

RESEARCH COMMENT

Developing targeted antimicrobial treatment protocols for mastitis

Lisa Morgans

ANTIMICROBIAL resistance (AMR) is a significant human health problem, with 10 million deaths from drug-resistant infections predicted by 2050.¹ The use of antimicrobials in food-producing animals is associated with the emergence of resistant bacteria in those species,² although there are now several studies suggesting that antibiotic use in food-producing animals is not the main driver of resistance seen in bacteria infecting people.^{3,4} The transmission of resistance in environmental reservoirs is believed to play a more dominant role.^{4,5}

However, practising prudent antimicrobial use (AMU) is still paramount to reduce the development and spread of resistant bacteria in both animals and people. Despite there being reportedly low levels of resistance currently seen in food-producing species,⁶ reductions in antimicrobial treatments will have a positive effect on reducing the levels of resistant bacteria that could end up in our shared environment.⁷

Mastitis is one of the major diseases affecting dairy production and is the leading cause of antibiotic use on dairy farms.⁸ Historically, mastitis treatment has been aimed at reducing somatic cell counts by following the five-point plan,⁹ which led to the promotion of blanket dry cow therapy.¹⁰ However, blanket treatments are contrary to the principles of responsible AMU, as set out by the World Health Organization.¹¹

The UK dairy industry has recently seen a rise of 9 per cent in total AMU,⁶ so studies aimed at reducing use are welcome. To this end, the study by Schmenger and colleagues,¹² summarised on p 401 of this issue of *Vet Record*, is an important addition to our knowledge.

This study followed five German dairy farms over a period of two and a half years as they implemented a targeted lactating cow therapy (tLCT) concept using a rapid on-farm culture (OFC) test called 'mastDecide'. The objective was to show that a targeted treatment protocol would maintain cure rates but reduce AMU. The authors analysed bacteriological and cytological

WHAT YOU NEED TO KNOW

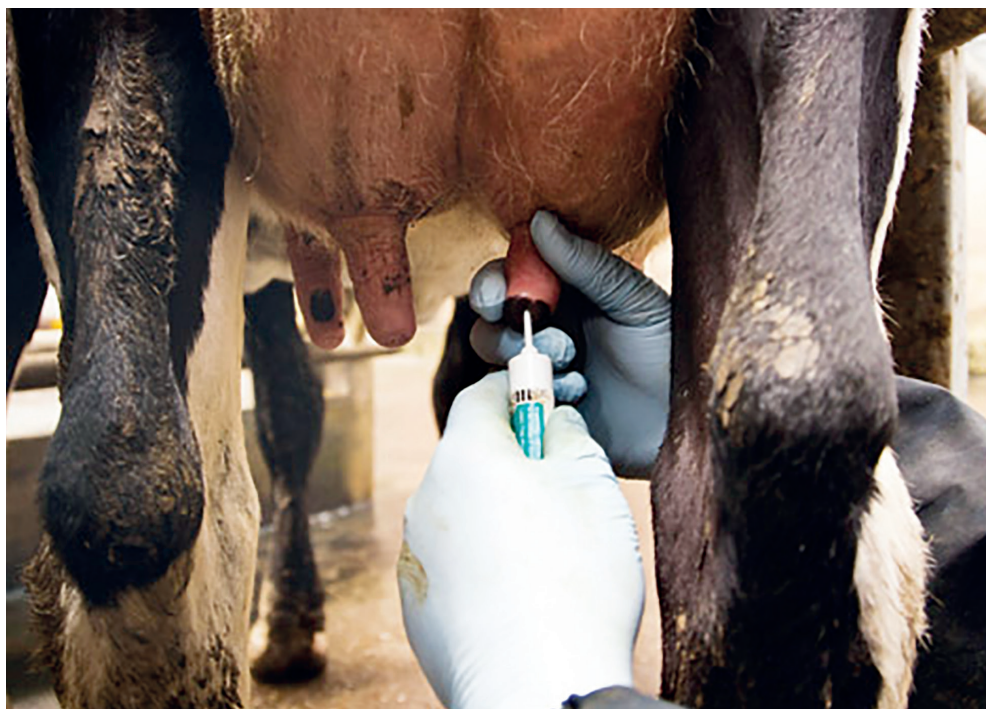
- Targeting antimicrobial treatments for mastitis, based on individual cows' treatment worthiness and on-farm culture (OFC) results, can significantly reduce antimicrobial use (AMU) with little to no detriment to the cows' health and welfare.
- Farmers using a targeted treatment approach valued the benefit of less bulk milk tank failures as an indirect result of reducing AMU, as well as the reduced time and effort needed to manage treated cows.
- Training farmers so that they are equipped with relevant knowledge and enabling them to follow a structured treatment protocol autonomously helps improve compliance with AMU reduction recommendations as well as increasing the perceived value of OFC.
- Participatory group workshops, where farmers discuss their mastitis treatments with one another and have their progress benchmarked, could also further help improve compliance.
- Farmers make treatment decisions based on multiple factors, and more than veterinary-led training is needed to influence their behaviour around AMU.

cures, as well as new infection rates and relapse rates at the quarter level. Various animal-based parameters, such as a mastitis score, age, lactation and production, were also recorded to identify 'treatment worthy' cows.¹²

Pathogen- and animal-related factors can help farmers and veterinarians identify cows that are likely to be cured and are, therefore, 'worthy' of treatment. Such targeting avoids treating cows that are unlikely to be cured, where antibiotic use would not only be a waste and increase the risk of bulk milk tank failures but may also contribute to AMR developing.

Targeted treatment also refers to localised administration of antimicrobials rather than systemic AMU, the latter of which exposes multiple species of often harmless bacteria living in the body to antimicrobials. Such systemic exposure may select for more AMR bacteria, which are then excreted into the environment as animal

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waste.⁵ Considering the apparent increase in meticillin-resistant *Staphylococcus aureus* in cattle over the past few decades and the reservoirs of bacteria of importance to human health found on farms,¹³ there is a definite need to target AMU more appropriately.

In the tLCT concept used by Schmenger and colleagues, cows were only given systemic antimicrobial treatment if they had a high mastitis score (ie, M3). In cows with lower mastitis scores, local antimicrobial treatment was administered if the results of the OFC indicated a Gram-positive pathogen and the cow fell into the 'treatment-worthy' category. Only anti-inflammatories were given immediately on detection of a case of clinical mastitis, as treatment with antimicrobials was delayed until the results of the OFC were known.¹²

A treatment delay of less than 24 hours can still result in successful clinical outcomes for mild mastitis cases when compared with immediate antimicrobial treatment.¹⁴ It also allows for self-cures, especially when coupled with anti-inflammatory use, and so confers benefits in terms of cure rates and cow welfare. However, as Schmenger and colleagues point out, many diagnostic tests can take 48 hours or more to produce a result, which leads to significant delays in treatment and poorer outcomes. This delay in obtaining results is a common reason

given for the lack of sampling on farms and the increased costs associated with OFC.¹⁵ Quicker, on-farm tests are needed to assist decision making,^{16,17} and Schmenger and colleagues' study presents a valuable step towards this goal.

Schmenger and colleagues also point out the challenge of motivating farmers to change their treatment practices. Many studies in the veterinary literature focus on how a change in attitudes

will result in a behaviour change.¹⁸ However, this narrative is narrow and fails to recognise contextual factors (eg, habits, farm culture and farmer identity) that influence people's behaviour around animal health and welfare.¹⁹ If we are to change farmers' behaviour, we need to shift away from a purely biosecurity viewpoint when approaching disease control and develop a better understanding of how different behavioural triggers work in different contexts.²⁰

A strength of Schmenger and colleagues' study¹² was the training provided for farmers on how to use and interpret the OFC test and the continued support offered by the veterinarians. Farmers had a say in the construction of the protocols to ensure they were as practical as possible (eg, data entry was ordered in a particular way to help farmers with treatment decisions and paperwork), and they were trusted to implement the testing regime on their own without continual supervision. Enabling farmers to conduct the OFC themselves can help improve buy-in and allows them to use their own experiential knowledge when changing practices.²¹

However, despite this support, the farmers frequently strayed from the recommended treatment protocols, and this resulted in a separate study group called the tLCTmod.¹² This group had relatively more mild mastitis cases

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that they treated with antibiotics, contrary to the recommendations. This deviation from the recommendations seemed to be linked to a disbelief in the OFC result or farmers' perceptions of 'good' cows that were worth treating (even though the targeted treatment protocol indicated they should not be). These findings echo those of previous studies that describe the extensive and holistic management variables farmers will juggle when treating mastitis.^{21,22}

Schmenger and colleagues' study documented reductions of 62 per cent in both parental and local antimicrobials with unaffected cure rates.¹² This appears to be the first clinical field trial with such impressive reductions, which may be a result of the more collaborative nature of the study. These findings highlight the urgent need to involve farmers at all stages of the research process if we are to achieve better compliance with strategies aimed at promoting responsible AMU on farms.

The RESET mindset model²³ is helpful in explaining the need for multiple different strategies to influence farmers' decision making. For example, external pressure from the public to reduce AMU is a 'social pressure' that can lead to more responsible use by farmers. A participatory group workshop approach, where farmers discuss their mastitis treatments with one another and have their progress benchmarked as a form of 'social improvement', could also further help with compliance.²¹ Such participatory approaches can be pivotal in helping farmers change their practices.^{24,25}

In conclusion, Schmenger and colleagues' study not only supports the case for more targeted antimicrobial treatment of mastitis based on pathogen- and animal-related factors, it is also a useful step towards understanding the use of decision-support tools by farmers in a real-world setting. The findings can help us improve the design and applicability of decision-support tools for treating mastitis based on the experiences of those intended to use them.

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