



ORIGINAL ARTICLE

# Utilization of Laboratory Tests for Tuberculosis and Mycobacterial Disease in Korea

Chang-Ki Kim <sup>a,\*</sup>, Sung Won Choi <sup>a</sup>, Mi-Sun Park <sup>b</sup>

<sup>a</sup>*Korean Institute of Tuberculosis, Cheongju, Korea.*

<sup>b</sup>*Division of Tuberculosis and Bacterial Respiratory Infections, Korea National Institute of Health, Cheongju, Korea.*

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**Abstract**

**Objectives:** In Korea, a large portion of tuberculosis (TB) patients are diagnosed and treated in private institutes. Laboratory tests are crucial for TB control. There are many possible problems using laboratory tests in the private sector. In this study, we aimed to investigate the characteristics and trends of utilizing laboratory tests for TB and mycobacterial diseases in the private sector by analyzing the National Health Insurance (NHI) database.

**Methods:** After selecting TB or other mycobacteria-related test items, we searched the number and cost of each item on the website of the Health Insurance Review and Assessment Service using the code of each test from 2007 to 2012.

**Results:** Our data revealed that the number and cost of tests drastically increased between 2007 and 2012. Culture and molecular tests primarily contributed to the tremendous increases. For each year, concentrated smearing and fluorochrome staining were more commonly used. The number of serologic tests for latent TB infection stagnated, despite the expansion of contact investigation.

**Conclusion:** The NHI data could be considerably useful for understanding the utilization trends of laboratory tests for TB and mycobacterial diseases in Korea. Our data showed that TB laboratory systems have recently improved. In this study, many issues were noticed. Therefore, solutions to these issues are required and the continued monitoring of NHI data regarding laboratory diagnosis.

## 1. Introduction

Tuberculosis (TB) is a very serious health threat in the world [1]. Many people develop and die of TB. Diagnosis and treatment are important pillars for controlling and eradicating TB, and laboratory tests are crucial for its

diagnosis. The roles of TB laboratory tests are to detect patients with TB, determine drug susceptibility, and monitor treatment response. Several conventional tests have been used for almost a century. However, there have been tremendous changes in TB diagnosis, and many new diagnostics have been introduced and

\*Corresponding author.

E-mail: [psaos95@gmail.com](mailto:psaos95@gmail.com)

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implemented for TB control [2]. Therefore, standardized use of various laboratory tests is necessary. The World Health Organization (WHO) released guidelines or policy statements regarding diagnosis to help TB programs use laboratory tests properly and adopt optimal diagnostic processes. Many countries, including Korea, prepare their own national guidelines for diagnosis and enable health workers to follow these guidelines [3]. However, this approach usually works well only in the public sector, not the private sector. There are many problems in the private sector in following a standardized practice. According to a TB notification report from the Korea Centers for Disease Control and Prevention (KCDC), >90% of patients with TB went to private institutes [4]. There are presumably many problems in using TB tests in the private sector, but few problems have been revealed. South Korea has a National Health Insurance (NHI) system, which is required by Korean law. It manages all medical practices and every private institute claims the fee of medical practice from NHI system. In this study, we aimed to investigate the characteristics and trends in the utilization of laboratory tests for TB and mycobacterial diseases in the private sector by analyzing the NHI database.

## 2. Materials and methods

We analyzed the insurance data of laboratory tests in relation to TB and mycobacterial diseases from 2007 to 2012. The names and insurance codes of the tests were selected from the health insurance database. These are

listed in Table 1 and included smear microscopy, culture, drug susceptibility testing (DST), nucleic acid amplification test (NAAT), rapid DST, identification of nontuberculous mycobacteria (NTM), and serologic tests for latent TB infection. We searched utilization information and the number of tests and their cost on the website of the Health Insurance Review and Assessment Service by using the code of each test ([http://hira.or.kr/rdd\\_disease.do?method=listInfoMdfee&pgmid=HIRAA020044020200](http://hira.or.kr/rdd_disease.do?method=listInfoMdfee&pgmid=HIRAA020044020200)).

## 3. Results

The total number of tests performed in 2007 was 1,941,086, which increased to 3,083,491 in 2012 (Table 1; Figure 1). The cost for TB and NTM laboratory tests was approximately 200 million Korean won, but it increased to more than twice this amount in 2012 (Figure 2).

### 3.1. Conventional tests

#### 3.1.1. Smear microscopy

Smear microscopy was the most frequently used test item for TB and NTM disease. In 2007, smear microscopy accounted for 56.2% of all tests. Since then, the proportion gradually declined and culture examination exceeded smear microscopy. Although the tested number was very large, its cost accounted for 13% in 2012. Smear microscopy had four types of smear preparation and straining methods. The proportion of concentrated smear tests with fuschin staining was highest in 2007; thereafter, it gradually decreased. In 2012, concentrated

**Table 1.** Insurance codes and tested number of laboratory tests for TB and mycobacterial disease (2007–2012).

Codes	Name of test	Year					
		2007	2008	2009	2010	2011	2012
B4105	Direct AFB smear (fuschin staining)	269,314	255,528	236,662	200,053	196,853	187,319
B4021	Direct AFB smear (fluorochrome staining)	164,399	211,119	225,209	233,912	224,115	204,167
B4120	Concentrated AFB smear (fuschin staining)	417,516	377,849	324,239	295,900	292,509	263,596
BX304	Concentrated AFB smear (fluorochrome staining)	240,335	292,028	375,930	456,174	525,890	631,729
B4054	Culture with solid media	641,642	684,430	673,820	747,309	785,001	844,677
B4055	Culture with liquid media	0	15,736	231,529	354,104	464,564	558,094
B4063	Drug susceptibility testing (<10 drugs)	1,773	1,548	1,260	1,214	1,395	1,427
B4064	Drug susceptibility testing (≥10 drugs)	24,557	25,916	28,029	30,240	32,894	38,560
C5953	TB PCR	19,549	23,606	19,344	17,567	15,859	20,871
CY051	TB nested PCR	36,347	33,567	28,918	29,485	23,636	34,555
C6021	TB real-time PCR	84,141	116,726	146,866	185,575	227,122	239,335
CY636	NTM identification	4,393	6,645	9,508	8,487	9,116	6,190
CY751	Rapid DST for RIF	1,565	2,294	3,089	3,763	5,111	6,673
CY752	Rapid DST for INH	1,088	1,788	2,681	3,471	4,950	6,465
CZ393	Interferon-gamma release assay	0	0	5,468	5,335	4,846	6,803
E7113	Tuberculin skin test	34,467	32,395	33,132	32,260	34,479	33,030
Total		1,941,086	2,081,175	2,345,684	2,604,849	2,848,340	3,083,491

AFB = acid-fast bacilli; DST = drug susceptibility testing; INH = isoniazid; NTM = nontuberculous mycobacteria; PCR = polymerase chain reaction; RIF = rifampicin; TB = tuberculosis.

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