

## Notified Incidence of Tuberculosis in Foreign-born Individuals in Jeju Province, Republic of Korea

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**Objectives:** In the Republic of Korea (ROK), the notified incidence of tuberculosis in foreign-born individuals (NITFBI) has increased recently, as has the rate of multidrug-resistant (MDR) and rifampicin-resistant (RR) tuberculosis in foreigners staying in the ROK. As Jeju Province in ROK has a no-visa entry policy, control programs for NITFBI should be consolidated. The aim was to evaluate the status of NITFBI, with a focus on the distribution of MDR/RR tuberculosis by nationality.

**Methods:** Data on tuberculosis incidence in individuals born in Jeju Province and in foreign-born individuals were extracted from the Korean Statistical Information Service of Statistics Korea, and the Infectious Disease Surveillance Web Statistics of the Korea Centers for Disease Control and Prevention, respectively.

**Results:** Among all notified incident cases of tuberculosis, the proportion of NITFBI increased from 1.46% in 2011 to 6.84% in 2017. China- and Vietnam-born individuals accounted for the greatest proportion of the 95 cases of NITFBI. Seven cases of MDR/RR tuberculosis were found, all involving patients born in China.

**Conclusions:** In Jeju Province, ROK, NITFBI might become more common in the near future. Countermeasures for controlling active tuberculosis in immigrants born in high-risk nations for tuberculosis should be prepared in Jeju Province, since it is a popular tourist destination.

**Key words:** Mycobacterium tuberculosis, Antitubercular agents, Drug resistance, Disease management, Internationality

### INTRODUCTION

Tuberculosis (TB) is one of the top 10 global causes of death, killing around 1.3 million individuals in 2017 [1]. Thanks to concerted international efforts, the incidence of TB has been decreasing at the rate of 2% per year globally [1], as well as in the Republic of Korea (ROK), for the last few decades [2].

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Meanwhile, the emergence of multidrug-resistant (MDR) and rifampicin-resistant (RR) TB has become one of the biggest issues in international TB control, as 3.5% of first-time patients and 18.0% of patients with a history of TB are determined to have either MDR or RR TB [1]. In particular, Chinese and Indian patients jointly account for 40% of the 160 000 global MDR cases [1], suggesting the importance of paying keen attention to TB patients from these countries.

The notified incidence of TB in foreign-born individuals (NITFBI) released by the Korea Centers for Disease Control and Prevention (KCDC) showed an increasing trend over a recent 5-year period, from 1213 cases in 2011 to 2569 cases in 2016 [3]. During the same period, the proportion of foreign nationals among MDR TB patients in ROK increased from 4.5% in 2011 to 20.5% in 2016 [2]. Given these circumstances, it is high

time for ROK to develop more proactive measures to manage foreign-born MDR and RR patients.

Jeju Province has proclaimed itself to be a “Free International City,” allowing foreigners to stay up to 30 days without a visa. As the island attracts more international visitors, it has become imperative that the government reinforce TB control policies and update the relevant guidelines. To this end, the present study examined the characteristics of foreign-born patients among new TB cases reported in Jeju Province and their drug resistance status.

## METHODS

This study included data from 2011 to 2017. In 2011, the nationality of TB patients began to be included in patient information as part of the National Tuberculosis Control Project,

aimed at enhancing the nationwide public-private partnership in TB control [2].

The data used for the analysis of new TB patients among

**Table 1.** Notified incident cases of tuberculosis in Jeju Province, Republic of Korea, 2011-2017

Year	Notified incident cases (n)	Foreign-born incident cases (%) [95% CI]	% change from 2011
2011	478	7 (1.46) [0.59, 2.99]	-
2012	498	14 (2.81) [1.54, 4.67]	1.35
2013	409	8 (1.96) [0.85, 3.82]	0.50
2014	375	12 (3.20) [1.66, 5.52]	1.74
2015	374	16 (4.28) [2.47, 6.86]	2.82
2016	311	12 (3.86) [2.01, 6.64]	2.40
2017	380	26 (6.84) [4.52, 9.86]	5.38
Total	2825	95 (3.36) [2.72, 4.09]	-

CI, confidence interval.

**Table 2.** General characteristics of notified tuberculosis (TB) cases in foreign-born individuals in Jeju Province, 2011-2017

Characteristics	2011 (n=7)	2012 (n=14)	2013 (n=8)	2014 (n=12)	2015 (n=16)	2016 (n=12)	2017 (n=26)	2011-2017 (n=95)
Age (y)								
≤19	0	0	0	0	1 (6.3)	0	1 (3.8)	2 (2.01)
20-29	4 (57.1)	8 (57.1)	4 (50.0)	6 (50.0)	7 (43.8)	8 (66.7)	6 (23.1)	43 (45.3)
30-39	1 (14.3)	2 (14.3)	4 (50.0)	3 (25.0)	4 (25.0)	1 (8.3)	8 (30.8)	23 (24.2)
40-49	1 (14.3)	1 (7.1)	0	1 (8.3)	0	0	4 (15.4)	7 (7.4)
50-59	1 (14.3)	1 (7.1)	0	0	1 (10.0)	2 (16.7)	5 (19.2)	10 (10.5)
60-69	0	1 (7.1)	0	1 (8.3)	3 (18.8)	0	1 (3.8)	6 (6.3)
≥70	0	1 (7.1)	0	1 (8.3)	0	1 (8.3)	1 (3.8)	4 (4.2)
Gender								
Men	3 (42.9)	8 (57.1)	2 (25.0)	6 (50.0)	6 (37.5)	9 (75.0)	13 (50.0)	47 (49.5)
Women	4 (57.1)	6 (42.9)	6 (75.0)	6 (50.0)	10 (62.5)	3 (25.0)	13 (50.0)	48 (50.5)
Nationality								
China	1 (14.3)	3 (21.4)	3 (37.5)	4 (33.3)	4 (25.0)	9 (75.0)	15 (57.7)	39 (41.1)
Vietnam	0	2 (14.3)	1 (12.5)	2 (16.7)	5 (31.3)	1 (8.3)	3 (11.5)	14 (14.7)
Nepal	0	0	1 (12.5)	2 (16.7)	3 (18.8)	0	2 (7.7)	8 (8.4)
Philippines	0	0	2 (25.0)	2 (16.7)	1 (6.3)	0	3 (11.5)	8 (8.4)
Indonesia	0	0	0	1 (8.3)	1 (6.3)	1 (8.3)	0	3 (3.2)
Mongolia	0	0	1 (12.5)	0	1 (6.3)	1 (8.3)	0	3 (3.2)
Cambodia	0	0	0	1 (8.3)	0	0	1 (3.8)	2 (2.1)
Russia	0	0	0	0	0	0	1 (3.8)	1 (1.1)
USA	0	0	0	0	0	0	1 (3.8)	1 (1.1)
Laos	0	1 (7.1)	0	0	0	0	0	1 (1.1)
Unknown	6 (85.7)	8 (57.1)	0	0	1 (6.3)	0	0	15 (15.8)
Others	-	-	0	1 (8.3)	1 (6.3)	-	-	-
Anti-TB medication history								
No	7 (100)	11 (78.6)	6 (75.0)	10 (83.3)	14 (87.5)	9 (75.0)	22 (84.6)	79 (83.2)
Yes	0	2 (14.3)	2 (25.0)	1 (8.3)	2 (12.5)	3 (25.0)	4 (15.4)	14 (14.7)
Unknown	0	1 (7.1)	0	1 (8.3)	0	0	0	2 (2.1)

Values are presented as number (%).

Jeju Province residents was the Tuberculosis Notification Status in ROK dataset, extracted from the Korean Statistical Information Service of Statistics Korea (<http://kosis.kr/index/index.do>). Statistics Korea has compiled the data that KCDC collected from public health centers and private clinics and hospitals across the nation. NITFBI in Jeju Province was defined as new TB cases reported in foreign-born patients whose residential address was in Jeju Province between 2011 and 2017. The data were derived from the Infectious Disease Surveillance Web Statistics of the KCDC (<https://is.cdc.go.kr>). Cases determined as MDR or RR through a drug resistance test were defined as drug-resistant TB.

The percentage of NITFBI in Jeju Province was calculated by dividing the number of foreign-born TB cases notified between 2011 and 2017 by the number of total notified TB cases during the same period. The 95% confidence intervals were derived using the binominal distribution method. Trends in the annual changes in the proportion of NITFBI were analyzed compared to the 2011 data. No further statistical analysis was performed, as the number of NITFBI cases was less than 30 each year. The institutional review board waived review of this study since only secondary data without any personal information were used.

## RESULTS

The total number of notified newly-occurring cases of TB between 2011 and 2017 in Jeju Province was 2825, among which 95 (3.36%) were in foreign-born individuals (Table 1).

The proportion of NITFBI has risen since 2011, growing by 1.77 times to 6.84% in 2017.

The general characteristics of the 95 NITFBI cases between 2011 and 2017 are demonstrated in Table 2. Patients in their 20s accounted for the largest proportion, followed by those in their 30s, together comprising 69.5% (66 of 95) of cases. There was no significant difference by gender. Chinese and Vietnamese nationals comprised the majority of cases, accounting for 69.5% (53 of 80) of all NITFBI cases, excluding those with unknown nationality. In 79 (83.2%) cases, the patients said they had never previously received anti-TB therapy at the time of notification, while 14 (14.7%) patients answered that they had.

Among the 82 cases where a smear test was performed for TB diagnosis, 22 (26.8%) had positive results (Table 3). Drug-resistance tests were positive in 7 cases (7.4%; 6 MDR, 1 RR), all of whom were Chinese nationals. This means that 17.9% of the 39 Chinese patients had drug-resistant TB.

## DISCUSSION

To summarize the results, the proportion of NITFBI in Jeju Province increased from 1.46% of all notified incident cases of TB in 2011 to 6.84% in 2017, and approximately half were in Chinese and Vietnamese nationals. A total of 7 cases were determined to be drug-resistant, all which were in Chinese nationals, indicating that 17.9% of all 39 Chinese NITFBI cases were drug-resistant.

It is notable that the number of NITFBI cases surged by 3.7 times from just 7 to 26 during the period from 2011 to 2017,

**Table 3.** Results of smear test and multidrug resistance (MDR)/rifampicin resistance (RR) test by nationality

Nationality	Smear test			Drug resistance test			Total
	Positive	Negative	No test	MDR-TB	RR-TB	No resistance	
China	11 (28.2)	25 (64.1)	3 (7.7)	6 (15.4)	1 (2.6)	32 (82.1)	39
Vietnam	2 (14.3)	10 (71.4)	2 (14.3)	0	0	14 (100)	14
Nepal	2 (25.0)	3 (37.5)	3 (37.5)	0	0	8 (100)	8
Philippines	1 (12.5)	4 (50.0)	3 (37.5)	0	0	8 (100)	8
Indonesia	1 (33.0)	2 (67.0)	0	0	0	3 (100)	3
Mongolia	1 (33.3)	2 (66.7)	0	0	0	3 (100)	3
Cambodia	0	2 (100)	0	0	0	2 (100)	2
Russia	0	1 (100)	0	0	0	1 (100)	1
USA	1 (100)	0	0	0	0	1 (100)	1
Laos	1 (100)	0	0	0	0	1 (100)	1
Others	2 (13.3)	11 (73.3)	2 (13.3)	0	0	15 (100)	15
Total	22 (23.2)	60 (63.2)	13 (13.7)	6 (6.3)	1 (1.1)	88 (92.6)	95 (100)

Values are presented as number (%).  
TB, tuberculosis.

while the total number of TB incidents was stable or decreased, as seen in Table 1. The number of foreign-born TB cases is expected to continue to grow, considering that Jeju Province is a popular tourist destination with a visa waiver program, attracting more and more visitors from abroad.

Most NITFBI are from high-TB-risk countries [4], with a transmission rate of TB of 50 or more per 100 000 population, and hold permits for work or study in ROK. The majority of the group was aged between 20 and 39, including individuals who were likely to be residing in Jeju Province for work or study. The key to managing incident TB cases in foreign-born individuals in the ROK is to understand and apply the 2018 National Guideline for Tuberculosis Control to visitors from high-TB-risk nations. Record-keeping regarding the personal information of foreign-born TB patients should also be strengthened, since 15 (15.8%) NITFBI cases were of unknown nationality.

The fact that all drug-resistant patients among foreign nationals were from China should also be considered in efforts to control TB in Jeju Province. This result is in line with a World Health Organization report [1] suggesting that 40% of all global drug-resistant TB cases are in either Chinese or Indian nationals. Visitors from high-TB-risk nations requesting visas for a stay of more than 90 days should be required to submit a verification of TB clearance issued by a hospital designated by the Korean embassy before entry [4], and the embassy should ensure that the verification is accurate. The 2018 National Guideline for Tuberculosis Control should also be updated to include protocols on how to manage latent TB cases during their stay in the ROK.

Furthermore, active TB patients from high-TB-risk nations who enter the country with a short-term visa and extend their stay are potentially harmful. Despite being diagnosed as active TB patients, there is a potential risk that they may transmit drug-resistant TB to domestic residents during their stay of up to 90 days, in which case the cost of diagnosis and treatment would be covered by the municipal government, and patients may abuse this system. These cases are managed as “intensive care targets” by the National Guideline for Tuberculosis Control [4], but care only takes place after an active TB patient has been granted entry. Strengthened measures should be taken against active TB patients before their entry in order to fundamentally address the issue. Without such measures, the management of drug-resistant TB patients is unlikely to be successful, with potentially disastrous consequences [5].

The limitations of this study mainly relate to limitations in

the data caused by the clinical characteristics of the disease. Individual patient information may vary at the time of data collection since it takes 2 months for *Mycobacterium tuberculosis* culture test results to be confirmed and 6 months for basic treatment. This is why the number of incident cases announced by the KCDC may not be consistent with the number of incident cases reported by the Jeju municipal government. The research team decided to use the municipal government data, considering the possibility of differences in the number of patients depending on the test and treatment periods and uncertainties in the statistical analysis. As a result, the annual KCDC data [3] reported a decline in the number of foreign-born TB patients in 2017 compared to the previous year, while Jeju Province has seen an increase from 12 to 26 during the same period. This discrepancy between the national and regional datasets is assumed to be the result of limitations in the data used for analysis, and the trends reported in this study should be confirmed through a further analysis of another dataset.

To conclusion, it is imperative that TB control measures and guidelines be updated and reinforced to effectively manage foreign-born active TB patients, in particular those aged 20-39 and those from high-TB-risk countries, as we have seen an increase in NITFBI and a greater potential risk of drug-resistant cases in Jeju Province. Stricter management policies should be put in place so that visitors' active TB status can be verified by qualified local hospitals.

## SUPPLEMENTARY MATERIALS

Korean version is available at <https://www.jpmp.org/>.

## CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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