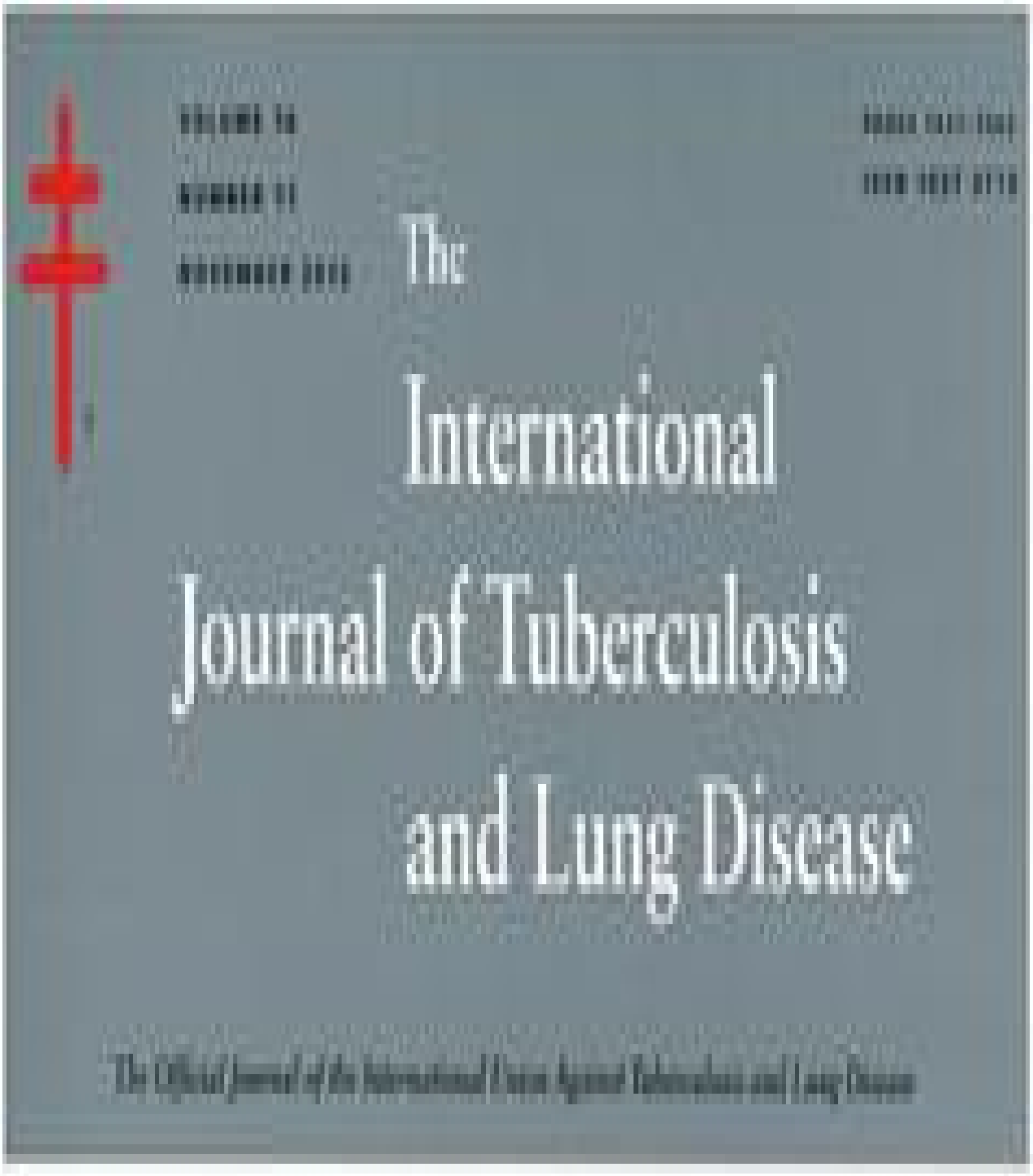
The
International
Journal of Tuberculosis
and Lung Disease

Volume 22, Number 9, 1 September 2018

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INT J TUBERC LUNG DIS 22(9):1088–1094

http://dx.doi.org/10.5588/ijtld.17.0827

Computer-assisted chest radiography reading for tuberculosis screening in people living with diabetes mellitus

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SUMMARY

BACKGROUND: Diabetes mellitus is a significant risk factor for tuberculosis (TB). We evaluated the performance of computer-aided detection for tuberculosis (CAD4TB) in people living with diabetes mellitus (PLWD) in Indonesia.

METHODS: PLWD underwent symptom screening and chest X-ray (CXR); sputum was examined in those with positive symptoms and/or CXR. Digital CXRs were scored using CAD4TB and analysed retrospectively using clinical and microbiological diagnosis as a reference. The area under the receiver operator curve (AUC) of CAD4TB scores was determined, and an optimal threshold score established. Agreement between CAD4TB and the radiologist's reading was determined.

RESULTS: Among 346 included PLWD, seven (2.0%) had microbiologically confirmed and two (0.6%) had clinically diagnosed TB. The highest agreement of CAD4TB with radiologist reading was achieved using a threshold score of 70 ($\kappa = 0.41$, $P < 0.001$). The AUC for CAD4TB was 0.89 (95%CI 0.73–1.00). A threshold score of 65 for CAD4TB resulted in a sensitivity, specificity, positive predictive value and negative predictive value of respectively 88.9% (95%CI 51.8–99.7), 88.5% (95%CI 84.6–91.7), 17.0% (95%CI 7.6–30.8) and 99.6% (95%CI 98.2–100). With this threshold, 48 (13.9%) individuals needed microbiological examination and no microbiologically confirmed cases were missed.

CONCLUSIONS: CAD4TB has potential as a triage tool for TB screening in PLWD, thereby significantly reducing the need for microbiological examination.

KEY WORDS: CAD4TB v 5; triage tool; Indonesia

IT HAS LONG BEEN RECOGNISED that people living with diabetes mellitus (PLWD) are disproportionally affected by tuberculosis (TB).[1] Compared with people without diabetes mellitus (DM), PLWD have an increased risk of *Mycobacterium tuberculosis* infection,[2] at least a two-fold higher risk of developing TB,[3–6] and experience worse outcomes once diagnosed with TB.[7] In 2015, there were approximately 10.4 million new TB cases and 1.4 million deaths caused by TB worldwide.[8] The six countries with the highest number of incident TB cases in 2015 were India, Indonesia, China, Nigeria, Pakistan and South Africa. Of these, Indonesia accounted for 10% of global cases, with an estimated 1 020 000 new TB cases in 2015.[8] Approximately 9.5% of all TB cases in Indonesia in 2010 were attributable to DM, and this percentage is estimated to increase to 14% by 2030.[9] The International Diabetes Federation predicts that global DM prevalence will increase from 7% (415 million) in 2015 to 10% (642 million) by 2040.[10,11] Indonesia has the seventh highest DM prevalence rate worldwide, with 10 million (6.2%) PLWD in 2015; this prevalence has been estimated to increase to 16.2 million people by 2040.[10]

To address the double burden of TB and DM and the absence of international guidelines, the World Health Organization (WHO) and the International Union Against Tuberculosis and Lung Disease developed a collaborative framework setting out the principles for bidirectional screening and integrated management.[12] Studies on how best to screen for TB in PLWD have mainly focused on symptom screening and chest radiography (CXR).[13,14] Novel technologies such as the Xpert® MTB/RIF assay (Cepheid,

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Article submitted 29 November 2017. Final version accepted 21 April 2018.