Longitudinal epidemiology of pulmonary nontuberculous mycobacteria and tuberculosis in Singapore (2006-2024): Emerging dominance of *Mycobacterium abscessus*

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Introduction

Nontuberculous mycobacteria (NTM) are increasingly recognized as significant emerging pulmonary pathogens, with rising incidence reported globally as tuberculosis (TB) declines.

Although NTM epidemiology is well described in temperate regions, long-term data from tropical, high-density cities such as Singapore remain scarce. Local snapshots have also suggested a shift from Mycobacterium avium complex (MAC) to M. abscessus as the predominant species, but robust longitudinal analyses are lacking.

This study aimed to define the epidemiological trends and species distribution of pulmonary NTM disease in Singapore over time.

Methods

Retrospective review of all respiratory mycobacterial cultures at Singapore General Hospital (SGH) between 2006 and 2024.

- ✓ SGH hosts the Central Tuberculosis Laboratory (CTBL), which performs approximately 80% of the country's mycobacterial culture testing and serves as one of two centralised national reference laboratories .
- ✓ Pulmonary NTM (pNTM) defined using 2007 ATS/IDSA microbiologic criteria (≥2 specimens with same species or one positive BAL/biopsy)
- ✓ Pulmonary TB (pTB) defined as a single culture-positive respiratory specimen.
- ✓ ICD-10 coding data (2018–2024) were also analysed to verify trends.

Results

A total of 3877 pTB and 1825 pNTM cases met inclusion criteria. The incidence of pNTM increased from 35 to 65 per 100,000 patient-years, while pTB declined from 225 to 70 per 100,000 patient-years **(Figure 1).** ICD-10 coding data confirmed similar trends, with pTB incidence declining from 185 to 41 per 100,000 patient-years between 2018 and 2024, while pNTM remained stable at 40-43 **(Figure 2).**

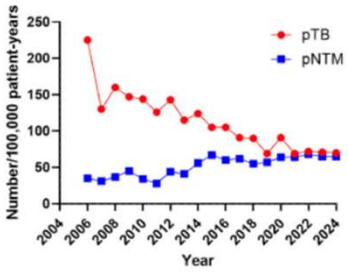

Figure 1: annual incidence of pTB vs pNTM (2006-2024)

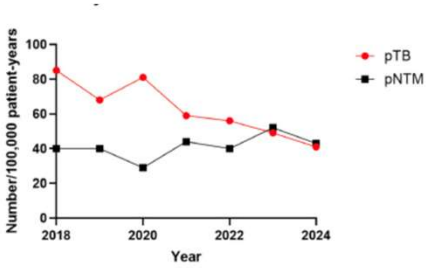

Figure 2: annual incidence of pTB vs pNTM by ICD-10 code (2018-2024)

Among the NTM isolates, the most common species in descending order were *M. abscessus* (*n* = 564, 30.9%), MAC (*n* = 510, 28.0%) and *M. kansasii* (*n* = 346, 19.0%) **(Figure 3).** Species distribution, derived from microbiological isolates, showed a steady decline in MAC and a marked rise in M. abscessus, which surpassed MAC as the most common species after 2014 **(Figure 4)**.

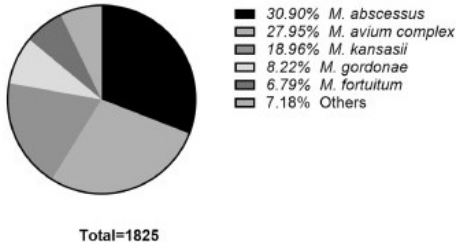

Figure 3: Distribution of pNTM subspecies identified (2006-2024)

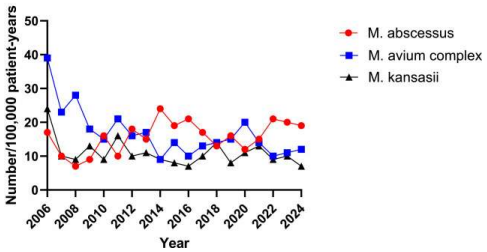

Figure 4: Annual incidence of pNTM caused by the most common subspecies (2006 - 2024)

Conclusion

Pulmonary NTM incidence in Singapore has increased two-fold over 20 years. Meanwhile, pulmonary TB incidence has declined steadily, approaching NTM case numbers by 2024. The emergence of M. abscessus as the predominant NTM species has important clinical and public health implications, underscoring the need for ongoing integrated surveillance and tailored management strategies in tropical urban environments.

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