

Evaluation and comparison of two point-of-care tests for bovine clinical mastitis

F B Malcata¹, L Viora¹, P T Pepler², R N Zadoks^{1,2,3}

¹School of Veterinary Medicine, University of Glasgow, UK

²Institute for BAHC Medicine, University of Glasgow, UK

³Sydney School of Veterinary Science, University of Sydney, Australia



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Next Generation Dairying...
...for Local and Global Consumers

Hannah Dairy Research
Foundation

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Introduction

Mastitis



Prudent antimicrobial use



World Health
Organization



Introduction

Antibiotics beneficial for non-severe clinical mastitis caused by Gram+ve but not for other causes of mastitis

Targeted/Selective treatment

- Severity
- Causative pathogen

Point-of-care tests

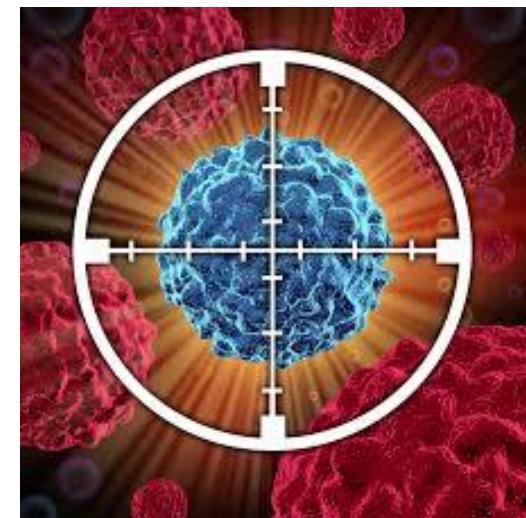


Image from: www.drugtargetreview.com

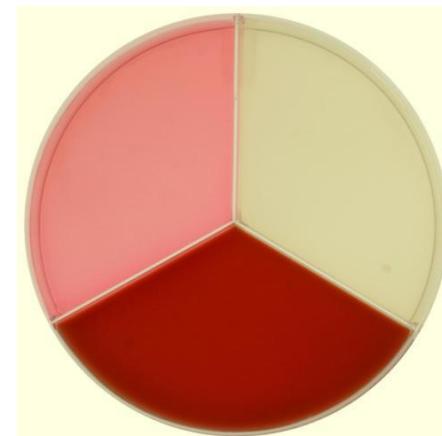
Aim

To evaluate two point-of-care tests against bacteriology culture + MALDI-ToF MS using clinical mastitis samples from commercial UK dairy farms



VétoSlide

Vs



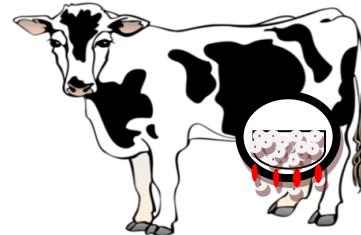
VétoRapid

M&M – Samples collection

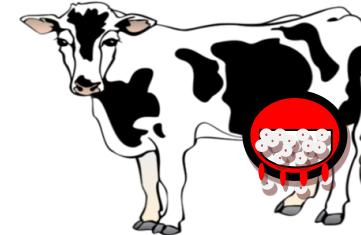
156 Clinical mastitis samples – 7 farms



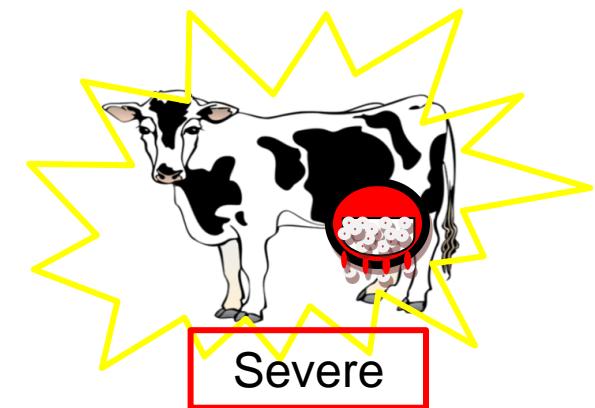
Severity score



Mild



Moderate



Severe

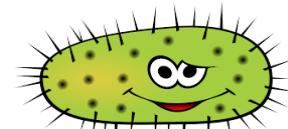
M&M – Samples collection

Reference Test

Standard bacteriology



+



MALDI ToF MS

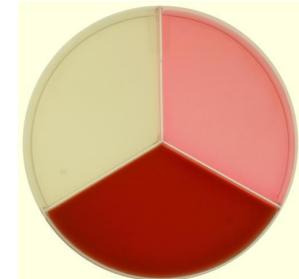


VS

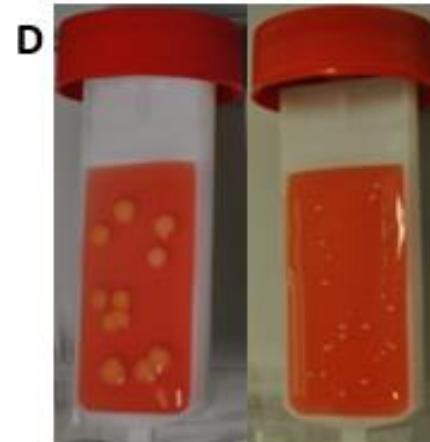
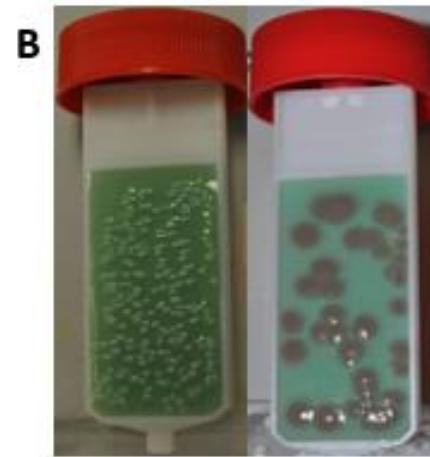
VétoSlide



VétoRapid



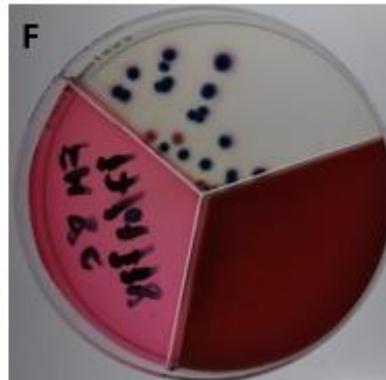
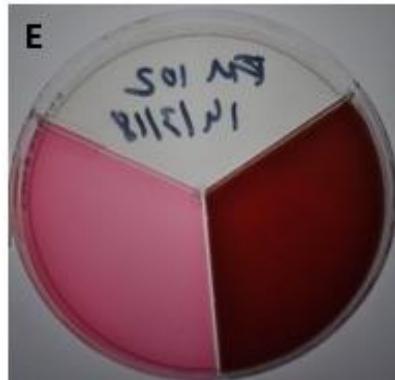
M&M – VétoSlide



The green media (A) allow for detection of Gram-ve bacteria *Escherichia coli* growing as red colonies and other species as white colonies (B)

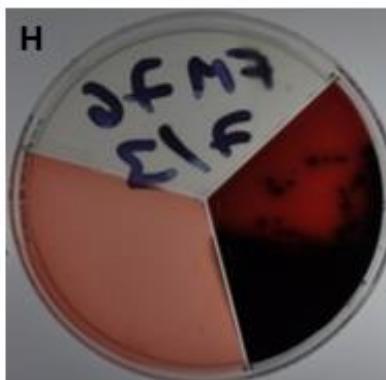
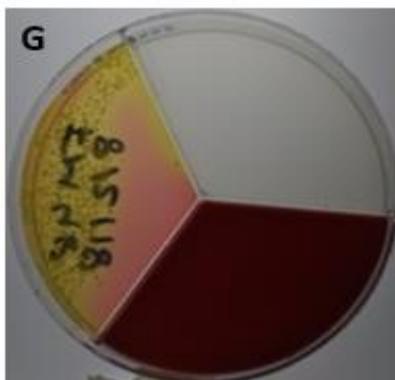
The red media (C) allows for detection of Gram+ve bacteria (D)

M&M – VétoRapid



(E) No growth.

(F) Growth in the sector selective for Gram-ve bacteria.



(G) Growth in the sector selective for staphylococci.

(H) Growth in the sector selective for streptococci and enterococci.

M&M – Data analysis

Ref. test results definitive (TP/TN/FP/FN)

Se, Sp, Ac, PPV and NPV

Diagnostic tool

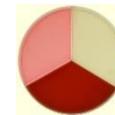
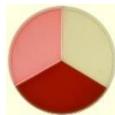
Treatment decision tool

Microsoft Excel and RStudio for 95% CI

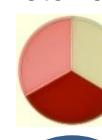
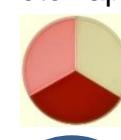
Results – Tests performance

Epidemiological parameter	Diagnostic tool			
	Gram-positive		Gram-negative	
	VétoSlide	VétoRapid	VétoSlide	VétoRapid
Sensitivity	82.0 [70.5; 89.6]	88.5 [78.2; 94.3]	83.3 [72.0; 90.7]	83.3 [72.0; 90.7]
Specificity	76.8 [65.6; 85.2]	58.0 [46.2; 68.9]	94.3 [86.2; 97.8]	88.6 [79.0; 94.1]
Positive predictive value	75.8 [64.2; 84.5]	65.1 [54.3; 74.4]	92.6 [82.4; 97.1]	86.2 [75.1; 92.8]
Negative predictive value	82.8 [71.8; 90.1]	85.1 [72.3; 92.6]	86.8 [77.4; 92.7]	86.1 [76.3; 92.3]
Accuracy	79.2 [71.5; 85.3]	72.3 [64.1; 79.3]	89.2 [82.7; 93.5]	86.2 [79.2; 91.1]

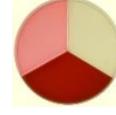
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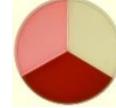
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Results – Tests performance

	Treatment decision tool	
	Gram-positive and non-severe clinical mastitis	
Epidemiological parameter	VétoSlide	VétoRapid
Sensitivity	 83.9 [72.2; 91.3]	 87.5 [76.4; 93.8]
Specificity	77.4 [64.5; 86.5]	60.4 [46.9; 72.4]
Positive predictive value	79.7 [67.7; 88.0]	70.0 [58.5; 79.5]
Negative predictive value	82.0 [69.2; 90.2]	82.1 [67.3; 91.0]
Accuracy	80.7 [72.3; 87.0]	74.3 [65.4; 81.6]

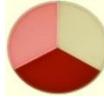
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Accuracy	80.7 [72.3; 87.0]	74.3 [65.4; 81.6]

Discussion – Tests comparison

Point-of-care tests	Gram-positive			Gram-negative/coliforms			Incub. time	References	
	Se	Sp	Ac	Se	Sp	Ac			
VétoSlide		82	77	79	83	94	89	24-48h	Malcata et al., submitted
VétoRapid		89-91	58-78	72-82	83	89	86-87	24-48h	Viora et al., 2014; Malcata et al., submitted
Minnesota Biplate		78-98	68-87	81-84	58-72	87-97	83-90	18-24h	Lago, 2009; McCarron et al., 2009a; Royster et al., 2014
Minnesota Triplate		60-86	76-93	81-83	56-78	94-97	80-93	18-24h	McCarron et al., 2009a; Royster et al., 2014, Ferreira et al., 2018
Petrifilm		64-94	48-76	NA	90	88	NA	24h	McCarron et al., 2009a, b; MacDonald et al. 2011; Mansion-de Vries et al., 2014
MastDecide		59-85	82-97	59-85	59-85	82-97	59-85	12-16h	Leimbach and Krömker, 2018
Mastatest		80	94	NA	77	100	NA	24 h	Jones et al. 2019

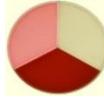
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average Ac: 79%

average Ac: 82%

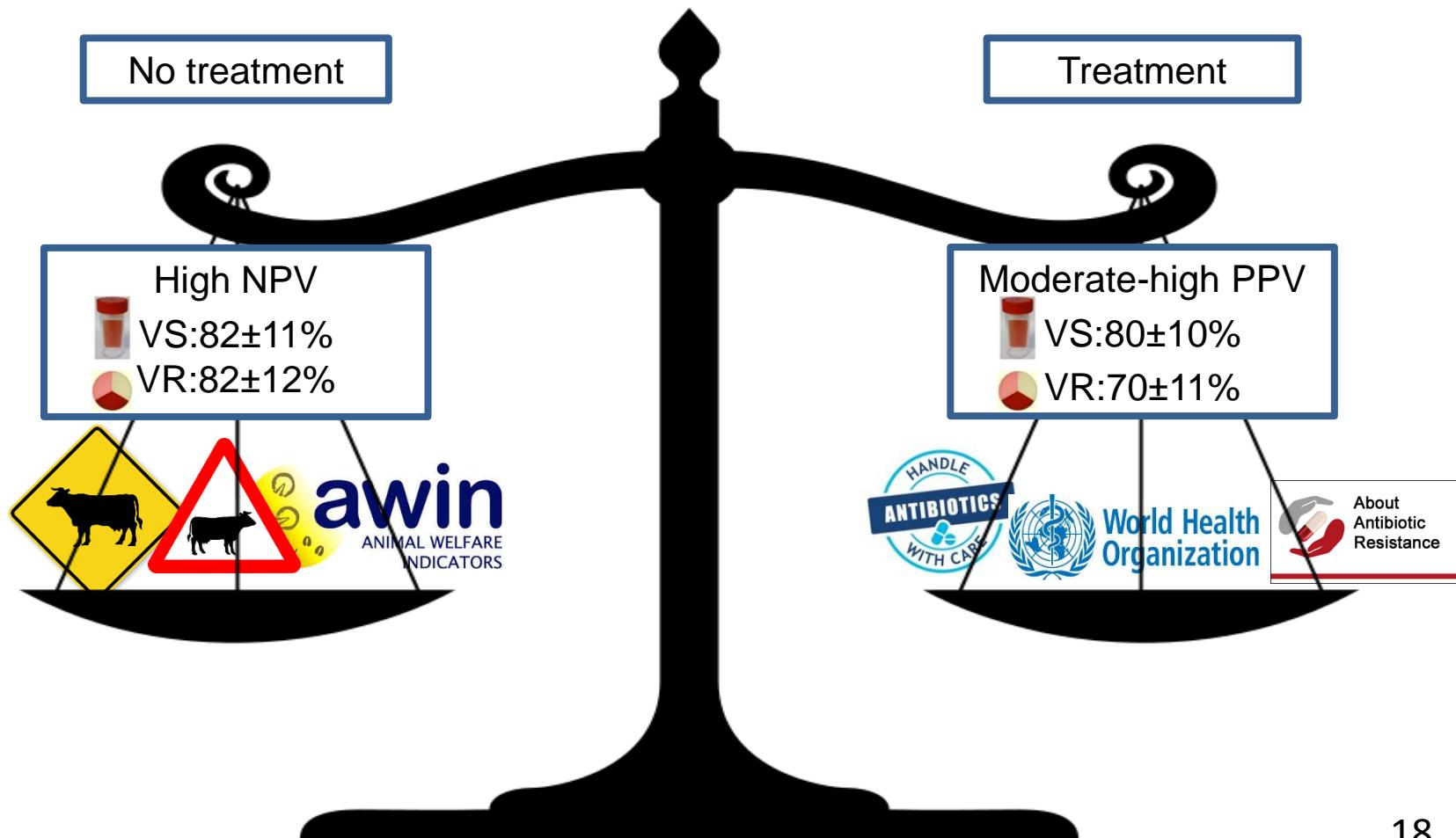
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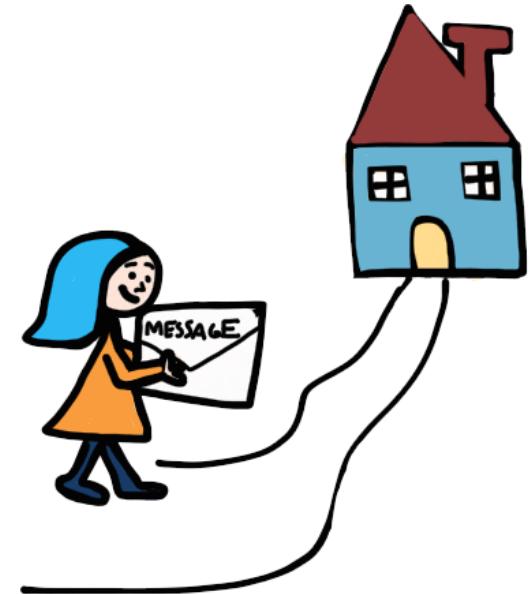
average Ac: 82%

Can these tests reduce antimicrobial usage?



Take-home message

- Tests suitable for selective treatment
 - Tools to be used “Next Generation Dairying”
- Results comparable to other studies
- Further evaluation of user-friendliness, tests accuracy and uptake on farm are needed



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Francisco Malcata

f.boavida-malcata.1@research.gla.ac.uk



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