Fever and cough and weight loss
1.3	1	Chest pain, night sweats	1.3	1	Long and severe fever
1.3	1	Cough shortness of breath	1.3	1	Fever and unconsciousness
1.3	1	Cough, fever and severe weakness	1.3	1	Severe fever and chills and bone pain
-	-	-	1.3	1	Fever, abdominal pain and swelling
1.3	1	Severe weakness and lethargy	1.3	1	Resistance to isoniazid and rifampin
1.3	1	Lung infection	1.3	1	Abdominal swelling and fever

4. DISCUSSION

This study was conducted to evaluate the tuberculosis surveillance system in southern Iran. The study found that 90.62% of patients were successfully treated, while the remaining patients were unsuccessful. These failures include death, hospital transfer, treatment absenteeism, and treatment failure. A study by Nasehi *et al.* focused only on smear-positive cases, and he reported 87.8% of treated patients [16]. In another study by Mohammadpour *et al.*, the proportion of all cases was 64.5% [17].

A study by Ghaffari-Fam *et al.*, based on the epidemiological pattern of tuberculosis in Babol, found that the mean time from symptom onset to diagnosis was 56.5 days in 200 TB patients. Of these patients, 181 (90.5%) completed treatment and recovered, 6 (3%) did not receive treatment, and 13 (6.5%) died of tuberculosis or other causes [18]. Another study by Bayat *et al.* In this study, he investigated the tuberculosis process over a 7-year period and found that 72% of his swab-positive patients received treatment and 74% completed the course [19].

Our study found a significant association between nationality and treatment, consistent with the findings of Nasehi *et al.* [16] match. The mean time from first symptom to disease diagnosis was 78 days for him, and the standard deviation was 126 days for her. This delay is due to the contagious nature of the disease, possible drug

resistance, and misdiagnosis by independent centers and practitioners. This increases the risk of treatment failure and drug resistance. Strengthening the disease treatment system, especially syndromic treatment, is critical to ensure timely identification and treatment of patients. The mean time from diagnosis to initiation of treatment was 5.53 days. Therefore, it is important to educate communities and raise awareness among health workers to encourage early treatment and prevent drug resistance. Special awareness programs for doctors and feedback from general health centers have proven effective in rapid tuberculosis diagnosis. In addition, all infected people had 100% access to medicines and services, and had no problems accessing medicines after the disease was discovered. This confirms the success of the Tuberculosis Control and Treatment Program (DOT). Regarding the timing of direct sputum swab testing, 79.1% of cases were referred on time, while testing was delayed in the remaining 20.9%.

The average treatment delay is 6.66 days, and efforts should be made to shorten this delay as much as possible. It is recommended to perform a sputum test immediately after starting treatment in order to make an early decision on whether to continue treatment. Regarding adherence to the treatment period, 95.5% of cases adhered to the recommended treatment period, while the remaining cases did not. It is important to emphasize the importance of this compliance indicator in

preventing drug resistance through staff and patient education. End-of-treatment laboratory results were monitored in all cases, which was a positive aspect of the program. The average length of hospital stay was 12.92 days with a standard deviation of 9.94 days. The longest hospital stay was 60 days, and the shortest was 2 days. A previous study by Khazaei *et al.* The researchers found that 60.8% of his tuberculosis patients were smear-positive, and 87.3% of these patients received treatment. Additionally, 22.7% of patients were hospitalized for tuberculosis. More than half (55.4%) of tuberculosis cases are reported by the public health system [20].

Planning and allocation of hospital beds and equipment is critical to effectively managing patient care and support. Policy makers and healthcare administrators should consider this factor as an important indicator. About 70% of health centers have experienced staff in disease departments. However, approximately 30% of new contract staff and corporate staff are inexperienced and require the support of experienced ward staff to ensure successful patient care. Additionally, about 10% of centers suffer from labor shortages. However, previous studies have shown no clear link between the number of workers and the burden of TB. Nevertheless, it is clear that experienced staff is essential in any center for proper follow-up of problems related to tuberculosis patients [21].

In this study, all health centers were treating tuberculosis (TB). However, he had only one center, which acted as a reference center, that performed testing for tuberculosis. The World Health Organization recommends one test per 50,000 inhabitants. However, in this study, the rate was much lower at 1 test per million, well below the standard rate [22, 23]. In their 2010-2014 Kerman study on the epidemiology of tuberculosis, Daneshi *et al.* Of the 674 infected people, the rate of treatment-resistant TB was found to be about 10 per 1,000. In addition, approximately 4% of patients had disease recurrence during the study period. Probabilities of relapse and resistance were higher for pulmonary TB than for extrapulmonary TB, and this difference was statistically significant ($P=0.001$). Approximately 4% of patients had previously received tuberculosis treatment [24].

In a study conducted between 2000 and 2011, Vesey *et al.* investigated tuberculosis (TB) treatment success rates in Kurdistan. They found that after 3 months, his 60.27% of patients had a negative swab test, indicating a positive response to treatment. Additionally, 87.69% of patients showed improvement in swabs. However, this study also revealed a high treatment failure rate of 69.4% [25]. Another study by Biranvand *et al.* investigated the epidemiology of tuberculosis in Ilam state from 2014 to 2015. In 41% of cases with a positive sputum swab test, a delay of 2 months or more was found between the onset of symptoms and the diagnosis of the disease [26].

Another study, conducted by Logita in southern Ethiopia, examined the process of treatment and

diagnosis of tuberculosis patients. The study found that tuberculosis treatment protocols recommended by the World Health Organization (WHO) were followed. However, there were problems such as insufficient drug dosage for children and insufficient environment for tuberculosis diagnosis. Only 64.8% of those infected received the necessary TB diagnostic tests and only 57.2% of patients received adequate doses of TB treatment. The remaining cases followed the WHO protocol [27]. Furthermore, Daneshi *et al.*'s findings support the need for an adequate TB early diagnosis program that monitors treatment duration, trains private and public centers to strengthen treatment systems, and strengthens the DOT's TB control program [6].

CONCLUSION

Program evaluation is an important step in understanding the factors that influence disease control. Sistan-Balochistan province has a high incidence of tuberculosis, partly due to its proximity to countries with high tuberculosis rates such as Afghanistan and Pakistan. In addition, the province is located south of Kerman Province, with the Afghan population migrating to Jiroft. Therefore, it is important to carefully consider disease control programs in this region. This evaluation should focus on maintaining the status quo and improving early detection of TB, ensuring an adequate duration of treatment, training private and public centers to improve care systems, and strengthening DOTs TB control program.

We need to have a suitable program for early diagnosis of TB, compliance with the length of treatment, and training of private and public centers to strengthen the care system. Additionally, we should strengthen the process of the directly observed treatment, short-course (DOTS) program to control TB.

LIMITATIONS OF THE STUDY

As this study was only conducted in the southern regions of Kerman province, it is important to be careful when applying the findings to other areas. To address these limitations, it is suggested to conduct similar research on a national scale.

DISCLOSURE STATEMENT

"Part of this article has previously been published in Process and outcome evaluation of directly observed treatment short course (DOTs) in Kerman city, Southeast of Iran.

LIST OF ABBREVIATIONS

TB = Tuberculosis

WHO = World Health Organization

DOTS = Directly Observed Treatment, Short-course

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article reports the results of a research project

approved by Jiroft University of Medical Sciences with the code of ethics (IR.JMU.REC.1399.067).

HUMAN AND ANIMAL RIGHTS

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1975 Helsinki Declaration and its later amendments or comparable ethical standards.

CONSENT FOR PUBLICATION

In order to comply with ethical considerations in this research, the information of the participants was kept confidential and other people were not able to access this information. The names and surnames of the participants were not used for data collection, and data collection was done after obtaining the code of ethics from Jiroft University of Medical Sciences.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author [S.D] upon reasonable request.

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CONFLICT OF INTEREST

The authors declare no conflict of interest financial or otherwise.

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