

# Bovine Tuberculosis Diagnosis: Estimation of the Tuberculin Skin Test and Post-mortem Examination Test Characteristics in Northern Ireland Using Bayesian Latent Class Analysis

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## Introduction

- Estimating the performance characteristics of bovine tuberculosis (bTB) diagnostic tests is necessary in order to help optimise detection of infected animals.
- One of the challenges is the absence of a reference bTB diagnostic test with known test characteristics.
- Latent class analysis has been previously used to address this, but the results have shown a lot of variation, particularly in relation to sensitivity of the Single Intradermal Comparative Cervical Tuberculin (SICCT) test.

## Materials & Methods

- Data were collected from all cattle slaughtered in abattoirs in Northern Ireland in 2015.
- We applied both the Hui-Walter latent class model under the Bayesian framework and the Bayesian model specified at the animal level, including various risk factors as predictors, to estimate the SICCT test and post-mortem examination characteristics.
- For the animal level model, the risk factors *age at death*, *sex* and *last test reason* were included.

## Results

- The Hui-Walter model and the animal level model demonstrated comparable posterior median estimation for the sensitivity of the SICCT test at standard interpretation (88.61% and 90.56%, respectively).
- The Hui-Walter model and the animal level model demonstrated comparable posterior median estimation for the sensitivity for post-mortem examination (53.65% and 53.79%, respectively).
- The two models showed almost identical posterior medians for the specificity ( $\geq 99.99\%$  vs 99.80% for SICCT test and 99.66% vs 99.86% for post-mortem inspection).
- However, the animal level model showed narrower posterior credible intervals, indicating more certainty for the estimates.



	Hui-Walter model	
	SICCT test <sup>#</sup>	Post-mortem
<b>Sensitivity (%)</b>	<b>88.61</b>	<b>53.65</b>
<b>(95% CrI<sup>^</sup>)</b>	[85.39 – 92.23]	[52.59 – 54.75]
<b>Specificity (%)</b>	<b>99.99</b>	<b>99.66</b>
<b>(95% CrI<sup>^</sup>)</b>	[99.97 – 100.00]	[99.60 – 99.71]
	Animal level model with risk factors	
	SICCT test <sup>#</sup>	Post-mortem
<b>Sensitivity (%)</b>	<b>90.56</b>	<b>53.79</b>
<b>(95% CrI<sup>^</sup>)</b>	[89.80 – 91.44]	[53.00 – 54.64]
<b>Specificity (%)</b>	<b>99.80</b>	<b>99.86</b>
<b>(95% CrI<sup>^</sup>)</b>	[99.51 – 100.00]	[99.55 – 100.00]

<sup>#</sup> Single Intradermal Comparative Cervical Tuberculin test (standard interpretation)

<sup>^</sup> Credible Interval

## Conclusion

- The Bayesian model specified at the animal level offers the possibility to make more precise estimates of test characteristics as well as assessing the impact of relevant risk factors.
- This study was carried out in slaughtered cattle. While this may not be an accurate representation of the general cattle population, it is probably less biased than estimates from similar studies that utilized data from established bTB breakdown herds.

