Tuberculosis case finding in South Africa
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SUMMARY
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South Africa is one of the 22 tuberculosis (TB) high burden countries in the world according to the World Health Organisation. TB is the main cause of death in South Africa with TB mortality at 49 (95% CI 21-87) per 100,000 population in 2011. In 2011 TB prevalence was estimated to be 768 (95% CI 399-1250) per 100,000 and TB incidence 933 (95% CI 819-1180) per 100,000. A quarter of notified cases in Africa are from South Africa. TB is acknowledged by the South African government as a major threat to the health of the South African population. TB is a notifiable disease and is recorded and reported (Health Act, Act No. 61 Of 2003) to the local, provincial and/or national Health Departments. The directly observed therapy, short course (DOTS) strategy was introduced in South Africa in 1999.

TB case finding is a crucial element of the TB control strategy since it identifies the source of infection in a community, indicating the individuals who are emitting *Mycobacterium tuberculosis* bacilli. By treating these individuals thereby making them non-infectious, the transmission chain is cut. Possible ways of case finding are illustrated in the ‘onion model’ and Piot model which include the following steps: developing TB, contact with health service, TB diagnosis, start of TB treatment, and treatment completion. The overall aim of this thesis was to evaluate gaps regarding case finding according to the ‘onion model’ in the South African National TB Programme.

In Chapter 1, the research topic area, namely TB case finding in South Africa, is introduced together with a description of the TB programme in South Africa, as the setting of the studies presented.

Chapter 2 describes a TB prevalence survey in two communities in the Western Cape province of South Africa with the aim of assessing the completeness of case finding. In Community A, the adjusted prevalence of culture positive TB was 32 (95% CI 25-41) per 1000. In Community B, the adjusted prevalence of culture positive TB was 24 (95% CI 17-32) per 1000. In Community A the patient diagnostic rate was 0.38 per person-year while in community B it was 0.30 per person-year. In both communities TB prevalence was higher and the patient diagnostic rate lower than the national estimates, suggesting that cases are not detected at a sufficient rate to interrupt transmission. Poor case detection may contribute to the rising TB incidence in South Africa. The TB epidemic should therefore be addressed rapidly and effectively, especially in the presence of the concurrently high HIV prevalence.

Chapter 3 describes an exit study completed at two primary healthcare facilities in the Western Cape province of South Africa in 2011. The participants in this study completed an exit interview after leaving the facilities in order to identify gaps in diagnosing TB among health facility attendees. Twenty-one (5%) participants were diagnosed with culture positive TB. None had sought care at the facility because of
their respiratory symptoms, none were asked about respiratory symptoms during their visit and none were asked to produce a sputum sample. This study indicates that patients with infectious TB attend primary healthcare facilities, but are not recognised and diagnosed as cases. Healthcare staff should search actively within facilities for cases who attend healthcare services to ensure that cases are not missed. Intensified case finding must start within the facility, without limiting it to patients who report respiratory symptoms or are HIV positive.

Chapter 4 describes a cross sectional ecological study which aimed to determine initial loss to follow-up (defined as loss to follow-up after diagnosis and before start of treatment) and determinants thereof at 133 primary healthcare facilities in five provinces of South Africa in 2009. The mean initial loss to follow-up rate was 25% (22-28%). Turnaround time was overall associated with initial loss to follow-up (p=0.008). Clinics were classified into three categories depending on the proportion of sputum results available within two days: category 1 (0-32%), 2 (33-66%) and 3 (67-100%). Compared with category 1, initial loss to follow up was lower in category 2 (OR 0.73, 95% CI 0.48-1.13) and category 3 (OR 0.62, 95% CI 0.39-0.99). This study showed that initial loss to follow-up should be reduced and reported as part of the TB programme.

Chapter 5 describes, from the same set of 133 primary healthcare facilities, the number of healthcare workers diagnosed with TB during a three year period and the infection control practices at the facilities. The standardised incidence ratio of smear positive TB in primary healthcare workers indicated an incidence rate of more than double that of the general population. In a univariable logistic regression, the infection control audit score was significantly associated with reported cases of TB in healthcare workers (OR=1.04, 95%CI 1.01-1.08) as was the number of staff (OR=3.8, 95%CI 1.8-8.1). In the multivariable analysis, the number of staff remained significantly associated with TB in healthcare workers (OR=3.3, 95%CI 1.4-8.1). The high rate of TB in healthcare workers suggests a substantial nosocomial transmission risk. The infection control audit tool used did not perform adequately as a measure of this risk. This study suggests that infection control measures should be monitored by validated tools developed and tested locally. Different strategies, such as routine surveillance systems, could be used to evaluate the burden of TB in healthcare workers in order to calculate TB incidence, monitor trends and implement interventions to decrease occupational TB.

The study in chapter 6 aimed at determining TB incidence in research field workers from the Western Cape. 180 field workers were included in the analysis. Eleven TB cases were identified over 250.4 person-years of follow up. All cases were identified among community based field workers. The TB incidence was 4.4 (95% CI 2.5-7.9) per 100 person-years. The standardised TB morbidity ratio was 2.5 (95% CI 1.3-4.3). Research field workers had a 2.5 times higher TB incidence than the community indicating that
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it is the responsibility of principal investigators to implement occupational health and infection control guidelines to protect researchers working in the community.

In chapter 7, the general discussion chapter, the implications of these studies are discussed. In essence, this thesis showed that TB case finding in South Africa is not sufficient to stop transmission. As a consequence, TB transmission continues within facilities and in communities. TB programme strategies to improve case detection and reduce initial loss to follow up need to be developed and evaluated.