Sensitivity, specificity, and predictive values are clinically relevant because they inform us how well a test will perform in certain clinical contexts. The preferred approach for ascertaining these parameters is therefore a per subject analysis in which each subject is labelled as either test positive or test negative and the test status is matched against the representative histological result of the subject’s biopsy. Study subjects should also be representative of those encountered in a typical clinical scenario.

To illustrate the potential flaw in a per lesion analysis, let us vary the number of biopsy samples taken arbitrarily from non-suspicious sites in both arms (WLB plus AFB arm versus WLB alone) of the quoted study without changing negative predictive values and the number of biopsy samples from suspicious sites (table 1). When the number of non-suspicious biopsy samples is doubled or tripled, the sensitivity, specificity and prevalence in each arm change accordingly. The sensitivity of WLB plus AFB relative to that of WLB alone also changes from 1.42 (95% CI 0.94 to 2.15) to 1.72 (95% CI 1.04 to 2.83) and 1.94 (95% CI 1.13 to 3.33), respectively. Likewise, the prevalence of invasive lesions detected by WLB plus AFB relative to that detected by WLB alone changes from 1.61 (95% CI 0.93 to 2.79) to 1.37 (95% CI 0.84 to 2.22) and 1.23 (95% CI 0.79 to 1.90), respectively. Thus, a per lesion approach could generate different sets of arbitrary values according to an arbitrary change in the number of biopsy samples taken from non-suspicious areas.

## Table 1 Effects of varying the number of samples from non-suspicious areas in a per lesion analysis

<table>
<thead>
<tr>
<th>Diagnostic test</th>
<th>Biopsy results</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>WLB alone</td>
<td>Test positive</td>
<td>98</td>
<td>73.5</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Test negative</td>
<td>6</td>
<td>96.9</td>
<td>3.6</td>
</tr>
<tr>
<td>WLB+AFB</td>
<td>Test positive</td>
<td>98</td>
<td>73.5</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Test negative</td>
<td>6</td>
<td>96.9</td>
<td>3.6</td>
</tr>
</tbody>
</table>

*Figures as reported in the study by Häußinger et al.*

### References


### Competing interests
None.

### Funding
None.

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## A&E department: a missed opportunity for diagnosis of TB?

The World Health Organization declared tuberculosis (TB) to be a global emergency in 1993. Since then there has been a resurgence of TB in England and Wales, particularly in London.3,4 Early diagnosis, particularly of infectious cases, is a major factor in the success of control programmes.3 In the UK, TB continues to disproportionately affect vulnerable groups—including the homeless, illicit drug users, alcoholics, and immigrants recently arrived from high prevalence countries. These groups frequently find it difficult to access appropriate health care and often rely on Accident and Emergency (A&E) departments for healthcare provision. We examined how frequently patients with TB attended the local A&E department before their diagnosis and whether their A&E attendances led to a diagnosis of TB being made.

From January 2001 to March 2002 there were 130 notifications of TB at University College London Hospitals. For each patient with TB the A&E department records were examined for the 6 month period before the date of diagnosis. Forty one (31%) of the 130 patients attended the A&E department on 51 occasions during the 6 months prior to diagnosis. Thirty six of the 41 (88%) had no access to a general practitioner; of the remainder, the majority self-referred to A&E. The demographic characteristics of patients attending A&E and the 130 patients were similar. Of A&E attenders, 17 were black African, 13 were Asian, and 11 were white. Eighteen had underlying risk factors...
Table 1 Patients in whom TB was not diagnosed as a result of their A&E attendance (12 attendances in 10 patients)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Ethnic group</th>
<th>Age (years)</th>
<th>Risk factor for TB</th>
<th>Admitted to hospital</th>
<th>Site of TB</th>
<th>Microbiologically confirmed diagnosis</th>
<th>Time from A&amp;E attendance to diagnosis of TB (days)</th>
<th>Reason for presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>White</td>
<td>65</td>
<td>HIV+</td>
<td>Yes</td>
<td>Pleural</td>
<td>No</td>
<td>178</td>
<td>Dyspnoea, ankle oedema</td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Pleural</td>
<td>No</td>
<td>155</td>
<td>Dyspnoea, ankle oedema</td>
</tr>
<tr>
<td>2</td>
<td>Asian</td>
<td>53</td>
<td>Dialysis</td>
<td>Yes</td>
<td>Pleural</td>
<td>No</td>
<td>122</td>
<td>Sepsis, MRSA bacteremia</td>
</tr>
<tr>
<td>3</td>
<td>Black African</td>
<td>25</td>
<td>HIV+</td>
<td>Yes</td>
<td>Meningitis</td>
<td>No</td>
<td>45</td>
<td>Headache, malaise, right iliac fossa pain,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dysspncea, bronchietasis</td>
</tr>
<tr>
<td>4a</td>
<td>Asian</td>
<td>59</td>
<td>No</td>
<td>Yes</td>
<td>Pulmonary</td>
<td>Smear positive, sensitive</td>
<td>126</td>
<td>Power failure at home</td>
</tr>
<tr>
<td>4b</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>Pulmonary</td>
<td>Smear positive, sensitive</td>
<td>134</td>
<td>Mouth ulcers</td>
</tr>
<tr>
<td>5</td>
<td>Asian</td>
<td>3</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>No</td>
<td>166</td>
<td>Mouth ulcers</td>
</tr>
<tr>
<td>6</td>
<td>Asian</td>
<td>24</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>Smear positive, sensitive</td>
<td>100</td>
<td>Malaise, weight loss</td>
</tr>
<tr>
<td>7</td>
<td>Asian</td>
<td>16</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>Smear positive, MDR</td>
<td>2</td>
<td>Haemoptysis</td>
</tr>
<tr>
<td>8</td>
<td>Black African</td>
<td>30</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>Smear negative, sensitive</td>
<td>184</td>
<td>Cough, diagnosed as LRTI</td>
</tr>
<tr>
<td>9</td>
<td>Black African</td>
<td>22</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>No</td>
<td>12</td>
<td>Foreign body in ear</td>
</tr>
<tr>
<td>10</td>
<td>Asian</td>
<td>40</td>
<td>No</td>
<td>No</td>
<td>Pulmonary</td>
<td>No</td>
<td>82</td>
<td>Cough</td>
</tr>
</tbody>
</table>

*HIV infection only diagnosed after admission to hospital. MRSA, methicillin resistant Staphylococcus aureus; HIV+; infected with human immunodeficiency virus; LRTI, lower respiratory tract infection; MDR, multidrug resistant.

for TB (HIV infection in 10, alcohol abuse in five, illicit drug use in one, and renal failure in two). The site of infection was pulmonary in 27 (17 smear positive), pleural in five, lymph node in three, meninges in three, abdominal in two, and spinal in one. Of 30 patients who were culture positive, 24 had sensitive TB, two had isoniazid monoresistant disease, two had streptomycin monoresistant disease, and two had multidrug resistant TB.

Patients were admitted to hospital on 35 of the 51 attendances at the A&E, three directly to the intensive care unit. TB was not diagnosed on five of the 35 occasions (three patients, table 1). Patients were not admitted following the remaining 16 attendances but in three patients a diagnosis of TB was made at the time of A&E attendance. Five patients were referred to (and one already had) an appointment for the TB clinic. In seven patients TB was not diagnosed (table 1).

At this centre almost one third of patients with TB attended the A&E department in the 6 months prior to diagnosis. The diagnosis of TB was missed in 10/41 A&E attendances (24.3%). This may represent an underestimate as patients may have attended other A&E departments, or may have been seen in our A&E department but treated for TB at another hospital. The reason for this high rate of A&E attendance may reflect the inability of this patient group to access appropriate health care. This suggestion is supported by the finding that 69% of patients in whom TB was subsequently found required admission to hospital compared with an overall figure of 6.7% of all A&E attendances during this period.

The diagnosis of TB was made as a direct result of the A&E attendance in three quarters of patients. Possible reasons for missed diagnosis in the remainder include failure to suspect TB, presenting symptoms not typical of TB, other diagnoses being more clinically apparent, and some patients may not have had TB at the time of their A&E presentation.

A&E departments serving vulnerable populations represent an opportunity for the early diagnosis of TB.1 Staff working in this environment should have a high index of suspicion for this diagnosis, particularly in patients at risk of infection, regardless of their reason for A&E attendance.

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