

# Update to: Application of Bayesian decision-making to laboratory testing for Lyme disease and comparison with testing for HIV

Michael J Cook<sup>1</sup>  
Basant K Puri<sup>2</sup>

<sup>1</sup>Independent researcher, Highcliffe, UK; <sup>2</sup>Department of Medicine, Hammersmith Hospital, Imperial College London, London, UK

Correspondence: Michael J Cook  
39, Merley Drive, Highcliffe BH23 5BN,  
Dorset, UK  
Tel +44 1425 270 832  
Email mcook98@msn.com

In our recent Bayesian analysis paper, false-negative results were compared between Lyme disease and HIV using a recommended test algorithm.<sup>1</sup> When the two-tier test methodology for Lyme disease was compared with HIV two-stage testing, false negatives could be more than 500 times higher for Lyme disease testing.

The two-stage HIV test was designed to be used if an initial test was negative and there was symptomatic or subjective evidence that HIV infection could be present. The method reduces the chance of negative results resulting from determinate or random errors encountered in sampling and medical laboratory practice.

Based on the very high sensitivity and specificity of HIV tests, an updated methodology recommends that a second test of negative samples should not be carried out.<sup>2</sup> A second test is recommended for positive samples, not as a two-tier confirmatory test as with Lyme disease but to identify the HIV-1 or HIV-2 antibody/antigen type.

The last column of Table 1 demonstrates that when false-negative tests are compared between the two-tier test for Lyme disease and a single HIV test, false negatives are still up to more than 500 times higher for Lyme disease testing.

**Table 1** Comparison of false-negative probabilities for LD and HIV testing: clinical samples

|                    | LD testing (test dependence 0.63) |                  |  |                  | HIV disease testing (test dependence 0.950) |              |  |                       | False negative ratio          |                                 |
|--------------------|-----------------------------------|------------------|--|------------------|---|--------------|--|-----------------------|-------------------------------|---------------------------------|
|                    | Test sensitivity                  |                  | Probability of a false-negative result |                  | Test sensitivity                            |              | Probability of a false-negative result |                       | Two-tier LD and two-stage HIV | Two-tier LD and single HIV test |
| LD stage           | First-tier test                   | Second-tier test | First-tier test                        | Second-tier test | First stage                                 | Second stage | Single-stage HIV test                  | Second-stage HIV test |                               |                                 |
| Acute              | 20.4%                             | 21.2%            | 79.6%                                  | 85.6%            | 98.6%                                       | 98.6%        | 1.40%                                  | 1.33%                 | 64                            | 61                              |
| Early intermediate | 30.4%                             | 31.5%            | 69.6%                                  | 77.3%            | 98.9%                                       | 98.9%        | 1.10%                                  | 1.05%                 | 74                            | 70                              |
| Convalescent       | 37.2%                             | 38.6%            | 62.8%                                  | 71.3%            | 99.4%                                       | 99.4%        | 0.60%                                  | 0.57%                 | 125                           | 119                             |
| Late intermediate  | 45.5%                             | 47.3%            | 54.5%                                  | 63.3%            | 99.7%                                       | 99.7%        | 0.30%                                  | 0.29%                 | 222                           | 211                             |
| Neuro/arthritis    | 53.1%                             | 55.2%            | 46.9%                                  | 55.7%            | 99.9%                                       | 99.9%        | 0.100%                                 | 0.095%                | 586                           | 557                             |

**Abbreviations:** LD, Lyme disease; Neuro, neurological.

## Disclosure

The authors report no conflicts of interest in this work.

## References

1. Cook MJ, Puri BK. Application of Bayesian decision-making to laboratory testing for Lyme disease and comparison with testing for HIV Application of Bayes to Lyme disease testing. *Int J Gen Med.* 2017;10:113–123.
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