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Molecular epidemiology of human tuberculosis in New Zealand and potential insights for disease control

Tuberculosis (TB) is a leading cause of infectious mortality worldwide, killing approximately 1.4 million people each year.[1] In New Zealand during 2011, 308 new cases of TB were diagnosed including 2 cases of multidrug-resistant TB.[2]

After a peak in TB notifications in New Zealand of 142 cases per 100,000 in 1943,[3] the incidence has decreased to the present 7 cases per 100,000.[2,4] Much of the decline can be attributed to appropriate public health control measures and enacted legislation including the 1948 Tuberculosis Act.

Today, New Zealand is considered a low incidence country with respect to TB. However, this status can potentially mask significant disparities that exist in the incidence of TB between different ethnic groups in New Zealand. For example, disproportionately high rates of TB were observed, in both 2010 and 2011 among the Asian ethnic group [51.9/100,000[4] and 40.6/100,000,[2] respectively]. This means that among Asian persons in New Zealand, rates of TB are roughly comparable to the overall national rate in Brazil, one of 22 World Health Organisation designated high-burden countries for TB.[1]

In recent years in New Zealand, there has also been a marked change in the demographics of TB patients specifically with respect to the patient's country of origin. The proportion of TB cases occurring in overseas-born persons has increased from 47.5% of cases in 1995[5] to 75.4% in 2011.[2]

Importantly, within this group, the highest numbers of cases occur within the first three years post entry into New Zealand.[2] This indicates that a large proportion of overseas-born individuals may already be infected with *Mycobacterium tuberculosis* complex (MTBC) prior to their arrival in New Zealand. This deduction is supported by recent molecular epidemiological evidence. A strong association has been identified between the genetic lineage of the MTBC strain causing infection and the predominant lineage in the patient's country of origin.[6]

Beyond the first year after arrival in New Zealand there is a sequential decrease in the rate of TB over subsequent years.[7] In contrast, for patients originally from low-incidence countries, few cases occur within the first year of arrival and most occur after being in New Zealand for a period of over 20 years.[7]

In response to this, Immigration New Zealand introduced additional TB control measures in 2005. These include the requirement that persons who do not hold a passport from a list of low incidence TB countries and who plan to stay in New Zealand for 6 to 12 months, provide a chest X-ray certificate with their temporary entry class visa application.[8] However, effective TB control not only requires measures to manage the number of overseas cases reaching New Zealand.

Some populations of New Zealand born persons also have disproportionately high rates of TB. Māori, for example, have an approximately six-fold higher rate of TB

compared to NZ Europeans.[2,4] Interestingly, recent findings based on molecular TB typing methods show that Māori are more likely than Europeans to be infected with non-unique molecular strains.[2,4] Clustering of non-unique molecular types has been seen also in the predominant genetic lineages of MTBC present in Māori cases.[6]

Patients sharing the same non-unique MTBC molecular type are likely to be connected epidemiologically by a shared chain of transmission. While further investigation is required to confirm this, the existing data suggest that there is a higher level of onward transmission of TB among Māori than among NZ Europeans.

The median interval from onset of symptoms to commencement of treatment reported for TB cases in New Zealand in 2011 was 5 months.[2] Delays in the diagnosis and treatment of TB of greater than 2 months increase the risk of spread of infection to household contacts, worsened severity of disease, and mortality.[9]

Conversely, early detection and treatment minimises the risk of transmission.[10] Proposed measures to reduce detection times in New Zealand include community education on the symptoms of TB, heightened clinical awareness of TB among general practitioners, and earlier laboratory investigation of individuals in high risk groups.[11]

Further measures that have recently been introduced into routine use in New Zealand include rapid laboratory diagnostic technologies and eNotification of laboratory results. Expansion of the DOTS programme could also be considered with a view to reducing disease progression and the risk of ongoing transmission among high TB risk populations.

While the level of investment required for each of these measures may vary, selective targeting of resources towards earlier diagnosis and treatment of TB among high risk populations in New Zealand seems likely to be a cost effective approach to reducing TB case numbers in New Zealand and decreasing the associated costs to the NZ healthcare system.

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