BRITISH MASTITIS CONFERENCE 2023

Wednesday 14th June 2023
Pitchview Suite, Sixways Stadium, Warriors Way, Worcester, Worcestershire, WR3 8ZE

Organised by

The Dairy Group	British Cattle Veterinary Association	The University of Nottingham UNITED KINGDOM · CHINA · MALAYSIA	QMMS

Topics:

- Teat condition and udder health
- Changing behaviour and implementing change
- Knowledge transfer & Research updates
- Successfully managing a dairy herd without antibiotics
- Relationship between cow space and mastitis
- AHDB mastitis control case study

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GENERAL INFORMATION

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CHAIRMAN'S INTRODUCTION

Welcome to the 2023 British Mastitis Conference at Sixways Stadium, Worcester.

At the last year´s conference the decision was made to bring BMC forward in the calendar due to the number of meetings and events that are now taking place in the autumn. In the short intervening period, the Organising Committee has brought together a group of speakers from across Europe which will provide interesting, thought provoking and stimulating presentations. We have tried to strike a balance between up-to-date research results and practical presentations with clear take home messages. As ever, we took on board suggestions from last year´s delegates.

The first paper discusses the role of teat condition on udder health and will be followed by a paper on how to change behaviour and motivate producers to take on new ideas. We will then have a short break for tea and coffee with time for delegates to look at the posters and ask questions of the presenters.

Now a staple of BMC we have selected four posters from the Knowledge Transfer / Research Update section for oral presentation. The four papers are followed by an opportunity for delegates to debate with each of the presenters.

After lunch there will be a presentation on how to successfully manage a dairy herd without antibiotics. This is followed by a paper on the relationship between space allowances and mastitis. The final paper at BMC 2023 will be the ever-popular AHDB Mastitis Control Plan case study.

This year we have seen an increase in the number of submitted posters with several from the next generation of mastitis researchers. The nine posters cover a range of topics – all targeting improvement in udder health and overall milk quality. I urge you all to make time to review the posters and speak with the authors. Presenters put a great deal of effort into providing the abstracts and preparing and presenting their posters, so please do read their work and vote.

We endeavour to find you the best speakers with the most relevant (and latest) information. This is only achievable thanks to the generous support of all our sponsors. This year our sponsors are: Fullwood JOZ (Gold), Hipra (Gold), Peacock Technology (Gold), Mastatest (Gold), Iddex (Gold), Boerhinger Ingelheim (Silver), ADF Milking Limited (Silver), Milkrite I InterPuls (Silver), DeLaval (Silver), Vetoquinol (Silver) and Ambic (Bronze).

As always, the event could not happen without able administration, provided by Karen Hobbs and Anne Sealey at *The* Dairy Group.

Finally, thank you for attending and supporting the conference. I trust you will have an enjoyable and worthwhile day and we hope to see you at our 36th BMC in 2024.

Ian Ohnstad, British Mastitis Conference Chairperson, *The* Dairy Group

TIMETABLE OF EVENTS

08.45	**ARRIVE / REGISTRATION / COFFEE & TEA AND POSTER DISPLAY**	
09.45	**CHAIRMAN'S INTRODUCTION**	**Ian Ohnstad** The Dairy Group, UK
	Session One	**Brian Pocknee** DHC, Spain
09.55	The role of teat condition on udder health - hyperkeratosis, a matter of meeting unneeded needs	**Carl Oskar Paulrud** DeLaval International AB, Sweden
10.30	Changing behaviour and motivating farmers to implement new ideas	**Vibeke Fladkjær Nielsen** Kvaegxperten, Denmark
	Session Two **Research Updates / Knowledge Transfer (also presented as posters)**	**Elizabeth Berry** BCVA; UK
11.40	Mastitis in the Langhill herd: What can we learn from the world's longest dairy genetics trial?	**Rowan Cook** Scotland´s Rural Centre, UK
12.00	Dry period cure rates depending on previous year's dry period performances	**Luke Gunter** Royal Veterinary College, UK
12.20	Evaluating the in-lactation 'Cell Count Solutions' training programme: a new, multidisciplinary, team-based approach to mastitis control	**Michelle McGrath** Animal Health Ireland, Ireland
12.40	Evaluation of milking performance following two different teat preparation routines	**Helen J. Williams** University of Liverpool, UK
13.00	**LUNCH & POSTERS**	
14.10	**WELCOME BACK & VOTING ON POSTERS**	
	Session Three	**Brian Pocknee** DHC, Spain
14.15	A discussion on mastitis management	**Wil Armitage** Tugby, UK
14.50	Space to live and mastitis	**Jake Thompson** University of Nottingham, UK
15.25	Mastitis control plan case study: short and long term results	**Bella Cima** Larkmead Vets, UK
16.00	**POSTER AWARD**	
16.05	**CLOSE**	

Titles of Papers and Presenters

Titles of Posters and Authors

Poster Abstracts – presented as Posters on the Research Update / Knowledge Transfer Display Panels
(Presenting author underlined)

Titles of Posters and Authors - Continued

FURTHER INFORMATION

Organised by *The* Dairy Group, BCVA, QMMS and University of Nottingham

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AMBIC

A global organization for mastitis control and milk quality

The National Mastitis Council is a professional organization that promotes research and provides information to the dairy industry to help reduce mastitis and enhance milk quality. For nearly 50 years, NMC has distinguished itself internationally as a leader in meeting those objectives.

What does NMC do?

- Provides a forum for the global exchange of information on mastitis and milk quality
- Publishes educational materials
- Establishes guidelines for mastitis control and milking management practices
- Monitors technological and regulatory developments relating to udder health, milk quality and milk safety
- Conducts meetings and workshops, providing educational opportunities for all segments of the dairy industry
- Offers a Scholars program for graduate students

A commitment to reducing mastitis and enhancing milk quality

Who are the members of NMC?

NMC membership is comprised of people from more than 40 countries, representing a wide range of dairy professionals who share an interest in milk quality and mastitis control. These people include dairy producers, veterinarians, university researchers and extension specialists, milk procurement field staff, equipment and supply representatives, government officials, and students.

What can NMC do for you?

The continued pressure to ensure milk safety and improve milk quality, as well as the need to increase production efficiency, requires greater team effort among producers, veterinarians and other dairy professionals. Each team member plays a key role in developing successful mastitis control programs. NMC can serve as your resource for information related to udder health, milking management, milk quality, and milk safety.

Why join NMC?

- To receive the latest technical and applied information on udder health, milking management, and milk quality
- To provide leadership on milk quality issues within the industry
- To participate and learn about mastitis and milk quality developments at NMC meetings
- To establish valuable industry contacts
- To support education and research efforts that help raise awareness and understanding of milk quality issues

NMC membership benefits

- NMC annual meeting and regional meeting proceedings, containing all of the papers and posters presented at the meetings
- NMC electronic newsletter, addressing the latest information on udder health, milking management, and milk quality
- Access to the Members Only section of the NMC website, which includes the NMC Proceedings Library, NMC newsletter archives, NMC membership directory, and NMC Job Board
- Opportunities to network with other dairy professionals concerned with milk quality

No other professional dairy organization enjoys the wide range of expertise found within the NMC membership.

Working together

Since 1961, NMC has coordinated research and education efforts to help control the losses associated with mastitis. By bringing together all segments of the industry, a strong and successful organization has been created to enhance the quality of milk and dairy products. NMC welcomes your active participation and support. Please visit the NMC website for additional information and resources.

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PAPERS

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THE ROLE OF TEAT CONDITION ON UDDER HEALTH - HYPERKERATOSIS, A MATTER OF MEETING UNNEEDED NEEDS

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SUMMARY

The continuous renewal of the outermost teat canal lining is continuously transporting potentially bacteria-contaminated material out from the teat. This process of continuous renewal is facilitated by the shearing forces from liner movement acting on the teat end during milking.

Hyperkeratosis is a chronic condition of disturbed balance of proliferation, differentiation and squamation/removal, seemingly caused by various forces acting simultaneously at the teat end during milking as a complex interplay between vacuum, teat anatomy, liner design.

Rough teat ends being more suitable for bacteria to colonize and harder to clean seem to be the logical and most feasible explanation to why hyperkeratosis is one of the few visible conditions that are well proven to have a positive correlation to increased mastitis risk.

Besides poor liner fit and liner over-pressure, overmilking is the single most important reason for hyperkeratosis and may be avoided by rigid milking routines and well-chosen milking machine settings. Modern milking machine automation that, to a greater extent, individualizes the milking machine settings in real time for individual cows has the potential to decrease overmilking and increase overall parlour performance.

INTRODUCTION

Mastitis is caused by pathogens entering the mammary gland through the teat canal and consequently, the defence mechanisms of the teat canal is certainly involved in the first line defence and a crucial component of the teat condition complex. The defence mechanisms of the teat canal against invading bacteria include physical, chemical and immunological mechanisms.

Epidermis of the teat canal is characterized by a single layer of proliferating keratinocytes and multiple overlaying differentiated layers. It belongs to the same type of epithelial tissue as the teat skin but is nevertheless highly specialized to trap bacteria and to seal the teat canal between milkings.

Morphologically, the cells transit from the basal layers on the basement membrane of the dermis, to finally end up in *stratum corneum* and as components of the teat canal surface, commonly referred to as keratin. Keratin, however, is actually the structural proteins that fill up approximately 85% of a fully differentiated keratinocyte. The epithelial cell specialisation for this particular and unique purpose includes also lipids, organisation and the epidermal architecture.

The mitotic rate and epidermal architecture is a result of the circumstances and a matter of the needs.

Dead flattened, enucleated squame (cellular detritus) are sloughed from the teat canal surface during milking, and continually replaced by inner cells differentiating outwards.

Throughout lactation, the continuous renewal of the outermost teat canal lining is continuously transporting potentially bacteria-contaminated material out from the teat, ideally ensuring a biochemically homogeneous and active surface facing the bacterial route. This process of continuous renewal is facilitated by the sharing shearing forces from liner movement acting on the teat end during milking.

Besides the importance of the actual route of pathogen entry, namely the teat canal, it seems logical to focus equally on pathogen presence and loading. Therefore, both teat skin condition and in particular hyperkeratosis is of interest.

Hyperkeratosis a matter of meeting unneeded needs

Although cell production and cell loss normally match to maintain an even epidermal thickness, this balance may be disturbed in certain circumstances and in initial stages of adaptation, such as at the occurrence of hyperkeratosis (rough teat ends).

Hyperkeratosis is one of the few visible conditions that are well proven to have a positive correlation to increased mastitis risk. Rough teat ends being more suitable for bacteria to colonize and harder to clean seem to be the logic and most feasible explanation to that increased risk. To my knowledge, however, impaired immune function associated to hyperkeratosis is yet to be proven.

Hyperkeratosis may then, as the name suggests, be understood as a condition of disturbed balance of proliferation, differentiation and squamation/removal. Possibly as a consequence of, the teat canal inner surface, still modulated as if located inside teat canal, is from milking induced forces, slightly rolled and therefore exposed to conditions that do not allow for the modulated turnover. However, both mechanical forces transferred to the teat from liner movements and the vacuum exposure are involved and have been suggested as the main causes.

Several attempts have been performed in order to quantitively study keratin production and degeneration rate (1). It seems reasonably to believe that 2-4 weeks is the necessary time frame, what seem to be logical based on *in vivo* observations, as the time to develop or regenerate from hyperkeratosis.

Predisposing factors

High teat end vacuum such as those typically associated with overmilking is well proven to increase risk of hyperkeratosis, even though most scientific work agree that certain teat shapes and liner fit is far more causative. How vacuum and liner interactions vary as a consequence of teat end shape and overall anatomy may explain those findings. Most certainly the effect from overmilking and/or high teat end vacuum act different all depending on teat anatomy and type of liner. Therefore, how liner fit to various individual teat´s anatomy explain main part of why high vacuum at teat end cause hyperkeratosis. Reinemann et al., 2021 (2) found hyperkeratosis significantly more prevalent on longer and wider teats.

Susceptibility is a matter of shape

Valuable to recognize is the value of attention to the visible acute responses associated to machine milking. These responses, such as acute and visible changes in colour, ringing of the teat base and increased teat firmness is frequently used as indicators to if milking is "gentle" or not. Such visible changes are often, as well, associated to teat anatomy and how well liner fits to teats. (3,4)

A general agreement that various machine milking induced acute responses can contribute to increased penetrability and impaired defence mechanisms seem to be the case rather than firm scientific proof that this is the case.

To my knowledge it is not well proven, either of these changes, are directly linked to increased mastitis risk. Nevertheless, many advisors and researchers have logical reason to use these mentioned indicators, as if present or prevalent, they are causative to increased risk of mastitis.

Haman (1989) pointed out, among others, various degree of altered teat tissue fluid dynamics as to be a significant reason why machine milking had a negative effect on upon teat defence mechanisms.

Important is to understand then how, and to what extent the specific characteristic teat ends react on certain aspects of machine milking, and how relevant changes may be measured and linked to development of hyperkeratosis.

And finally, how hyperkeratosis link to bacterial colonization, migration and eventually bacterial presence in the gland and mastitis.

Decades of research have closed the gap, and logically and overall, the assumptions and the usefulness of the mentioned observations, supports the fact that hyperkeratosis rarely develop if not acute and visible responses have been present. Again, however, fact is that the scientific link to true mastitis risk is rather weak.

Resent developments and research

The use of milking time test (MTT) or dynamic testing have gained in popularity as a useful tool to evaluate milking performance. The outcome of a MTT may be analysed and reveal important aspects of degree of overmilking, liner fit, and various components of the teat prep/attachment routines. Indicators that all of them may, or may not, be linked to mastitis risk, but indeed are extremely useful to determine milking performance. One could possibly claim that MTT can measure certain aspects of milking that may predict, support or even replace visual inspection of acute responses of milking on teats.

The one vacuum approach dilemma

In particular, avoiding overmiking and high teat end vacuum have been claimed to be the most important aspect of milking, in order to maintain teat integrity.

Overmilking is defined as when the milk flow through the teat canal is higher than the flow from the alveolar compartment to the cisternal cavity, causing the cisternal cavity eventually being empty. (ref Rasmussen) Avoiding overmilking, is therefore about balancing milking machine pull, to cows push.

Fact is that cows “milk push” or single glands milks availability, throughout a single milking, change during milking. The milk flow curve, as an outcome of the same vacuum and the same pulsation throughout a single milking, is itself a perfect proof for exactly that. Fact is also, that in any milking installation, milk flow itself, when passing through the milking machine milk path, cause a vacuum drop. The changing availability of milk throughout milking combined with the vacuum drop caused by the milk flow, create the well-known dilemma, that vacuum is too high when milk flow is low in order to be sufficient and efficient when milk flow is high. Any chosen single vacuum level will consequently be a compromise.

In practice, a well performed teat stimulation ensures milk ejection. The correct time from stimuli to attachment of the milking unit then eliminate milking at low milk flow in the beginning of milking. In addition, a take-off setting that eliminate time of low flow in the end of milking and overmilking of single teats eliminate overmilking in the end of milking. Both attributes to minimize the length of low flow periods and therefore also allow for higher system vacuum, that accommodate more efficient milking at high milk flow.

Before milk ejection have occurred the flow from the alveolar compartment are zero. Milk extracted prior to milk ejection is from milk leaked into and stored in the cisternal cavity of the udder. If milking is initiated prior to milk ejection this particular volume of milk will act as a buffer volume until milk ejection occurs and in that period of time, milk flow will prevent teat end vacuum to reach detrimental levels. If the volume of cisternal milk is however emptied before milk ejection occurs and refill is initiated, visible as a bimodular milk flow curve, teat end vacuum will climb towards system vacuum levels.
Time from tactile stimuli to milk ejection is almost alone determined by degree of udder fill and so is the amount of milk, acting as buffer in the cisternal cavity of the udder. (Bruckmmeier).

In the end of milking milk flow retards, vacuum drop decrease and teat end vacuum increase so therefore the risk of overmilking increase. Most milking installations include some kind of automatic cluster remover (ACR), and most of these are triggered by input from a milk meter.
In conventional milking installations, the milk meter is most commonly measuring the accumulated flow from all four teats. The slope of the milk flow curve is mainly a result of the differences in yield between glands and generally, a steeper milk flow decline is a consequence of an even distribution of milk between glands, while a less steep slope is a consequence of some glands are emptied long before others. The chosen take-off level must consequently take into account the obvious fact that not all four glands empties at the same time, and the risk of overmilking one, two or even three glands.

Avoiding overmilking and utilize cows potential

Resent advancement in milking technology have made it possible to better accommodate cows' potential by simply automatically balancing the milking machine pull to cow's push (2,5,6).
Milking machines are now able to slowly and gently remove buffering milk from the cisternal cavity of the udder, while awaiting the milk ejection. As the milk meter indicate milk ejection as an increased flow, it will automatically then shift to a more progressive pull. All in order to accommodate the need for different pull at different push and make it possible to attach clusters immediately after teat cleaning. Same logic may also be used later in the milking process, when milk flow peaks and the resulting vacuum drop is undesirably high. Then vacuum/milk pull is compensatory upregulated. Such atomization not only avoid overmilking in the early and late phases of milking, but it also saves

parlour time, and increase efficiency by better utilizing single cow's milk flow potential.

Tuor et al., 2023 reported that milking cows at even 60 kPa could be done successfully without presence of overmilking, if lower vacuum was applied when milk flow was low. Reinemann et al, 2021 (1) studied data from a German farm milking some 800 cows three times/d in a DeLaval 60 stall rotary equipped with flow responsive vacuum (FRV). They concluded that this dual vacuum approach increased peak milk flow by 12 % and increased average milk flowrate by 4 %. Comparing teat condition after 3 weeks of milking with FRV the occurrence of rough teat ends was slightly reduced, they concluded, the combination of reduced vacuum during the low flow period of milking and the decrease in milking duration was likely factors that are protective of teat tissue.

CONCLUSIONS

Hyperkeratosis is proven to increase the risk of mastitis. Main reason is likely that rougher teat ends is harder to clean and act as bacterial reservoir. Other not as well documented reasons may be insufficient keratin turnover and associations to circulatory impairments. Overmilking, in particular of teats with poor liner fit, is the overall reason for hyperkeratosis and may be avoided by rigid milking routines and well chosen milking machine settings, or by applying milking machine automation that, to a higher extent, individualize the milking machine settings and real time utilize single cows potential.

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CHANGING BEHAVIOUR AND MOTIVATING FARMERS TO IMPLEMENT NEW IDEAS

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SUMMARY

When it comes to change and motivation, we assume that people think rationally and that we all are motivated by the same things. But we are not, because we think with our feelings, and they determine our actions. If change is not appealing to our feelings, we will not do it.

Motivation of people comes in two different types: external and internal motivation. External is when we do something to achieve an external reward or avoid something unpleasant. Internal motivation on the other hand is when we do something because of interest and engaging in activities that we find challenging, interesting, and internally rewarding without the prospect of any external reward. To get a better understanding on how we motivate farmers and employees, several field studies, was made and 5 motivational archetypes were identified, and what these types are motivated by, and how you as a manager or advisor should work with the different types. The method was then used with a basic knowledge of psychological processes in people and how changes most easily occur. The method focuses on the individual person, their identity and what motivates them, and that focus is to take offset in the individual and thereby made the farmer more motivated to implement new ideas.

INTRODUCTION

In the perfect world, employees follow the motivating leader and make rational decisions. However, change management in the perfect world has one problem - that it does not work in the real world because some completely different rules apply here. When it comes to change and motivation, we assume that people think rationally – they will follow the parlor SOP anytime. We often assume that people can change behavior and become motivated if they have enough knowledge and have an intention to so. These assumptions are essentially wrong, that`s why workshops and seminars in this context are a dead end.

We think with our feelings, and they determine our actions. If change is not appealing to our feelings, we will not do it – even if we rationally know that we should. We always choose the easy solution viewed in our own perspective, although the other will provide better results.

MATERIALS & METHODS

Motivation of people comes in two different types: external and internal motivation. External is when we do something to achieve an external reward or avoid something unpleasant in common term is, we motivate with the whip or carrot. Internal motivation on the other hand is when we do something because of interest and the enjoyment of the activity. Intrinsic motivation also involves seeking out and engaging in activities that we find challenging, interesting, and internally rewarding without the prospect of any external reward (Di Doménico SI, Ryan RM.2017). The internal motivation talks to our feelings.

Common knowledge is that these two ways of being motivated influence each other. So, we must look out for the external motivation, because it displaces good behavior and motivate only on the short run. If we want motivated and dedicated employees in the long run, it is the inner motivation we need to encourage. Research shows that we have three basic needs for internal motivation (Deci, E.L and Ryan, R.M 2008).

- Self-determination, that we have influence on our job.
- Competence, that we feel competent in the work we do.
- Social cohesion, that we are together with other people, and work together as a team.

Not all three areas are evenly distributed between humans. Employees becomes motivated by different internal factors; therefore, the leader must be aware of different approaches to motivating the empyees. To get a better understanding on how we motivate farmers and emplyees, several field studies, was made and 5 motivational archetypes were identified, and what these types are motivated by, and how you as a manager or advisor should work with the different types. Each of these profiles get motivated by different things in their work life. So, we must understand what motivates the individual person to change their behavior, and then apply it practically on the farms.

We must recognize that change will arise when we practice and try something new. Not when we just talk about it during the lunch break. Yet we continue to believe that we can only change employee behavior and attitude through more information and more arguments to work after the “gold standard”.

RESULTS

We are all motivated by very different things. Based on several field studies, 5 motivational archetypes have been identified, and what these types are motivated by, and how you as a manager or advisor should work with the different types.

It can be difficult to find out what really motivates us, as we are easily influenced by what others think. Motivation is a social construct. This means that we tend to be bound by the stories and narratives that are about us. Thereby, firstly, we become less aware of what drives us.

In addition to the fieldwork, a tool has been added for you as a manager or adviser to get to know your farmers and employees, and perhaps yourself, better, and creates an awareness of what you can do to motivate the individual person. Therefore, we tried something new, we took the motivation theory and applied it practically on the farms. Our focus was to find the farmers' internal motivation and we used the 5 motivational profiles (see figure 1) to get a better understanding of the farmer, and how we could make the farmers change their behaviour and implement new ideas. We used the farmer's inner motivational need to achieve results and for that we used other tools such as the target management board, deeper professional insight, human cohesion, communication etc.

The result was that farmers achieved results on their farms in small steps. and they gained an understanding of how they themselves should work with their employees, to also get them to achieve results out on the farms.

CONCLUSIONS

A change in behaviour requires a lot of energy, and therefore it is rare that we achieve an actual change in behaviour. Getting the changes to take root on the farms is difficult, all too often the action plans are not carried out, but are forgotten after a period, and thus the results are not realized on the farms. This method is based on knowledge of psychological processes in people and how changes most easily occur. The method works with the person, and it focuses on understanding the problem and understanding the person you are facing and their identity and what motivates the person, rather than continuing to focus on changes happening if we gain more evidence-based knowledge.

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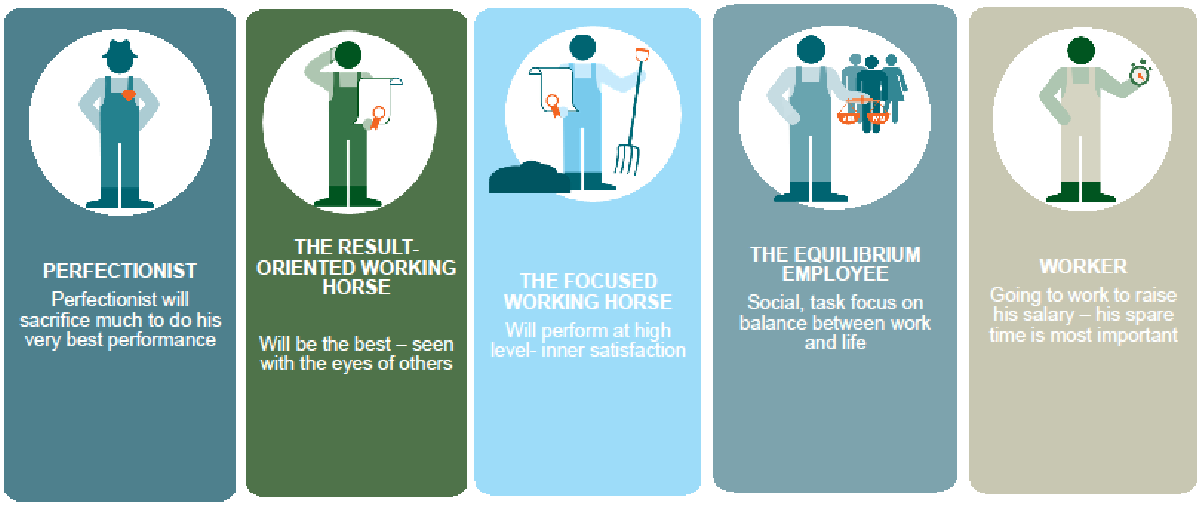
The 5 motivation profiles, Vibeke F. Nielsen, Seges 2017 (not published)

Figure 1 The five motivations profiles



THE PERFECTIONIST

Characteristics

Aims at making a difference in the service of a higher cause
Ready to sacrifice a lot to perform his/her very best
Hard-working and passionate about the job
Gets frustrated when prevented from aiming high

The Perfectionist

Motivated by

Achieving the highest standard and making a difference in the service of a higher cause
Rare but strong adrenaline rushes when succeeding
Feedback when satisfied with his/her own job

Best managed by

A clear vision
Creating wide bounds and making room (show trust)
Meaningful feedback (rarely needs praise)
Asking about his/her interests
Respecting that he/she is more skilled than you in his/her area of expertise

THE RESULT-ORIENTED WORKHORSE

Characteristics

Considers his/her job as a career
Gets energy from the surroundings (extrovert)
Depends on the surroundings' reaction to his/her performance
Wants to be considered to be the best within his/her area of expertise (competitive)
Invests a lot in the job

The result-oriented workhorse

Motivated by

Performing at a high level seen through other people's eyes
Specific success criteria
Ambitious and clear goals
Praise in public
Constantly striving to outdo him-/herself

Best managed by

Continuous feedback on goal fulfilment
Support in order to develop
Involvement in goal setting
Committing to the goals
Praising in public – praise on a one-to-one basis is not sufficient

THE TASK-FOCUSED WORKHORSE

Characteristics

Invests a lot in the job (seeks perfection)
Performance is a goal in itself
Gets energy from within (introvert)
Needs time to work alone – time to be creative

The task-focused workhorse

Motivated by

Concentrating on difficult problems pertaining to his/her profession
Getting a kick and inner satisfaction by performing at a high level
Moving out of his comfort zone to find a solution to a challenging task

Best managed by

More loose management – with room for self-determination within the limits agreed
Sparring and inspiration
Ensuring focus on the right tasks

THE WORK-LIFE BALANCE EMPLOYEE

Characteristics

A great, loyal and responsible employee
Comes to work because of his/her colleagues and a good workplace
Focuses on his/her tasks
Work-life balance is essential for him/her (keeps his/her work and spare time separate)
Affected by the atmosphere between the colleagues

The work-life balance employee

Motivated by

Doing a good job
Guidelines for how to do a good job
Clear targets for his/her tasks
Systems and procedures
Pulling together as a unit or achieving a positive atmosphere
Going home on time (is demotivated by overtime)

Best managed by

(This type of employee is in the majority – therefore, most workplaces are adjusted to his/her needs)
A well organized work day with clear guidelines
LEAN and other management tools
Feedback, recognition and praise

THE WAGE-EARNER

Characteristics

Goes to work to get his/her paycheck
Focuses on outer motivational factors such as wages, bonus and working hours
Wants the largest possible benefit with a little work as possible
Expresses dissatisfaction and is often more absent due to sickness than other employees

The wage-earner

Motivated by

Activities outside the workplace (is not motivated by his/her job)
Similar to one of the other archetypes but his/her need for motivation is unfulfilled

Best managed by

Asking about what characterizes his/her best days at work
Asking about what motivates him/her

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MASTITIS IN THE LANGHILL HERD: WHAT CAN WE LEARN FROM THE WORLD'S LONGEST DAIRY GENETICS TRIAL?

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It is well known that mastitis is a major welfare and economic concern for dairying globally. Exploring trends in mastitis incidence over time could allow for identification of markers or specific factors which influence the levels of the disease in a herd. The Langhill research trial has been running since 1973, allowing for multiple retrospective studies. The Langhill herd consists of two genetic lines of dairy cattle; the "SELECT" group, bred for increased milk fat and protein content, and the "CONTROL" group, representative of the UK average milk fat and protein content.

Records from January 1973 to November 2022 were extracted from the Langhill database; including the prevalence of mastitis over time, occurrence of mastitis in each genetic line, the quarter in which mastitis occurred, and the environmental temperature one week prior to the mastitis event. A case of mastitis was defined by the observation of clinical symptoms (udder inflammation, milk changes) by trained farm staff. Data were analysed using chi squared analysis, generalised linear model (poisson regression), and Tukey's pairwise comparison.

From 3368 animals, 3122 mastitis cases could be attributed to 1320 individuals (39.2% of the herd). Spikes in mastitis cases occurred in 1979, 2000-01, 2013, and 2016. The 2013 spike is thought to be a result of a heatwave and the 2016 spike due to substantial staff changes. The other spikes are currently unexplained, however, the drop in cases in 2003 is thought to be due to the herd moving location and being milked through a new parlour. Most mastitis cases occurred in the winter months (January, February, and December), though a peak was also noted in July.

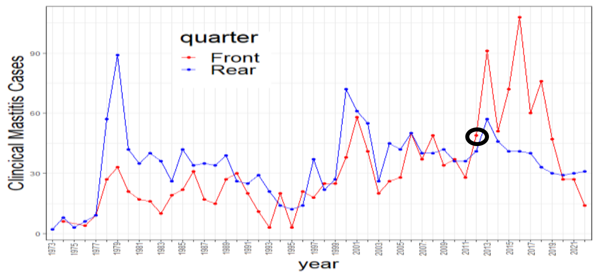
Genetic line had a significant impact on the occurrence of mastitis. Of the CONTROL genetic line cows, 52% experienced mastitis at least once, compared to 82% of the SELECT genetic animals (Table 1.) (X-squared = 36.365, df = 1, p < 0.001).

Table 1. The prevalence of mastitis in the select vs control genetic lines in the Langhill herd from 973 to 2022.

	Mastitis	No Mastitis
Control	440	844
Select	899	1102

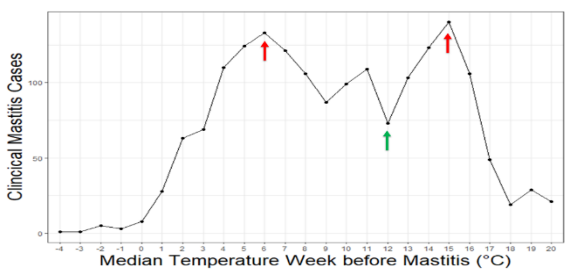
Before 2012, rear quarters were more likely to be affected by mastitis (fig. 1). However, in 2012 there was a significant increase in mastitis cases occurring in front quarters ($p < 0.05$).

Figure 1. Number of mastitis cases affecting the front and rear quarters from 1973 to 2022. Circle indicates a significant increase in front quarter mastitis cases (p<0.05).



Environmental temperature had a significant effect on mastitis incidence with the highest numbers of mastitis cases occurring when the median environmental temperature one week before was 6°C or 15°C (red arrows) (fig. 2). There was a significant drop in cases when the median temperature one week prior was 12 °C (green arrow) ($p < 0.01$).

Figure 2. Median Temperature 1 week before clinical symptoms were observed. Red arrows indicate spikes in cases and green arrow indicates a drop in cases observed at 12 °C.



The results of this study suggest that mastitis incidence at the herd level depends on various factors, including animal genetics, selection for milk quality parameters and that the likelihood of front quarters being affected has increased over time. The importance of the effect of environmental temperature on mastitis incidence is of particular interest with the increasing impact of climate change and temperature change in the UK. Further research is required to explore in depth the effects of environmental and genetic factors on disease incidence and the impact this has on animal health, welfare, and productivity.

ACKNOWLEDGEMENTS

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DRY PERIOD CURE RATES DEPENDING ON PREVIOUS YEAR'S DRY PERIOD PERFORMANCES

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SUMMARY

Assessing the likelihood of a positive dry period outcome should be part of selective dry cow therapy. This study investigated on two farms whether a dry period outcome is dependent on a previous dry period outcome. Between the farms a previous negative dry period outcome made a subsequent negative dry period outcome about 2.5 times more likely than a previous positive dry period outcome. Therefore, previous dry periods influence significantly subsequent dry period outcomes, which can be used in decision making in selective dry cow therapy.

INTRODUCTION

Ruegg (1) and Schmenger and others (2) propose a triage protocol for clinical mastitis which reserves antimicrobial treatment to cases likely to benefit from it, while cases with either high spontaneous cure risk or cases with a low chance of bacteriological cure are left untreated. In contrast, in selective dry cow therapy only two outcomes are usually considered – infected (to be given antimicrobials) or uninfected (to be given teat sealant only. This preliminary study investigated whether previous dry period outcomes influence a subsequent dry period outcome, potentially as a first step to use a triage for selective dry cow therapy.

MATERIALS & METHODS

The aim of the study was to establish whether cows with previous negative dry period outcomes will be more likely to have subsequent negative dry period outcomes. Records from two farms were analysed using data from National Milk Records (NMR).

The categories of dry periods are those used by NMR Herd Companion, with "high" to "low" and "low" to "low" defined as positive outcomes and the other two as negative outcomes.

Using these categories of positive and negative previous and subsequent dry period outcomes (PDPO1, NDPO1, PDPO2, NDPO2), a Chi Squared test was performed on GraphPad PRISM 9.2 on Farm A (n=63), Farm B (n=310), and both farms combined (n=373) to determine any statistical differences from expected and observed values. Odds ratios with 95% CI-levels were also calculated to determine the likelihood of a subsequent negative dry period outcome (NDPO2) after a previous negative or positive dry period outcome using the Baptista-Pike method.

RESULTS

The results are summarised in Table 1.

Table 1: Summary of results.

Farm	Number of pairs of dry periods	Odds ratio neg to neg v pos to neg	95 % Conf Interv	p-value
Farm A	67	3.626	1.098-11.380	0.025
Farm B	310	2.288	1.331-9.941	0.0025
Combined	377	2.492	1.509-4.010	0.0002

The data show that for the individual farms as well as the two farms combined dry period outcomes are influenced by previous dry period outcomes. In total a negative dry period outcome is 2.5 times more likely to be proceeded by a previous negative dry period outcome than a previous positive one.

DISCUSSION AND CONCLUSIONS

The data show a clear dependence of dry period outcomes on the outcome of the previous dry period outcome, and this can be used to potentially refine decisions on selective dry cow therapy.

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EVALUATING THE IN-LACTATION 'CELL COUNT SOLUTIONS' TRAINING PROGRAMME: A NEW, MULTIDISCIPLINARY, TEAM-BASED APPROACH TO MASTITIS CONTROL

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CellCheck is the national mastitis control programme in Ireland run by Animal Health Ireland (AHI). AHI co-ordinates a government-/EU-funded Targeted Advisory Service on Animal Health (TASAH) for farmers, delivered by trained private veterinary practitioners (PVPs). In 2022 a new TASAH-funded CellCheck consult to be delivered during lactation was introduced called 'Cell Count Solutions'. Its aim is to address the economic and health impact of underlying mastitis issues in lactation, mitigate the risk associated with implementing selective dry cow therapy and in addition, facilitate the establishment of multidisciplinary support for farmers and highlight the role of the PVP in routine herd health planning. As mastitis is a multifactorial problem, it requires a multidisciplinary approach. AHI's Cell Count Solutions training is therefore delivered to PVPs, farm advisors, milk quality advisors and milking machine technicians with the TASAH-consult intended to act as a potential catalyst for ongoing multi-disciplinary teamwork (MDT).

The content and structure of training draws on the latest empirical evidence, expertise of the CellCheck Technical Working Group, industry experience and psychological theory and practice such as motivational interviewing and behaviour change techniques. It provides participants with the tools for an epidemiological pattern assessment of the herd. This considers the cows, the bacteria, the environment including the milking machine and the milking routine, while taking into consideration the individual motivations, concerns, and priorities of the farmer. The training programme takes a blended learning approach reflecting Bloom's Taxonomy to support participants to understand and remember technical content through self-paced eLearning online modules followed by an in-person training event to apply this learning to analyse, evaluate and create consults and recommendations with their clients through scenario-based learning and problem-solving case studies in MDT group work.

A questionnaire was distributed to PVPs (n=41), milking machine technicians (n=7), milk quality advisors (n=8) and Teagasc advisors (n=8) who had completed the training. Analysis of qualitative data showed that participants responded positively to the multidisciplinary nature of the training and blended learning style and that they would like further training on the milking machine and motivational interviewing. In advance of this consult being rolled out nationally, a pilot version of the consult was delivered in 2022. Follow-up focus groups were carried out with PVPs who had delivered TASAH consults in 2022. Further mixed methods evaluation of the Cell Count Solutions consults is ongoing, including focus groups to gain a deeper understanding of the experience of disciplines other than PVPs, as well as on-farm practices and the uptake of recommendations over time by farmers.

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EVALUATION OF MILKING PERFORMANCE FOLLOWING TWO DIFFERENT TEAT PREPARATION ROUTINES

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It is well recognised that fore-milking improves milk let down (2) and enables the early detection of mastitis however, many UK farmers do not carry out this practice (1). This study aims to investigate whether use of traditional pre-dip and paper towel gives improved milking parameters compared to a proprietary wipe when fore stripping is not part of the teat preparation routine.

The study was carried out at a Holstein dairy herd with 195 lactating cows. Mean 305-d yield was 13105 kg for cows and 11533 kg for heifers. Cows were milked 3 times daily in a 24:24 herringbone parlour. Cows over 14 days in milk and free from udder abnormalities or clinical mastitis for at least two weeks were eligible. Eight experimental milkings were performed by the same operator alternating between two teat preparation routines as follows:

1) "WIPE" The teats of six cows were wiped in turn with a disinfectant wipe (Teat Wipes, Teisen). Cow identity was entered into the parlour software working in a reverse direction, before clusters were attached in the same order as teat wiping occurred. This was repeated for the next six cows in that side.

2) "DIP" started by pre-dipping the teats of six cows (DermaPre F, GEA) In the same order cows had teats wiped dry with a paper towel. Freeze brand number was then entered and clusters attached in an identical way to "WIPE" routine.

Data from 1287 milkings and 194 cows were eligible for analysis. The mean wiping time for the "WIPE" routine was 5.40 s (95% CI 5.21-5.60) whereas it was 6.25 s for "DIP" routine (95% CI 6.09-6.42).

Multivariable mixed effects models utilising a backward stepwise model building strategy were fitted to investigate the association of routine (WIPE or DIP) and the outcome variables "Bimodal milk flow" and "Percentage of yield in the 1st 2 minutes". Parity, Days in milk/30, Cluster position, Pre-lag time and Yield were considered as potential co-variates. Cow identity and Milking Position were initially included as crossed random effects.

Table 1 Model Results showing variables associated with Bimodal milk flow and Percentage of yield achieved in the first two minutes of milking

		Bimodal Milk Flow		Percentage of yield in 1st 2 minutes	
Variable		Odds ratio	95% CI	Coefficient	95% CI
Routine	DIP	reference		reference	
	WIPE	1.60	1.19 - 2.15	-3.30	-4.27- -2.32
Parity		2.05	1.40– 3.00	N/A	N/A
Yield (Kg)		0.81	0.76 - 0.86	-0.71	-0.91- -0.52
Days in milk/30		N/A	N/A	0.47	-0.05- 0.98
Baseline		1.63	0.24 – 1.60	45.20	40.64– 49.75
Cow identity (Variance)	3.29	2.22 – 4.86		136.6	109.7 – 170.0
ICC	0.50			0.64	

On this farm there was an improvement in milk ejection and a reduction in bimodal milking when teat dipping and wiping with a paper towel was used compared to wiping with a disinfectant teat wipe alone. Cow identity had a large effect on both the outcome variables.

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NOTES

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A DISCUSSION ON MASTITIS MANAGEMENT

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SUMMARY

Organic Dairy Farmer farming 3000 acres of Organic land with 3 dairy units totalling 850 cows and followers. In partnerships & contract farming agreements.

Wil managed the highest yielding herd in the UK in the 90s and then went into partnership with Peter Dixon Smith, converting to Organic in 2005.

Selling milk to OMSCo meant he produced milk to the PWAB standard with NO antibiotics used for seven years.

The aim is to feed high quality diverse forage mixes and fodder beet through the winter in a TMR and then effectively graze grass from March to November.

Herd information

1990 – 2000 (Conventional)

Cow No.	Litres	Kg MS	BF	Prot.	SCC	Mastitis Cases/100 cows
160	11,650	846	3.97%	3.32%	164	32

Conventional farming 200kg N/ha.
Fully housed – 7 months.
TMR & PMR – Year-round.
3.8t concentrate/cow.
Cubicle bedded – Chopped straw.
Limited grazing.

Antibiotics to all cows at drying off.
No teat sealant.

Mastitis cases occurred throughout the whole lactation with peak yields between 60-80kg.

Poor cure rate whilst in milk – Good cure rate through dry period.

Mycotoxins during summer may have been a contributing factor to mastitis cases by feeding PMR.

Antibiotics used:

In milk - Tetra Delta, Leo Yellow, Antibiotic injections later on.

Dry Period – Cepravin, Leo Red

2005 – 2015 (Organic)

Cow No.	Litres	Kg MS	BF	Prot.	SCC	Mastitis Cases/100 cows
330	7,120	554	4.2%	3.36%	182	12

Housed – 5 months.
Paddock grazed - 7 months.
TMR – Fed through winter.
1.8t concentrate/cow.
Cubicle bedded – Envirobed, Gypsum.

Back flush system put into milking parlours from 2013-2015.

No antibiotics at drying off.
Orbseal – teat sealant used.

Selective dry cow therapy - 4th generation antibiotics with excellent cure rates in both milking and dry cows.

Antibiotics used (in dry period thresholds):

1 & 2 calvers >200
3rd Calvers >300
4th+ Calvers >400

2015 – 2022 (Organic – PWAB)

Cow No.	Litres	Kg MS	BF	Prot.	SCC	Mastitis Cases/100 cows
530	7280	590	4.41%	3.45%	238	4-7

Housed – 4 ½ months.
Paddock Grazed – 7 ½ months.
TMR – fed through winter.
1.72t concentrate/cow.
Cubicle bedded – Chalk.

NO antibiotic use!

Teat sealant used on every cow at drying off.

Treatments used:

Udder mint
Anti-inflammatory – Gram -ve
(Gram +ve – antibiotic use now with new Arla contract)

Twice previous levels of cows ¾.
Currently 4.2% of herd but won't necessarily stay ¾.

Prevention Is Better Than Cure.

Prevention is a necessity in an Organic PWAB system.
The goal - A healthy cow with a high immune status that is able to survive and thrive in a healthy environment we create for her on farm.

Genetics

Modern technologies and historical data provide us with a wealth of data that we can use in the breeding of our cows.

Using bulls with:

- -20 SCC
- -3 Mastitis
- + Immunity
- +ve Udder traits
- + Lifespan

Going forward there is a consideration to use genomic testing to evaluate individual animals' health traits.

Feeding

Organically.

- Begins at birth.
- Testing of colostrum is imperative.
- No high SCC milk to be fed to heifer calves.
- 12 weeks on milk.
- Mineral boluses in growing stock.
- Quality, high integrity forage throughout life.
- Seaweed at critical times.
- Be aware of excessive protein and mycotoxins.

Environment

Cow paddocks/Grazing land – Very rarely have slurry.

- Biosecurity.
- Composted FYM on young stock land.
- Dry cows fed standing hay.
- Cows close to calving - in at night.

Housed Environments

- Cubicles - Chalk on mats and mattresses once a week through winter – more if bad weather.
- Straw yards – bedded every day with straw blower.
- Parlour –
    - Well maintained parlour.
    - Back flush system – blast of peracetic acid between every cow.
    - Iodine teat dip – post. Pre if dirty.
    - Dry wipe – winter.

We have recently started a new contract with Arla and have new protocols in place:

1. Udder mint & strip ¼.
2. Strip ¼, Udder mint & Anti-inflammatory – Type the mastitis.
3. Strip ¼, Udder mint, Anti-inflammatory & Antibiotic.

Health Is or Should be the 'Norm' and it starts in our Soils.

Cows with a high immune status can only be achieved by feeding quality, high integrity feed with bio-available minerals that are readily absorbed by the cow.

High integrity feed can only be produced on living, biological soils where the translocation of mineral from the soil to plant is maximised producing top quality forage for the cow.

Dead soils produce empty calories with very little mineral content leaving deficiencies in our stock resulting in challenged immune systems.

Not all soils contain all the requires mineral and we as dairy farmers are good at mineral supplement feeding however most is still fed in a rock form which is not bioavailable to our cows. These bought in minerals are not as effective in building strong immune systems as quality forage.

CONCLUSIONS

1. Blanket treatment with antibiotics is wrong. It creates naïve udders that are susceptible to infection in later life.

2. Be informed in the genetic choices made during breeding.

3. Quality, high integrity feed is vital to build a strong immune system.

4. Watch excesses and indicators – dung, cudding rates, respiratory rates, milk ureas.

5. Stop killing and start growing positive microbes into your systems – competitive exclusion.

6. Be careful with antagonists, only use positive elements.

7. Back flush systems have value.

8. Use teat sealants.

9. Use Udder mint then anti-inflammatory.

10. Know the mastitis type Gram +ve / -ve. Use antibiotics with Gram +ve.

11. 4th Generation antibiotics were very good when we were able to use them.

Cows are Brilliant at Self Cure and she will save the Planet if we let her.

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SPACE TO LIVE AND MASTITIS

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SUMMARY

Economic profitability of dairy enterprises is of critical importance, but farms also have a duty of care to ensure high health and welfare status of stock, social equity and limit environmental impact. Despite the importance of housing for managing dairy cows worldwide, there is a limited amount of research into how the industry can evaluate and optimise housed conditions. A new term "living space" has been developed with a set definition that allows for comparison of space allowances provided to inhabitants irrespective of how this space is provided, for example wide passageways versus outdoor loafing areas. There is substantial variability in the amount of living space provided to dairy cows. Living space allowances have been shown to greatly impact on production, reproduction and behaviour parameters. Worryingly, little research has been undertaken into how space allowances impact on udder health. Given 99% of dairy cows are housed at some point during the year, it is essential for this environment to be optimised to promote improvements to udder health and thus reduce economic losses and pain associated with mastitis.

BACKGROUND INTO HOUSING AND SPACE ALLOWANCE RESEARCH

Sustainable management of livestock agriculture, including the dairy industry, is critically important to ensuring healthy business enterprises (Herrero and Thornton, 2013). Sustainability in livestock agriculture has been described as having 'three pillars', which are: to be socially acceptable for animal, farmer and society, to have a neutral or positive environmental impact, and to allow economic reparation for continuation of development (ten Napel et al., 2011). Economic profitability is important but farms also have a duty of care to ensure high health and welfare status of stock, social equity and limit environmental impact (Mandel et al., 2016; Appleby and Mitchell, 2018; Nannoni et al., 2019; Mehrabi et al., 2020).

Despite the importance of housing for managing dairy cows worldwide, there is a limited amount of research into how the industry can evaluate and optimise housed conditions to achieve sustainable intensification in dairy farming. Consequently, decision makers lack the access to critical evidence which could support appropriate policies and regulations (Appleby and Mitchell, 2018).

For context, in the humans the environment the majority of daily life is spent has been shown to directly impact on health (Hancock, 2002). Furthermore, the quality of the environment determined by building design (specifically layout and air quality) has been shown to be associated with disease incidence (Hood, 2005). The limitation of quality science to optimise the living conditions required by dairy cows is lacking, despite strong evidence available in human literature to show that the living environment strongly impacts the health, fertility and wellbeing (Thompson, 2021).

Concerningly, there has been a trend to minimise building space. The main driver of this trend is associated with rising building costs, arguably without sufficient consideration about its impact on cows. Recommendations for space allowances for housed dairy cows in the 1980's were 7.4m^2 per cows. Compared to 1960's standards of 9.3 m^2 of floor space area or approximately 13-15 m^2 of total area per cow is a significant reduction (Bewley et al., 2017). This period in the 1980's, was a time where the new focus was on cubicle design and implementation, a very different philosophy to interpreting cow comfort and cleanliness, thus the reduction in total space allowance recommendations (Bickert and Light, 1982).

More recently the industry has attempted to promote increases to housing space allowances. The focus shifting to the term "loafing space". These are areas associated with housing where cows could spend part of their day, not associated with feeding or lying down. Typically, "loafing areas" are considered as additions to existing buildings to increase overall space allowance, usually as outdoor areas of concrete or composted pads (Haskell et al., 2013). Passageways are necessary for cow flow but their inclusion as loafing areas is disputed has been described (Thompson et al., 2020). Thus, there is ambiguity and confusion surrounding the definition of loafing space and there is obvious confusion within the industry.

ASSESSMENT OF SPACE ALLOWANCES WITHIN THE HOUSED ENVIRONMENT

A new term "living space" has been developed with a set definition that allows for comparison of space allowances provided to inhabitants irrespective of how this space is provided, for example wide passageways versus outdoor loafing areas. Described by Thompson et al., 2020, the original definition of living space is: "A novel bespoke definition of the space within the dairy cow accommodation that was greater than that considered a baseline requirement for movement and feeding within the overall accommodation area, excluding lying areas" (Thompson et al., 2020).

To explore how much space dairy cows in the Great Britain were being provided, a single researcher visited 50 randomly selected farms during the 2017–2018 Winter housing period (Thompson et al., 2020). Data collection occurred at a single visit and precise measurements of adult dairy cow accommodation was undertaken. The variation in space allowance was substantial across the study farms. Total area per cow ranged between a minimum of 5.4 m^2 and maximum of 12.7 m^2, with the mean = 8.3 m^2 and median = 8.2 m^2 respectively. The mean living space across the 50 farms was 2.5 m^2 per cow at maximum stocking density (median = 2.4m^2), with a minimum of 0.5 m^2 and maximum of 6.4 m^2.

The farmers involved in the study answered 11-point (0-10 scale) questions on the importance of space to housed dairy cows. Generally, scores were ranked relatively high, indicating that farmers valued space and outdoor access for housed dairy cows. The highest score for the importance of space was in association with cow welfare, with a median of 8 and IQR of 8 to 10. Outdoor access importance had most variation in scoring, with a range of 0 to 10. Interestingly, the farmer's opinions of important of space and outdoor space alongside their geographical location appeared to statistically linked with how much space was provided to cows on their farm.

Following this study, it has been shown that increases to living space have substantial impacts on dairy cow production, reproduction and behaviour parameters (Thompson et al., 2022). A 12-month randomised controlled trial was undertaken in a unique, purpose-built facility, which allowed layout reconfiguration. All elements of the trial were conducted under license, in accordance with government regulations. Adult Holstein dairy cows (n = 150) were randomly allocated to a 'high' living space group (living space = 6.5m^2, total space = 14m^2) or 'commercial average' living space group (living space = 3m^2, total space = 9m^2); all other aspects of the housed infrastructure (e.g. feed-face length, lying areas) were identical between groups. Compared to cows in the commercial average space group, cows with increased space, produced more milk per 305 day lactation (first parity cows; 12235L vs 11592L, $P<0.01$, parity >1 cows 14746L vs 14644L, $P<0.01$) but took longer to conceive (135d vs 101d, $P<0.05$). Cows with less living space spent less time in lying (64 minutes/d) and feeding (10 minutes/d) areas, and more in passageways (67 mins/d). This is the first long term study in dairy cows to demonstrate that increased living space results in meaningful benefits in terms of productivity and welfare. It is likely that additional living space will be of benefit to adult dairy cows but further research is required into generalisability and the links with disease. Health event parameters were not analysed as part of this research. However, housing is likely to be fundamentally linked to the incidence of disease events, for example mastitis.

BACKGROUND REVIEW OF RESEARCH RELATING TO THE HOUSED ENVIRONMENT AND UDDER HEALTH

Measuring health outcomes were not an objective of the original study but hypotheses could be made about the impact of living space on common endemic disease. Indeed, previous research suggests that living conditions are likely to impact upon the health of inhabitants (Bonnefoy, 2007; Jacobs, 2011). It has been hypothesised that variation in the housed environment on farms has a relationship with health, welfare and productivity of the cows.
Mastitis is important to the dairy industry as it is a cause of pain and economic loss. Inadequate housing is likely to be an important factor for increasing the risk of environmental mastitis (Blowey and Edmondson, 2010), with recent literature placing a focus on the environment for prevention (De Vliegher et al., 2018). Prevention is the key to controlling mastitis within dairy herds (van Soest et al., 2016), thus ensuring appropriate housing facilities would aid this process.

Udder health is important to the dairy industry, with financial costs being sustained through culling, treatment and labour, milk withdrawal times and reductions in milk yield. However, very little research has been undertaken into how space available in housing for lactating dairy cows is likely to affect incidence. Recommendations such as those listed below have been made to provide more appropriate housing conditions to reduce the likeliness of causing a case of mastitis. For example, providing >5-10% more cubicles than cows and adequate passageway area (>2-3m^2/cow) and feed space to reduce competition and reduce stocking density and subsequent soiling of the udder (Green et al., 2012). Recent literature places focus on the environment for management and prevention of mastitis (De Vliegher et al., 2018). It has been shown that on farm management practices like accommodation of cows in the dry period is linked with changing the incidence of dry period clinical mastitis (Green et al., 2007) and raised somatic cell counts (Green et al., 2008). There has recently been a scoping review to assess the available literature on modifiable management practices used during the dry period and the effects on udder health (McMullen et al., 2021). The papers that were identified reported effects on udder health in the dry period on nutrition, vaccines, and dry period. With virtually no literature having reported on space allowances or the environmental conditions that the animals were managed in.

Most studies which have assessed the housed environment have investigated freestall housing and have mainly used stocking density in terms of cubicle to cow ratios for these assessments. A study looking into the use of alternative housing systems compared key udder health parameters on farm before and after a change in the housed environment for dairy cows. This change in environment was subsequently associated with changes somatic cell counts, and mastitis infection rates (Barberg et al., 2007), providing evidence for the likely impacts of the housed environment on udder health. Very few studies have investigated how space allowances of bedded packs effects cow health. Therefore, it is currently unclear as to how health outcome and cow cleanliness are impacted by space allowances in these environments. Although there is now some evidence to suggest that cows are more likely to have poorer hygiene scores in high space allowances yards based on a trial comparing two space allowances (7.7-12.9m^2 vs. 15.4-25.8m^2) (Creutzinger et al., 2021).

Dufour et al., have reported a number of housed infrastructure characteristics that could influence somatic cell counts. These authors concluded that freestall housing systems with sand-bedded cubicles are the housing related features which were associated with improving SCC parameters, however space allowances were not explored (Dufour et al., 2011). In freestall housing, high stocking densities or narrow passageways are likely to lead to dirtier udders and limbs due reduction in available space per cow leading to increased faecal build up in the environment. However, no research has investigated the impact of general non-bedded space within freestall housing on cases of mastitis or intra-mammary infections. Housed dairy cows may be more likely to be dirtier when high stocking densities are employed and less space available because faecal contamination may increase. Dirty udders have been shown to increase rates of clinical E.coli mastitis (Breen et al., 2009). Higher hygiene scores of the udder and hindlimbs have been shown to have associations with increased somatic cell counts likely due to increased contact time with moisture and manure (Reneau et al., 2005).

Thus, further investigation into this area will provide information to further optimise housing conditions to aid prevention of subclinical and clinical mastitis events.

CONCLUSIONS

In conclusion, there is a current lack of peer-reviewed research which has investigated the impact of space allowances within the housed environment on udder health parameters. The housed environment and particularly space allowance has been shown to have substantial impact on dairy cow production, fertility and behaviour. Therefore, an emphasis must be placed on performing research into the likely links between the housed environment and udder health performance. This will allow the industry to improve its understanding of how to optimise the conditions that dairy cows are provided with.

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NOTES

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MASTITIS CONTROL PLAN CASE STUDY: SHORT AND LONG TERM RESULTS

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SUMMARY

A herd milking 460 Holstein Fresian cows carried out an AHDB Mastitis Control Plan in the spring of 2022. The herd had a clinical mastitis rate of 42 cases per 100 cows per year and an annual cell count of 208,000.

The mastitis control plan was carried out including pattern analysis using the QuarterPRO tool. Analysis showed a mixed environmental pattern that demonstrated seasonality. In-depth on-farm observations and discussions were completed during the summer months and actions were selected from a list of recommendations produced by the Mastitis Control Plan software.

A three month and one year review was carried out to discuss compliance with the plan and assess progress. Compliance with the plan was moderate, with five agreed action points continued. Rates of clinical and subclinical mastitis decreased at both reviews, with the herd mastitis KPIs currently greatly improved.

INTRODUCTION

An AHDB Mastitis Control Plan was carried out on a herd of 460 Holstein Fresian cows in the South of England in the spring of 2022. The herd produces a 305 day average of 11,500L and is milked twice daily through a rotary parlour. Milk is sold to Arla on a Sainsbury's contract and the control plan was requested following a Sainsbury's audit; clinical and subclinical mastitis were flagged as requiring intervention. The annual average milk protein was 3.18% and fat 4.08% at the time of the plan assessment.

Cows are housed and bedded on a mixture of deep sand cubicles and mattresses topped with sand. Cows are grazed during the far-off dry period in the summer then transitioned in sand cubicles. Automatic scrapers are run 9 times daily. The herd has a good health and vaccination status and clinical and subclinical diseases related to transition are rare. Heifers are reared at a separate site before joining the adult herd in the far-off dry group.

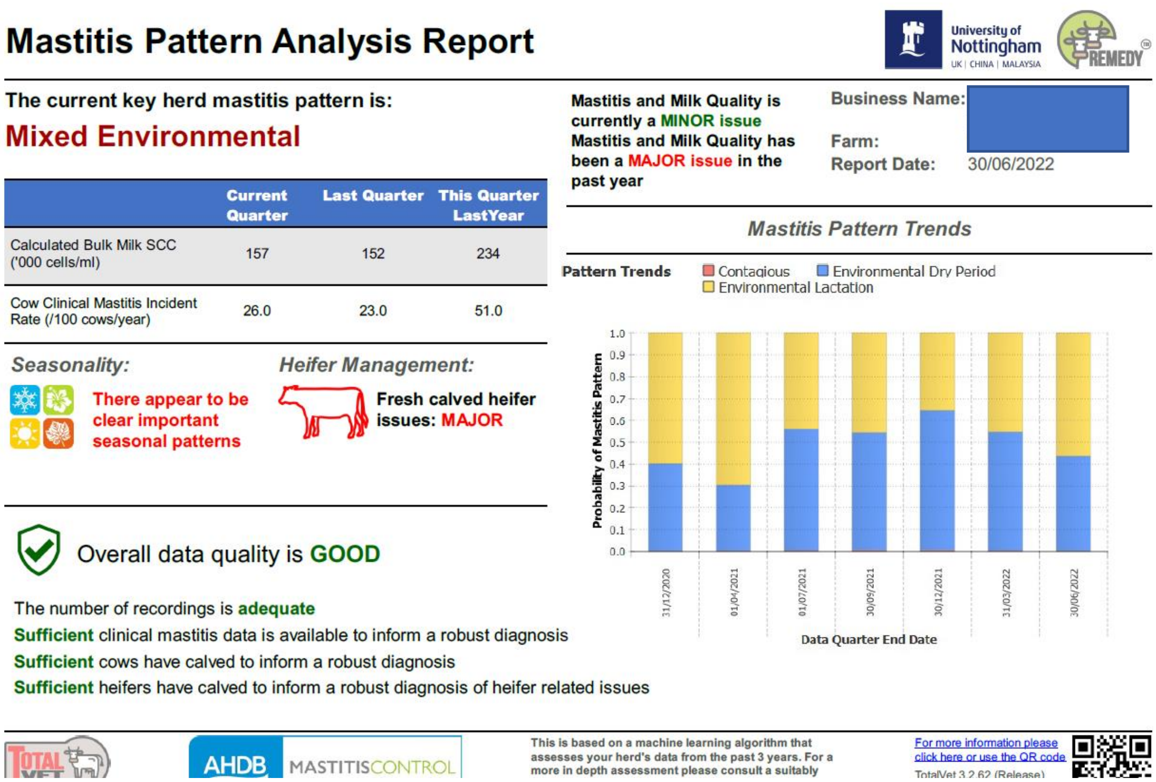
At the time of the plan request, the herd had an annual mastitis rate of 42 cases per cow per year and an annual cell count average of 208,000. It was decided the plan should be carried out in the summer following assessment of the mastitis data. The farm had carried out multiple control plans over the previous years and valued the input and evidence-based approach.

PLAN IMPLEMENTATION

Data Analysis

Firstly the mastitis pattern was determined by uploading the herd CDL file to the QuarterPRO tool (Breen, Hudson et al. 2017). This is checked quarterly and historically the pattern has been either environmental lactation origin or environmental mixed origin. As seen below (Figure 1), the pattern was mixed environmental origin at the time of the plan and freshly calved heifers were shown to be a major issue in the previous year.

Figure 1: QuarterPRO Mastitis Pattern Analysis



The farm uses Interherd + as an on-farm recording system and data was analysed using a combination of Interherd + and TotalVet.

The clinical mastitis rate was analysed and evidence of seasonality discussed (Figure 2). As you can see in the graph below, the mastitis rate had been worse in the summer of 2021, which was predominantly lactation origin. This was mirrored in the herd average cell count (Figure 3). The dry period origin cases suffered a spike which appears to correlate with the turnout of 2021.

Figure 2: Clinical mastitis cases

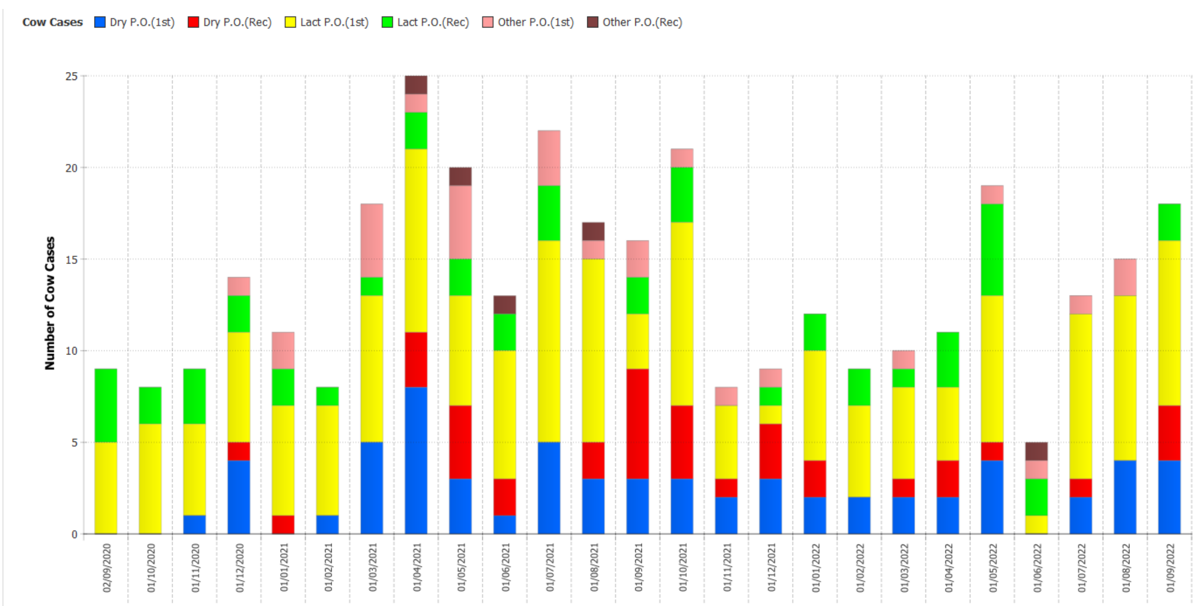
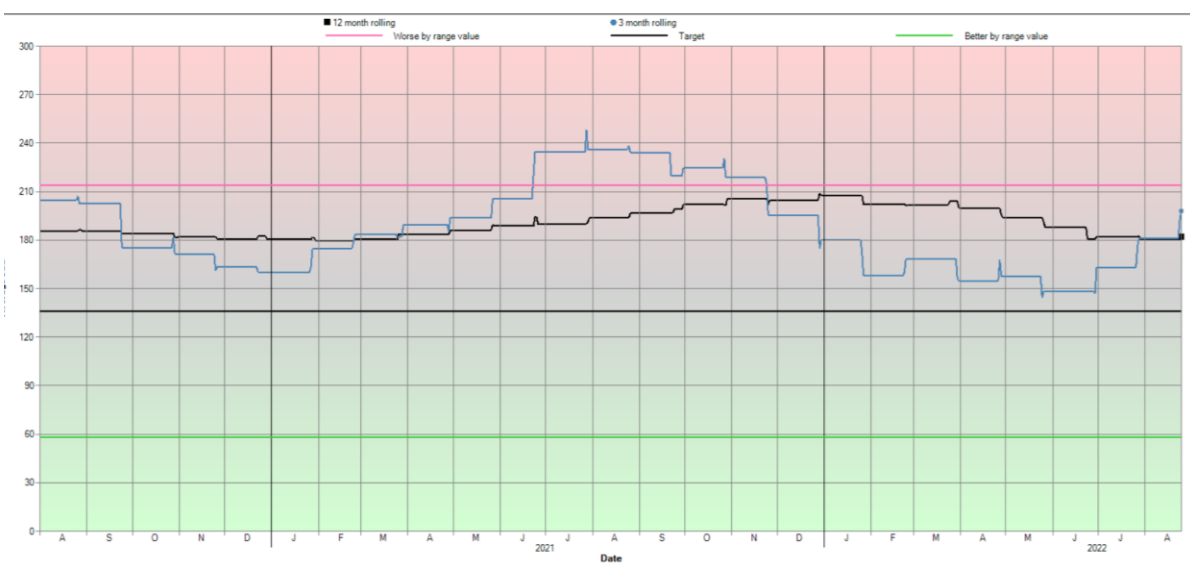


Figure 3: Bulk Milk Cell Count



Dry period and lactation origin rates were assessed. As you can see from the below graph (Figure 4), dry period origin cases were not under tight control. This was significantly worse in the summer, which was suspected to be linked to dry cows following milkers during grazing.

Figure 4: Rate of cows dried off with low cell count that calved with high cell count

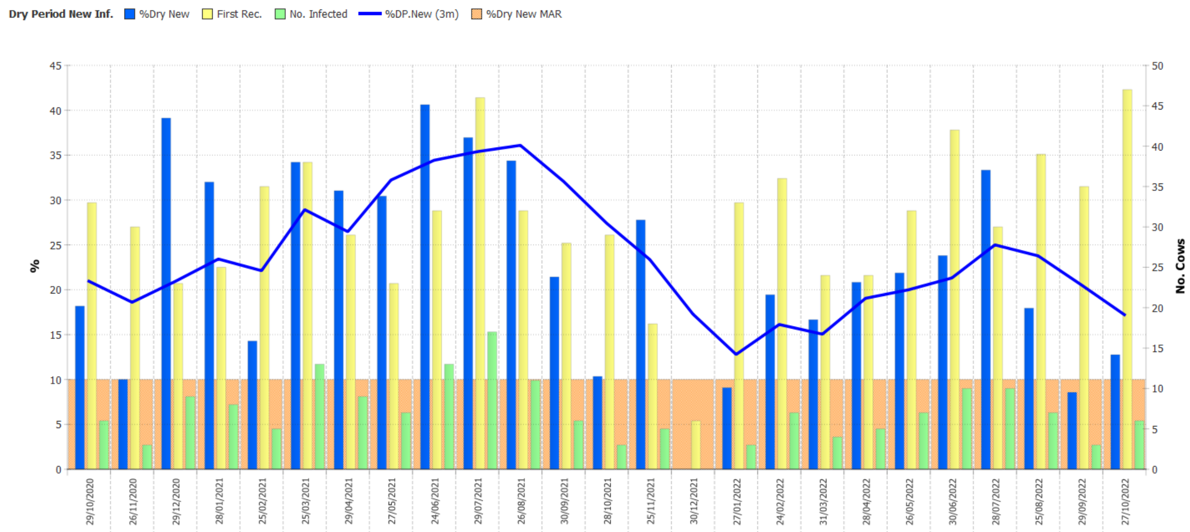
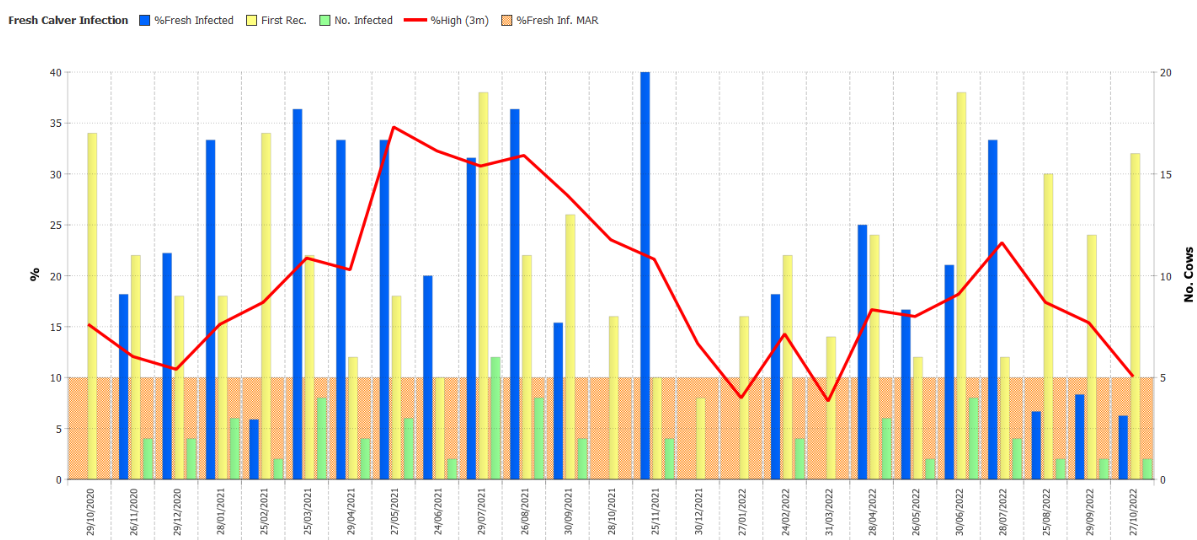


Figure 5 shows the percentage of heifers calving with a high cell count. This pattern mirrors the dry period origin cases, bolstering evidence that cows were infected during the grazing period.

Figure 5: Rate of heifers calving with a high cell count



Farm Observations & Questions

An AHDB mastitis control plan was carried out as described by (Green, Leach et al. 2007). An assessment of both parlour routine and milking, dry cow and heifer environment was performed and recorded using the mastitis control plan software.

An in-depth discussion was carried out between the herdsman, key members of staff and the plan deliverer. The Mastitis Control Plan questionnaire was used as the basis for the discussion, with emphasis on the practicalities of the farm routine and areas farm staff felt were significant for mastitis control.

Bacteriology

Figure 6: Pre-treatment clinical case bacteriology

Sample ID	Cow ID	Qrt	Date	SCC (,000/ml)[1]	DIM	Sample Type[2]	Result	Penicillin Sensitivity[3]
1	2851	BR	9/7/22	Clot	360	C	Mixed, heavy growth of *E. coli* and scant growth of *Streptococcus lutetiensis.*	NT
2	3338	FR	30/6/22	Clot	360	C	Mixed, scant growth of *E. coli* and *Corynebacterium bovis.*	NT
3	3158	FL	19/6/22	Clot	100	C	Heavy, pure growth of *Corynebacterium bovis.*	NT
4	2182	BR	26/6/22	Clot	365	C	Mixed, heavy growth of *Streptococcus uberis* and scant growth of *Staphylococcus xylosus* and *Staphylococcus simulans.*	NT
5	2842	BL	3/7/22	Clot	255	C	Mixed, heavy growth of *Streptococcus uberis* and moderate growth of *Corynebacterium bovis.*	NT
6	3455	BR	5/3/22	Clot	6	C	Heavy, pure growth of *Streptococcus uberis.*	NT
7	1187	BL	8/2/22	Clot	30	C	Mixed, heavy growth of *Streptococcus uberis* and *Staphylococcus simulans* and moderate growth of *Staphylococcus haemolyticus.*	NT
8	3099	BL	21/2/22	Clot	12	C	Mixed, heavy growth of *Streptococcus uberis* and scant growth of *Staphylococcus haemolyticus.*	NT

Key: [1]Clot = Clotted, Insuff = insufficient volume [2]C = Clinical, S = Sub-clinical, UK = Unknown; [3]S = Sensitive, R = Resistant, NT = Not Tested (only *S. aureus* tested)

Figure 6 shows the latest bacteriology results taken from pre-treatment clinical mastitis samples, reflecting a majority of pathogens with environmental aetiology. The Streptococcus uberis was further strain-typed and concluded to be from likely contagious spread. However, pattern analysis has never indicated a contagious pattern so this is monitored closely.

Agreed Actions

The following actions were decided upon collectively following discussion of the list of recommendations produced by the Control Plan software.

- Take measures to ensure slurry scrapers and fans are working whenever possible; ensure repairs are carried out as soon as possible
- Aim to understock yards if at all possible
- Use Kings Lynn sand for bedding, not washed sand
- Consider options for storing sand undercover
- Consider options to ensure each teat is cleaned with a clean / fresh part of a laundered towel
- Ensure static and dynamic parlours tests are carried out every 6 months
- Run refresher training in drying off techniques to ensure this is being done aseptically
- Discuss as a team practical implications of changing dry cow grazing rotation. (Recommendation 2 weeks grazed followed by 4 weeks rest, areas of camping fenced off)

Long Term Considerations

- Loafing space

The cows suffer from heat stress in the summer- understocking yards and providing outside loafing area could alleviate this.
There is a fine balance of scraper frequency to ensure they run smoothly while keeping alleys clean. Allowance of further loafing space will aid this.

- Heifer teat condition

While cow teat condition was excellent, a lot of first lactation heifers were scored as “rough” in teat end score (de Pinho Manzi, Nóbrega et al. 2012). Younger heifers were housed on deep straw at the time of the plan. This was not well draining and heifers were dirty around their hind limbs and udders. There was a high frequency of wart infection. More frequent bedding, alternative accommodation or bedding substrate could be considered. Flies are also difficult to control in the summer months despite frequent fly control application. Fly control was discussed with ideas for optimisation.

3 MONTH REVIEW

Three months after the control plan, a meeting was arranged to assess progress on the agreed actions and identify any evidence the actions were starting to reduce mastitis rate. The list of actions were reviewed and the farm confirmed they are implementing the below:

- Take measures to ensure slurry scrapers and fans are working whenever possible, ensure repairs are carried out as soon as possible
- o Continues to be a challenge
- Aim to understock yards throughout the summer
- Continue to use the Kings Lynn sand for bedding

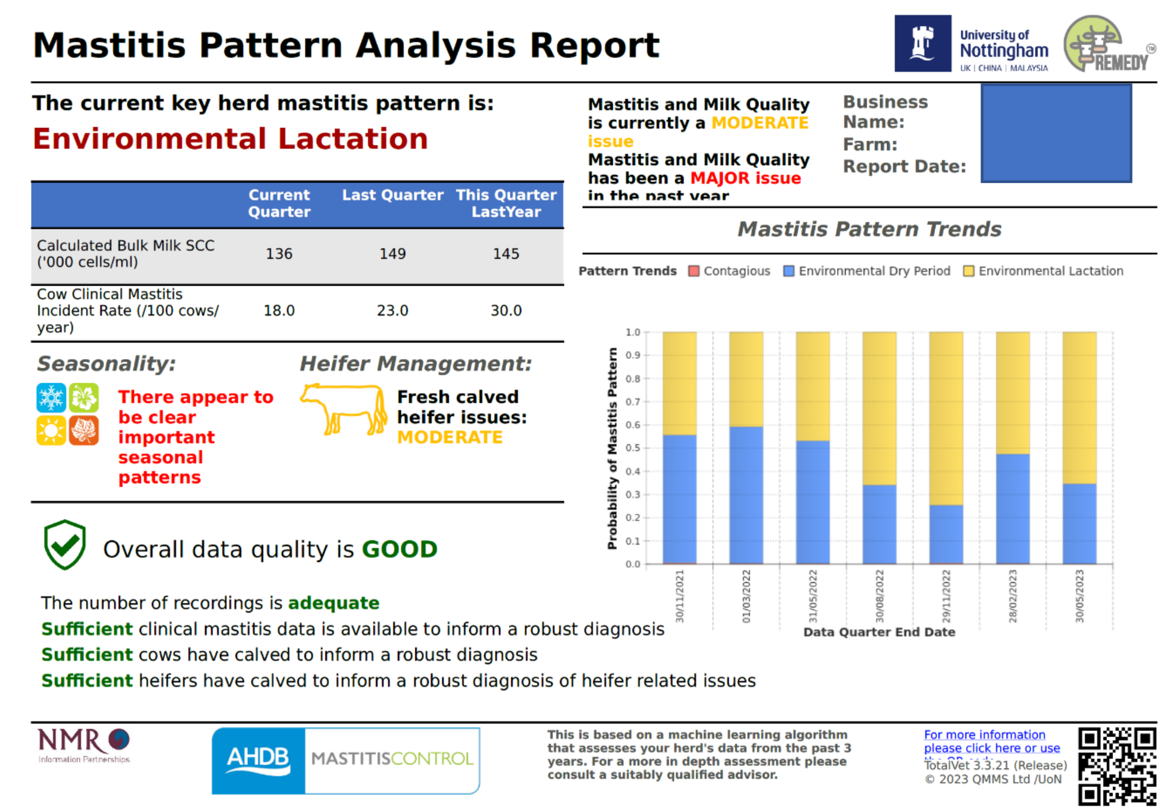
- Ensure static and dynamic parlours tests are carried out every 6 months
- Dry cow grazing rotation. (Recommendation 2 weeks grazed followed by 4 weeks rest, areas of camping fenced off)

The mastitis KPIs had improved, with a three month rolling rate of clinical mastitis of 32 cases per 100 cows and a 12 month average of 33. There was no evidence of a summer spike in cases. The cell count had also improved, with a three-month average of 180,000.

ANNUAL REVIEW

At present mastitis KPIs are good. As shown below (Figure 7), the clinical and subclinical mastitis rates have improved, with an annual average clinical mastitis rate of 28 cases per cow per year and a well-controlled annual cell count of 158,000. The graph below (Figure 8) shows the decline in 12 month rolling clinical mastitis rate (black line) in the year since the plan implementation.

Figure 7: Current QuarterPRO pattern analysis



Mastitis Pattern Analysis Report

The current key herd mastitis pattern is:
Environmental Lactation

Mastitis and Milk Quality is currently a MODERATE issue
Mastitis and Milk Quality has been a MAJOR issue in the past year

Business Name:
Farm:
Report Date:

	Current Quarter	Last Quarter	This Quarter LastYear
Calculated Bulk Milk SCC ('000 cells/ml)	136	149	145
Cow Clinical Mastitis Incident Rate (/100 cows/ year)	18.0	23.0	30.0

Seasonality: There appear to be clear important seasonal patterns

Heifer Management: Fresh calved heifer issues: MODERATE

Overall data quality is GOOD

The number of recordings is adequate
Sufficient clinical mastitis data is available to inform a robust diagnosis
Sufficient cows have calved to inform a robust diagnosis
Sufficient heifers have calved to inform a robust diagnosis of heifer related issues

This is based on a machine learning algorithm that assesses your herd's data from the past 3 years. For a more in depth assessment please consult a suitably qualified advisor.

For more information please click here or use
TotalVet 3.3.21 (Release)
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Figure 8: Clinical Mastitis Rate

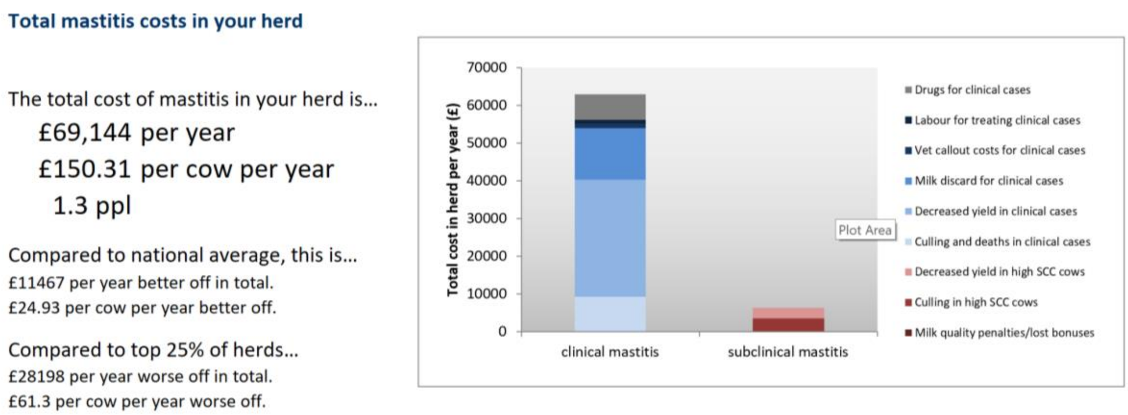
The farm firmly believes mastitis was at its worst when washed sand was used, and that the improvement in mastitis rate can be greatly attributed to the change to Kings Lynn sand. However, this farm has implemented multiple changes over the year that will have produced gains as well. The changes of paddock rotation, dry cows not following milking cows and the addition of grass silage to the transition ration are changes that will have influenced results.

Looking towards the future, the farm could next focus on the heifer environment and routine.

REFLECTION

Use of the Mastitis Control Plan Cost Calculator tool estimated that mastitis was costing the farm £69,144 per year at the time of the plan. The majority of this cost was from milk discard and reduced milk yield from clinical cases (Figure 9).

Figure 9: Mastitis Control Plan Cost Calculator



The cost calculator also predicted that the farm would need to commit to comply with 33-66% of plan recommendations to achieve an 18% reduction in clinical cases. It suggested that a compliance level of <33% would achieve a 4% reduction in clinical cases, and a net saving of only £2179 after the control plan.

At present it is estimated that mastitis is costing the farm £45,572, which is a saving of £23,572. We can conclude that the changes the farm chose to make had a greater impact than suggested as the compliance level was mixed. However, the plan opened up an opportunity for discussion, time allocation and staff awareness of issues related to mastitis control that is difficult to measure.

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NOTES

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REGIONAL VARIATIONS IN LACTATING/DRY COW TUBE USAGE AND TEAT SEALANTS

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SUMMARY

Regional trends from Kingshay's antimicrobial monitoring service, which analyses annual antimicrobial purchase data, were highlighted and reported in Kingshay's 2nd Antimicrobial Focus Report. The overall trend showed a drop in lactating cow tube usage over the last 5 years from 0.833 DCDVet in 2018 to 0.471 DCDVet in 2022. Improvements in herd health during this period will have played a key part in this reduction, as well as an increased awareness of using critically important antimicrobials. However, teat sealant usage for 2022 was similar to 2019, averaging 0.41 courses per cow.

Antimicrobial and teat sealant use was broken down by UK region. This highlighted that the South / South East regions had the lowest antimicrobial use, averaging 13.0 mg/kg PCU and the North region to be the highest at 20.7 mg/kg PCU. A more comprehensive analysis would be needed to understand why these differences exist, as average herd size and milk yields suggests similarities between all regions.

INTRODUCTION

Kingshay's antimicrobial monitoring service was established in 2017 in response to demands from farmers, vets, and milk processors. The results are published annually in our Antimicrobial Focus Report. The data used in this abstract has been taken from the 2nd annual report (for a March 2022 year-end), which is free to download at www.kingshay.com.

METHODOLOGY

The service obtains client sales data from the vet practice for each herd, with livestock numbers and other herd details being gathered from the farmer. The number of herds using the service has grown year-on-year with 1,044 herds being analysed in 2022. The data was then validated by both the vet and farmer to ensure its accuracy. Other enterprises (such as beef/sheep units) where antimicrobial sales were on the same account are removed and adjustments are made for products bought in bulk and not used in the specified time period. Along with dry cow therapy, a detailed list of products used and the quantity, the report includes comparisons with other herds, and to last year's results.

RESULTS

The overall trend shows a drop in the number of lactating tubes used over the last 5 years from 0.833 DCDVet in 2018 to 0.471 DCDVet in 2022.

Since collecting records in 2018 there has not been further improvements in the use of teat sealants, which was lower than the 2020 RUMA target of 0.7 courses per cow, averaging 0.41 courses per cow in 2022. Shown in Table 1.

Table 1 Antimicrobial use trends over the last 5 years

Antimicrobial Use (March year end)	2018	2019	2020	2021	2022
Dry cow tubes (DCDVet)	0.509	0.512	0.484	0.471	0.454
Lactating cow tubes (DCDVet)	0.833	0.596	0.558	0.491	0.471
Sealant tube usage (courses/cow)	0.61	0.41	0.36	0.39	0.41

The results for 2022 were then split further into UK regions, to see if there was a pattern in usage. Table 2 shows a trend of higher usage in the Northern regions, however it is not understood why this may be the case. Further in-depth analysis shows herds in the North had total antimicrobial usage 44% higher than the Southwest. Focusing on the highest 25% of users of antimicrobial products, 40% of the herds located in the North region were within this highest quartile.

Table 2 Regional variations in antimicrobial usage and teat sealants

Antimicrobial Use (March year end)	South West	South/ South East	Midlands	North	Wales	Scotland
% of herds	41%	5%	8%	13%	16%	17%
Dry cow tubes (DCDVet)	0.416	0.350	0.439	0.551	0.452	0.507
Lactating cow tubes (DCDVet)	0.476	0.605	0.581	0.424	0.406	0.464
Sealant tube usage (courses/cow)	0.50	0.55	0.32	0.28	0.40	0.32
Total Antimicrobial Use (mg/kg PCU)	14.5	13.0	13.2	20.7	16.5	17.1

CONCLUSIONS

There are differences in antimicrobial use and teat sealants by region, of which it is not clear as to why there are such differences when herd size and milk yields are similar (see Kingshay's Antimicrobial Focus Report 2022 for more detail). These variations may be down to a combination of factors, such as attitudes to antibiotic reduction (both farmer and vet), product availability (which has been a challenge for some products), mixed / traditional vet practices in certain areas or simply down to good herd health.

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BACTERIAL SPECIES PREVALENCE AND ANTIBIOTIC SENSITIVITY IN A COHORT OF BOVINE MASTITIS SAMPLES FROM THE UK

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It is widely understood that not all cases of mastitis require, or respond to, antibiotic treatment. On-farm diagnostics are rapidly becoming the standard mechanism for ensuring mastitis cases requiring treatment are identified, and antibiotics used prudently.

Mastatest is an innovative on-farm diagnostic for bovine mastitis that can identify the bacterial species within a milk sample, and test for antibiotic sensitivity of the strain identified. It simplifies sample preparation for farmers using a patented cartridge system that takes seconds to fill. Samples are poured into the easy-to-use cartridge and placed in the Lapbox hardware device for automated sample processing and analysis. Results and a treatment recommendation are interpretated using cloud analytics and returned to the farm via email within 24hrs. All farm results are retained in an online portal for later herd analysis by the farmer. Veterinarians can also access data and create reports for all farms allocated to them within the system. Mastaplex can also centrally produce reports for certain geographies, meaning they now possess a unique and extensive dataset of the causes of mastitis globally.

Between July 2022 and April 2023, a total of 1616 clinical mastitis samples originating from farms in the United Kingdom were evaluated using Mastatest. A summary of all evaluable results during this time period was downloaded by Mastaplex on 1 May 2023 and analysed using standard reports available within the Mastatest portal.

Analysis of the UK dataset to-date shows 16% of all samples had no bacterial growth. Also of particular note was that 24% of all samples contained E.coli or other gram-negative bacteria.

Antibiotic sensitivity testing data confirmed that of the E.coli/other gram negative isolates, 100% were identified as having a low chance (Minimum Inhibitory Concentration (MIC) = 4 or >4) of responding to benzylpenicillin or cloxacillin, and 98% of isolates having a low chance of responding to cephalexin. This data confirms that for almost all cases identified as being E.coli/other gram negative, commonly used licensed antibiotics for dairy use are unlikely to be beneficial.

Taken together, a farmer utilising Mastatest would be able to rule out the need for antibiotic treatment in 40% of all presenting clinical mastitis cases.

Other common bacteria identified were S. uberis (12%), other Strep. species (10%), Coagulase negative staphylococci (10%), other gram positive bacteria (8%), S. aureus (4%), S. dysgalactiae (2%), and Klebsiella/Serratia (2%). 10% of samples were found to have more than one bacterial species present.

Detailed data on antibiotic sensitivity for each bacterial type is available within the dataset, and indicates that for most bacterial species there is no 'one-size-fits all' choice of optimal antibiotic.

Data from the expanding Mastatest cohort of clinical mastitis samples within the UK presents a unique and ongoing opportunity to understand the causes of mastitis and ensure the most effective treatment and management plans are being implemented on-farm.

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UDDER HEALTH IN 84 UK SENTINEL DAIRY HERDS IN 2022

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The AHDB Sentinel Herds Project provides an annual overview of udder health parameters in a cohort of well recorded herds, with reliable clinical mastitis records and regular individual cow somatic cell counts (SCCs). One hundred and twenty-five herds were recruited on the basis of quality of 2016 records. A group of 84 surviving herds supplied data for 2022, which is summarised and compared with 2016 data in Table 1. Reasons for loss of herds from the study were summarised and recruitment year parameters were compared for herds that survived in the study to 2022 and those that were lost. Performance in 2022 was compared between herds with 11 or 12 milk recordings in 2022 and those that recorded less frequently.

Table 1 Key farm indices and udder health indicators 2022 and comparison with 2016. Significance of difference between 2016 and 2022: * $p < 0.05$ (Wilcoxon signed-rank test)

Variable	n	Mean 2022	Median 2022	1st Q 2022	3rd Q 2022	Median 2016
Herd size	84	370	284	207	440	260
Mean annual rolling 305 day yield (l)	80	9021	8788	7612	10757	8886*
Calculated bulk milk SCC (,000/ml)	82	155	149	116	190	141
Clinical mastitis (CM) rate (cows affected /100 cows/ year)	83	23.3	18	12	27.5	32*
Dry period origin CM rate (cows in 12)	83	0.52	0.45	0.32	0.62	0.71*
Lactation origin CM rate (cows in 12)			1.31	83	1.50	1.96*
Lactation new infection rate (%)	82	5.9	5.4	3.8	7.2	6.8*

Variable	n	Mean 2022	Median 2022	1st Q 2022	3rd Q 2022	Median 2016
Dry period new infection rate (%)	80	13.0	11.7	8.5	15.4	14.3
Dry period cure rate (%)	80	78.2	80.9	73	86.3	82.1
Fresh calver infection rate (%)	80	14.9	13.5	10.3	18.2	15.9
% chronically infected	82	7.8	7.2	4.6	9.9	9.2*
% > 200,000 cells/ml	82	14.3	13.7	9.9	17.9	16.0*
Number of recordings	84	9.7	10.5	8	12	11

All parameters showed a significant improvement since 2016, with the exception of SCC dynamics over the dry period and calculated bulk milk somatic cell count.

Compared with herds that were lost, herds that survived had, in 2016, a lower median clinical mastitis rate (32 v 38 cases/100 cows per year), lactation new infection rate (6.8 v 8.0%) and higher dry period cure rate (82% v 76%). The most common reasons for loss from the study were sale of the herd (n = 13), reduced frequency or cessation of milk recording (n = 7 and 5 respectively), and a move to incompatible data systems (n = 6). The mean number of recordings per year fell from 9.7 in 2016 to 9.4 in 2022, and the proportion of herds recording "monthly" (11 or 12 recordings in the calendar year) from 0.56 to 0.50. Herds recording less often than "monthly" had a higher new infection rate in lactation (6.57% compared with 5.33% for those recording 11 or 12 times in the year) but there was no other difference in the udder health parameters analysed.

CONCLUSIONS

Udder health parameters continue to indicate improved performance in surviving herds over time. Herds lost from the study performed less well in 2016 (in terms of clinical mastitis rate, lactation new infection rate and dry period cure rate) than those still reporting in 2022. Less frequent milk recording was associated with a higher lactation new infection rate.

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INVESTIGATION OF INCREASING ANTIMICROBIAL SENSITIVITY SURVEILLANCE FOR MASTITIS PATHOGENS ACROSS THE UK

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The identification of mastitis pathogens and subsequent antimicrobial sensitivity testing (AST) in the United Kingdom (UK) is undertaken in a variety of settings, and by a variety of methods. This has many advantages, as one size does not fit all, but one of the disadvantages is that it makes it very difficult to see the bigger picture for mastitis pathogens.

During 2021 and 2022, the Animal & Plant Health Agency (APHA) and the Veterinary Medicines Directorate (VMD) have collaboratively run several pilot projects, under three main workstreams, to investigate the methods whereby an increased volume of data on mastitis pathogens can be collected and combined to increase our understanding of the bigger picture. We are continuing this through 2023 and, hope to encourage expansion of these initiatives in the future.

The main remit of the Surveillance Unit of APHA is to undertake surveillance for new and re-emerging threats (NRET). These fall into six main categories: antimicrobial resistance (AMR), novel diseases and pathogens, new strains of pathogens, zoonoses and toxicities, endemic disease trends changes, and notifiable and exotic diseases. It is possible that the testing of milk samples for both pathogen identification, and AST, could alert us to any one of these NRETs, but particularly to AMR threats and to new strains of pathogens.

The VMD undertake surveillance of antimicrobial usage (AMU) and of AMR. Information for both these surveillance streams is published annually in the UK Veterinary Antibiotic Resistance and Sales Surveillance Report (VARSS). One of the aims of our collaborative projects is to increase the volume of information and data that is available for the VARSS report (1).

Broadly, the three workstreams are:

1. Encouraging the sharing of data by private veterinary laboratories (PVL) and, investigating the incentives and barriers for doing so.
2. Encouraging private veterinary surgeons (PVS) to submit isolates from their practice labs to APHA for subsidised parallel bacteriology testing; either as an informal proficiency test, or if the PVS has concerns about a particular isolate or mastitis case.
3. Offering free of charge bacteriology testing to farmers who are using on-farm mastitis testing, in parallel with their own testing.

Workstream 1

The APHA project team have approached six PVLs during 2021/2022 and have had discussion with them about their opinions on the incentives and barriers for them to share data with APHA and VMD. Data from four laboratories has been shared. This data has been analysed and data from one PVL has been published in both the 2020 and 2021 VARSS reports. The information given by the labs on incentives and barriers to data sharing has been assessed and stored. The assessment of the different methods used by PVLs, and the challenges this poses to seeing the bigger picture, are also part of this workstream. These include different bacterial identification methods and cut-off values used for PVL to determine antimicrobial susceptibility (2).

Workstream 2

Subsidised parallel testing has been offered to PVS who are undertaking culture within their practice labs. This workstream has been started more recently than the other two and, is a similar voluntary initiative to that being undertaken in Denmark, as presented by Michael Farre at BMC in 2022 (3).

Workstream 3

On-farm testing has increased in recent years in response to moves across the livestock sectors towards reducing AMU (4)(5)(6). Subsidised parallel testing has been offered to farmers (via their vet) who are undertaking culture (or other testing) on their farm. This has produced some interesting results and, has increased our surveillance for threats such as MRSA (7)(8).

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COMPARISON OF CLINICAL AND SUBCLINICAL MASTITIS CURE PROBABILITIES IN 10 UK DAIRY HERDS

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Previous research presented at the British Mastitis Conference has shown mastitis cure probability can be estimated based on a combination of cow- and herd-level data (1). Individual cow factors include previous milk recording results, clinical mastitis history, stage of lactation and parity. Herd factors include prevalence of infection, rates of new infection and average bulk milk somatic cell count. Subclinical mastitis cure probability assumes no therapy, and could also be described as the probability of self-resolution. In comparison, the clinical mastitis cure probability assumes treatment. These definitions are in line with recommendations from the Mastitis Control Plan – that subclinical cases should not be treated, but clinical cases should be. This study describes the distribution in subclinical and clinical mastitis cure probability across a cohort of UK dairy herds.

Data were collected from a convenience sample of 10 QMMS milk recording herds, selected on accuracy of record keeping, and frequency of milk recording (>10 recordings per year). Key performance indicators were calculated using TotalVet (QMMS Ltd): 12-month average prevalence of infection, clinical mastitis rate, calculated bulk milk somatic cell count (BMSCC). Subclinical cure probabilities were calculated for all cows >200 or >1000 x10^3 cells/ml at the latest milk recording; clinical mastitis cure probabilities were predicted for all cows in the herd at the latest milk recording (April or May 2023).

Table 1 Key performance indicators compared to the UK Sentinel Herds (UKSH)

Farm ID	Herd size	Prevalence of high SCC	Clinical mastitis rate / 100 cows / year	Calculated BMSCC ,000 cells/ml
1	-	28.5%	97	322
2	-	14.3%	15	180
3	-	18.6%	11	177
4	-	27.4%	25	280
5	-	15.2%	10	166
6	-	9.3%	11	103
7	-	7.7%	23	82
8	-	9.5%	10	120
9	-	14.4%	46	188
10	-	13.1%	20	147
Mean	**424**	**15.8%**	**27**	**177**
Median	**308**	**14.4%**	**18**	**172**
UKSH Mean	**365**	**15.0%**	**25**	**160**
UKSH Median	**286**	**14.4%**	**20**	**160**

Key performance indicators were similar to figures reported from the UK Sentinel Herds (2). There was considerable variation in predicted cure probability across and within the 10 herds. In subclinical cases (>200,000 cells/ml), cure probability ranged from 0.003% to 77.9% (median 11.8%). In higher cell count cows (>1,000,000 cells/ml), cure probability ranged from 0.3% to 66.1% (median 5.6%). For clinical mastitis, cure probability was higher, ranging from 0.8% to 75.6% (median 51.5%).

There was a wide variation in subclinical mastitis cure probability across and within farms. Interestingly, some subclinical cases had much higher cure probabilities, similar to what would be expected of clinical mastitis cases. For clinical mastitis, cure probability tended to be higher, though all farms showed variation. Interestingly, those herds with the lowest subclinical cure probability had the largest variation in clinical mastitis cure probability. These herds tended to have higher prevalence of high cell count cows, and may be better candidates for a selective treatment approach.

The concept of 'treatment worthiness' has recently received attention with on-farm culture and selective treatment (3). Before carrying out selective therapy, it is important to have realistic expectations of cure. Eight per cent of cows in this study had a clinical mastitis cure probability of <20% i.e. more than five of these cases would need to be treated in order for one to cure. Many of these cases are repeats, or those occurring in older chronic high cell count cows. If farmers are looking to reduce antimicrobial use, these cows with a very low probability of cure should be considered. In these cows, reduction of AMU is likely to have least negative impact on cure rate. In contrast, cases of mastitis with high probabilities are likely to be new cases in low cell count, younger cows. These cases represent best value for treatment and are an ideal target for antimicrobial therapy.

This study shows large variation in mastitis cure probability. These data could be used on farms opting for a selective treatment approach i.e. withholding of antibiotics in cows with a low probability of cure. On some farms, these results could guide treatment of rare high cell count cows with a high probability of cure. It should be highlighted, that from a welfare perspective, anti-inflammatory drugs are indicated where there are signs of inflammation.

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IDEXX REALPCR MILQ-ID DNA SYSTEM: THE NEW SOLUTION FOR MASTITIS TESTING

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INTRODUCTION

Mastitis is the most frequent infectious disease with the most important economic consequences in dairy cattle (1). The identification of mastitis-causing pathogens is key to adapting treatments and reducing the number of cases. These causative pathogens were historically identified by culture (2), but today, IDEXX RealPCR* MilQ-ID DNA System, for use with milk samples, allows for identification of 4–16 targets in a single test run in 3 hours.

MATERIALS & METHODS

- Automated extraction with RealPCR* MilQ-ID Magnetic Bead Kit
- Reagents for 16 targets: 4 multiplex 4-targets mixes, run independently or together, including an internal positive control (IPC) for control of extraction and PCR,
- Thanks to a modular platform, mixes can be run side by side on the same plate with a single PCR protocol for all reactions and components are sold independently as needed,
- Quality control: the IPC monitors extraction and PCR runs and the lab monitoring program detects contamination,
- Extraction is validated with KingFisher* Flex & Duo and PCR with Applied Biosystems* 7500 & QuantStudio* 5,
- A dedicated cloud-based software, available on any device, permits to import run files and to analyse curves with a semi-quantitative approach. Results are then securely stored and exported to LIMS.

Studies were conducted to determine the performance of the RealPCR* MilQ-ID DNA System in synthetic or clinical samples. Analytical sensitivity and PCR efficiency were determined through testing dilutions of synthetic DNA representing the RealPCR* MilQ-ID DNA System targets. Log dilutions in the range of 10,000,000 copies to 1 copy per 25 µL reaction were prepared, and multiple replicates of each dilution were tested with the DNA mixes, using standard test reagents and protocol. The analytical sensitivity limit of detection (LD_{PCR}) is the smallest number of target nucleic acids per reaction, detectable in at least 60% of the test results. PCR efficiency is calculated as $(10^{(-1/slope)}-1)$ x100 over a 7-log range plotted from one session of testing.

RESULTS

Table 1 Performance data of the four MilQ-ID mixes

Target	LD_{PCR} (copies/reaction)	PCR % Efficiency
MilQ-ID DNA Mix 1		
M. bovis	1 copy	104.5%
S. aureus	1 copy	108.9%
S. uberis	1 copy	103.0%
S. agalactiae	1 copy	105.6%
MilQ-ID DNA Mix 2		
S. dysgalactiae	1 copy	100.5%
ß-lactamase	10 copies	99.4%
E. coli	10 copies	98.6%
Staphylococcus spp.	10 copies	106.3%
MilQ-ID DNA Mix 3		
T. pyogenes	10 copies	98.0%
Enterococcus spp.	10 copies	98.7%
Prototheca spp.	1 copy	97.8%
Klebsiella spp.	1 copy	99.7%
MilQ-ID DNA Mix 4		
Mycoplasma spp.	10 copies	99.8%
Pseudomonas aeruginosa	1 copy	101.6%
Yeast	10 copies	90.2%
Corynebacterium bovis	1 copy	106.2%

Each of the MilQ-ID DNA targets was detectable at 1 or 10 copies per reaction, which demonstrates excellent sensitivity for the MilQ-ID DNA System.

CONCLUSIONS

The RealPCR*R MilQ-ID DNA System offers a new, quick, and accurate tool for the management of mastitis at farm level. Thanks to interesting features. RealPCR* MilQ-ID DNA System is changing the game in mastitis testing:

- Less than 3 hours are required to run a full test with excellent accuracy,
- A modular platform permits maximum flexibility for PCR runs,
- RealPCR Connect* software provides an improved workflow,
- The internal control system assures confidence in results.

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NOTES