Abstract

Background: In Kenya, sputum smear microscopy, especially Ziehl-Neelsen (ZN) method has been the cornerstone for tuberculosis (TB) diagnosis at most public health facilities. Recently, Led Emitted Diodide (LED) fluorescent microscopy (FM) and Xpert MTB/ RIF (GeneXpert), have been introduced in selected health facilities for diagnosis of TB and Drug Resistant TB. This study was undertaken to determine and compare the performance (sensitivity, specificity, positive and negative predictive test values) of these two new TB diagnostics with ZN microscopy as a benchmark.

Methods: A cross-sectional study was conducted between February 2013 and August 2014 in nine selected public health, facilities in Kenya. People with presumptive TB aged 18years and above both new and retreatment cases attending the facilities with symptoms suggestive of TB (including cough of two or more weeks) were eligible for the study and consecutively recruited. Two sputum specimens (spot and early morning) were collected over two consecutive days. A total of 3073 sputum samples were collected from 1891 people with presumptive TB. The specimens from study sites were appropriately packaged and shipped to the TB research laboratory in KEMRI, Nairobi, where samples were received and processed for ZN, LED, GeneXpert, LJ and MGIT culture in accordance with standard procedures. Culture was used as a gold standard. The study was approved by the Ethical Review Committee of KEMRI.

Results: A total of 639 specimens from 390 patients with culture results were included in the analysis. GeneXpert showed significantly higher sensitivity (83.7% (95%CI: 76.6-90.8)) than ZN (65.4% (95%CI: 56.3-74.5)) and FM (68.3% (95%CI: 59.4-77.2)) microscopy methods in the diagnosis of TB. On the contrary, specificity of GeneXpert (87.9% (95%CI: 85.1-90.7)) was significantly lower than that of ZN (93.5% (95%CI: 91.4-95.6)) and FM (93.3% (95%CI: 91.2-95.4)) microscopy. GeneXpert sensitivity in smear positive culture positive was (95.6% (95%CI: 90.7-100.0)) and (97.2% (95%CI: 93.4-100.0)) for ZN and FM, respectively, it was significantly lower in smear negative culture positive specimens with (61.1% (95%CI: 45.2-77.0)) and (54.5% (95%CI: 37.5-71.5)) for ZN and FM, respectively. Sensitivity was significantly higher in specimens from new people with presumptive TB (71.1% (95%CI: 61.4-80.9)) for ZN, (73.5% (95%CI: 64.0-83.0)) for FM and (89.2% (95%CI: 82.5-95.9)) for GeneXpert than those from retreatment cases (42.9% (95%CI: 21.7-64.1)), (47.6% (95%CI: 26.2-69.0)) and (61.9% (95%CI: 41.1-82.7)), respectively. Overall, HIV status did not affect

the performance of GeneXpert. However, Sensitivity of GeneXpert (84.4(95%CI: 71.8-97.0))was significantly higher in HIV positive than that of ZN (53.1% (95%CI: 35.8-70.4)) and FM (56.3% (95%CI: 39.1-73.5)) microscopy. There was no significant difference in sensitivity of ZN (70.8% (95%CI: 60.3-81.3))and FM (73.6% (95%CI: 63.4-83.8)) in HIV negative specimens compared to sensitivity of ZN (53.1% (95%CI: 35.8-70.4)) and FM (56.3% (95%CI: 39.1-73.5)) in HIV positive specimens. A small proportion (6.2%) of specimens with ZN and culture negative results was positive by GeneXpert.

Conclusions: Performance of GeneXpert is higher than both ZN and FM microscopy for diagnosis of TB in Kenya and is comparable w ith performance indicated in a few previous studies in Africa. Despite the low sensitivity in smear negative culture positive specimens, GeneXpert has potential to increase diagnostic yield in smear and culture negative specimens, especially from HIV positive people with presumptive TB. Further studies are required to ascertain its specificity and applicability in specific patient populations. This will be possible when patient clinical details are linked with respective laboratory data as a result of combination of tests to improve diagnostic yield.