

2012

BRITISH MASTITIS CONFERENCE

Organised by

The Dairy Group

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The University of
Nottingham

Topics:

- AMS
- Liner mapping
- Research updates
- Antibiotic resistance
- Mastitis control programmes
- Heifer mastitis

Wednesday 17th October 2012

**Pitch View Suite, Worcester Rugby Club,
Sixways Stadium, Warriors Way,
Worcester, Worcestershire WR3 8ZE**

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GENERAL INFORMATION

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TIMETABLE of EVENTS

09:00	ARRIVE / REGISTRATION / COFFEE and POSTER DISPLAY	
09:45	CHAIRMAN'S INTRODUCTION	Brian Pocknee <i>The Dairy Group, UK</i>
	Session One	
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10:25	Liner mapping and teat health	Ian Ohnstad <i>The Dairy Group, UK</i>
10.55	Questions and Discussion	
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11:45	Evaluation of dipping and flushing systems	Andrew Bradley QMMS Ltd, UK
12.00	Is there an ideal bedding material?	Neil Howie Cheshire, UK
12:15	Sensors for mastitis management	Jens Yde Blom Biosens, Denmark
12:30	National Mastitis Survey 2012	Andrew Biggs Vale Veterinary Group, UK
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13:00	LUNCH and POSTERS	
14:15	CHAIRMAN'S INTRODUCTION and VOTING ON POSTERS	Elizabeth Berry DairyCo, UK
	Session Three	
14:30	Antibiotic resistance - fact or fiction?	Declan O'Rourke Ortec Consultancy, UK
15:00	Mastitis control programmes - the Irish experience	Finola McCoy Teagasc, Ireland
15:30	Heifer mastitis	Roger Blowey Wood Veterinary Group, UK
16:00	Questions and Discussion	
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¹ Veterinary Investigation Officer, Animal Health and Veterinary Laboratories Agency (AHVLA), Luddington, Stratford upon Avon, Warwickshire, CV37 9SJ, UK; ² Head of Knowledge Transfer, DairyCo, Agriculture & Horticulture Development Board, Stoneleigh Park, Kenilworth, Warwickshire, CV8 2TL, UK
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Appendix

National Mastitis Survey 2012

CHAIRMAN'S INTRODUCTION

Welcome to the 24th British Mastitis Conference, with our return to the conference facilities at Worcester Rugby Club.

The Organising Committee has worked hard throughout the year to bring together a group of speakers, both international and home grown, that we believe will prove thought provoking and stimulating.

Our first paper looks at the experience of AMS in Denmark, which has by far the highest proportion of herds milked by this method throughout the world. The second paper of the first session introduces the concept of liner mapping and how each liner has unique effects on milking speed and teat condition, dependent on vacuum levels and pulsation characteristics.

We then move into our research updates with four papers considering efficacy of dipping and backflush systems, bedding materials for the dairy herd, sensors for mastitis management and an update on the National Mastitis Survey. These four papers are followed by an opportunity for delegates to debate with the presenters.

After lunch, we will turn our attention to whether antibiotic resistance in the dairy herd is fact or fiction, the experience from Ireland on their Mastitis Control programme. The conference is closed with a paper on heifer mastitis.

This year we have an increased number of posters on a wide range of topics. As ever I would urge you all to make time to review the posters and speak with the authors.

We continue to try to find you the best speakers with the best and most relevant (and latest) information. This is achievable only thanks to all our generous sponsors, a number of whom are first time supporters. This year our sponsors are: MSD Animal Health, Milk-Rite, Elanco Animal Health, Boehringer Ingelheim Ltd, Evans Vanodine, Ambic Equipment Ltd, Fullwood Ltd, ADF Milking Ltd and Vetoquinol. As usual the event could not happen without able administration, provided by Karen Hobbs and Anne Sealey at *The Dairy Group*.

Finally, as always, thank you for attending and supporting the conference. I trust you will have an enjoyable and worthwhile day.



Ian Ohnstad
British Mastitis Conference Chairman
The Dairy Group

FURTHER INFORMATION

Organised by *The Dairy Group*, DairyCo
and University of Nottingham

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The NMC is a professional organization that promotes research and provides information to the dairy industry to help reduce mastitis & enhance milk quality. For nearly 50 years, the 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 including books, brochures and CDs
- 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 & workshops, providing educational opportunities for all segments of the dairy industry
- Helps fund the National Mastitis Research Foundation

*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.

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- The NMC printed and electronic newsletters, addressing the latest information on udder health, milking management and milk quality
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PAPERS

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DANISH EXPERIENCE OF AMS

Jens Yde Blom

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SUMMARY

Automated milking has been used in Denmark since the late 90's. Today more than 900 installations of robotic milking equipment (25 % of milk produced in Denmark) are in use. A significant number has been bought by Dutch farmers moved to Denmark. After a slow introduction to Denmark, the sales peaked in 2007. Since then the sales have plummeted due to the international economic crisis.

Robotic farmers are happy about the novel equipment, leaving them time for other farm work and time with the family, and no adverse effects as to health and welfare have been seen. A few farmers revert to parlour milking due to the stress of robotic alarms showing up on the cell-phone. If not prepared for a 24/7 life with robotic milking farmers will not adapt to the system.

INTRODUCTION

Denmark is a major dairy producing country in Europe measured by the output of dairy produce per capita. More than 11% of agriculture products amounting to 10 bio. UK£ go to Great Britain. 520,000 dairy cows produce more than 4,400 bio. kg of milk every year which makes Denmark a large dairy producing country in Europe, exporting more than 80% of the dairy produce to other countries, particularly to the European Community.

Since the introduction of automated milking in the late 1990ties the number of farms with robotic milking has grown considerably, basically because of the ease of milking, time to be spent overlooking the herd and the time saved for being with the family. As of mid 2012 more than 900 installations of automated milking systems have seen their way to Danish dairy farms.

Research into robotic milking

Coming totally out of focus of research and authorities, a large EU-funded research programme into robotic milking was launched in 2000 (1).

The research programme was divided into 11 subprojects:

- Socio-economic aspects of robotic milking
- Public acceptance of robotic milking
- Redefinition of acceptable milk quality
- Milk quality on farms with a robotic milking system
- Prevention of antibiotic residues

- Effectiveness of automatic cleaning of udder and teats and effect of hygiene management
- Optimal cleaning of equipment
- Health of dairy cows milked by an automatic milking system
- Welfare assessment of dairy cows in automatic milking systems
- Automatic milking and grazing systems
- Demands and opportunities for operational management support

This presentation will only focus on the most important finding of the project, aiming at animal health and welfare.

The project was ended in 2002, and since then very little attention has been paid to automated milking, apart from a number of reports concerned with automated mastitis alarms. Interesting also was the lack of attention to the EU funded project by Danish farmers. They easily adapted to robotic milking systems and were less concerned with formalities in the academic world!

The public perception of automated milking has been favourable on the European continent, basically due to consumers' acceptance of the "free lifestyle" of dairy cows in a robotic environment, but also the consumers' total ignorance and lack of knowledge of the life of the dairy cow.

RESULTS

Animal health in automated milking

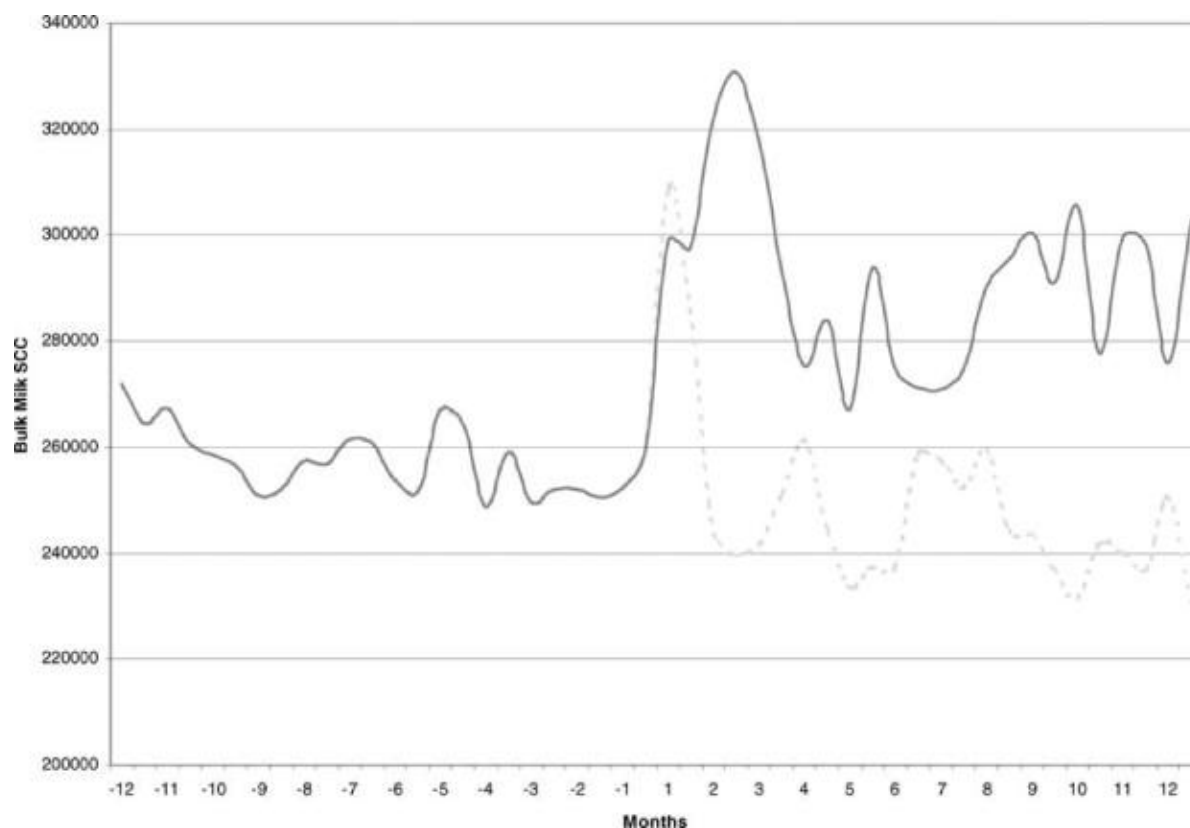
The health of dairy cows milked by an automatic milking system has been reviewed thoroughly in the EU funded project.

In a report headed by Hillerton *et al.* (1), based on a number of farms in the Netherlands, UK and Denmark it was stated that the lameness, assessed as locomotion score, increased slightly in the Netherlands and the UK. No concerns were raised but were to be further investigated including examination of changing risk factors including comparison of zerograzed and part-grazed systems.

Fertility was not affected. Breeding success might be more difficult or lactations may have been extended with automated milking as the time to conception and the calving interval might be lengthening. These are not primary health issues that affect the well-being of the cows *per se*.

It is clear in the Netherlands and the UK that bulk milk cell count increased, at least in the short term, on installation of automated milking. This is also reflected in a Danish study (2).

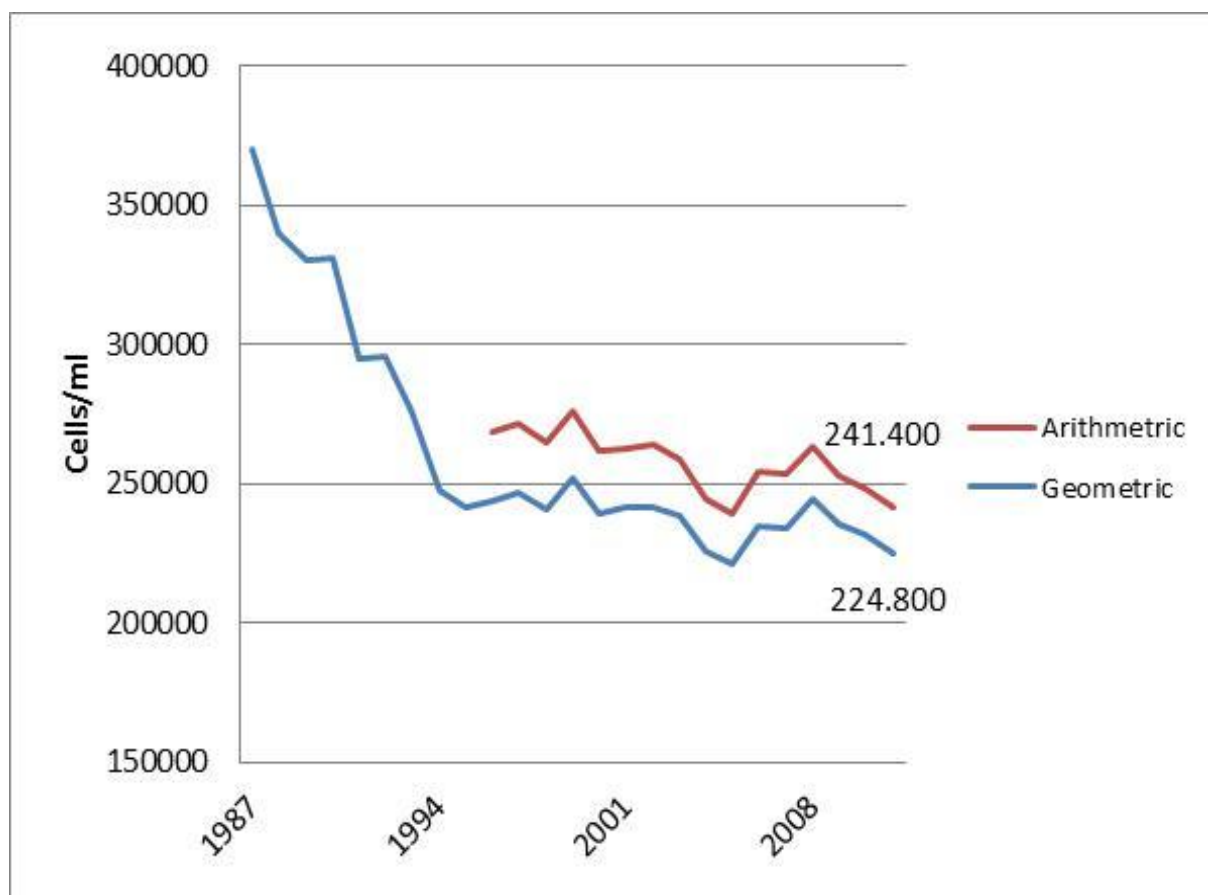
Figure 1. Changes in somatic cell counts in Danish dairy farms before and after the installation of automated milking (2).



However, the mastitis and teat health studies in the study showed no indications of a change in the incidence of udder infections. Experience from Danish dairy herds have shown no change in mastitis incidence rates, and somatic cell counts were declining from more than 350,000 in 1987 to less than 250,000 in 2010 (figure 2). Danish dairy producers aim at less than 150,000 in 2015, including also robotic farms.

Overall, there were few indications of general health problems on conversion to robotic milking. Individual farms often have their own unique problems. These appear to be related to management, expectations and facilities rather than the milking system.

Figure 2. Development in somatic cell counts in Denmark 1987-2010.



Welfare in automated milking

The welfare of dairy cows in automatic milking systems (AMS) is dependent on several factors, related to the barn design and cow traffic systems, the cows themselves and social interaction with other cows in the herd, to feeding and nutritional supply, and general management, including the operator.

In the EU funded project, three commonly used cow traffic systems were investigated: forced traffic, partially forced traffic (selection gate or by-pass gate) and free traffic (1). It was shown that the number of cows and time spent in the waiting queue in front of the milking unit increased when more restrictions were introduced in the traffic system. At forced cow traffic, the average number of feeding visits was too low (3.9 visits/cow/day) to be optimal. A larger number of cows had to be fetched at the free traffic system because they frequently exceeded the upper limit for stipulated milking interval of 14 hours. It also resulted in greater variation in milking intervals. While both the forced and the free traffic system proved to be suboptimal, forced traffic with a by-pass gate resulted in satisfactory feeding visits (6.5 – 7.1 visits/cow/day) and a low percentage of cows fetched for milking.'

The Danish experience is that free cow traffic is to be preferred, although some providers of automated milking systems prefer the “feed first” option. If this has any influence on the frequency of mastitis due to cows lying down in cubicles soon after milking has not been investigated.

Milking robots and grazing

A considerable number of Danish milk producers are organic. This means that cows must be grazing 150 days per year. This can be practised in automated milking, but with some trouble, bringing cows back to the barn for milking.

Recently a Danish company moved the milking robot into the field, as to accommodate dairy cows to be milked while grazing.

Robotic milking and human interaction

Using a robotic milking system also involves a human factor. Being used to a 2-3 times/day interaction with cows during milking, and taking care of “problem” cows, the operator of a robotic milking system also has to manage an automated system. Failure alarms will appear on the cell phone 24 hours a day, telling about cows not appearing at the robot, and also mechanical failures on the system.

Most farmers adapt to this condition of business, but a few people never adapt, leaving them to go back to parlour milking. There have been very little research into this matter, but a recent UK project might shed light on the issue.

CONCLUSIONS

Having experienced automatic milking since the late 1990ties, Danish producers are content with the automated milking solution. The development in somatic cell counts appear to be of a limited duration due to the stress of changing from parlour to automated milking, and the development in the national somatic cell count figures show that although automated milking amounting to 25% of milk produced the figure is decreasing.

REFERENCES

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2. Rasmussen, M.D., M Bjerring, P. Justesen and L. Jepsen (2002): Milk Quality on Danish Farms with Automatic Milking Systems. *J. Dai. Sci.*, 85, 2869-2878.

NOTES

LINER MAPPING AND TEAT HEALTH

Ian Ohnstad

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SUMMARY

There are many milking machine factors that can affect teat condition, which can include the fit of the liner to the teats, the type of liner used (shape and material), the working vacuum level at which the system operates, the degree of over-milking and the adjustment of the pulsation.

All of these factors are interactive and must be considered in the context that all milking must achieve the ultimate compromise of milking quickly, gently and completely.

Different farms have differing objectives when considering milk harvesting. Some farms want to milk as quickly as possible while other farms are more driven by post milking teat condition.

The selection of liners and pulsation settings that maximise milking speed is likely to increase the risk of teat congestion and teat-end hyperkeratosis. Optimising post milking teat condition will generally result in a modest reduction in milking speed.

INTRODUCTION

Machine milking has often been described as the ultimate compromise between milking gently, quickly, and completely (1). To achieve gentle milking, the milking system needs to maintain the optimal keratin balance in the teat canal, minimise the amount of hyperkeratosis noted around the teat end while minimising congestion in the teat tissue to assist teat closure after milking. As herd size increases, there may be more interest in milking quickly, although the achievement of high average milk flow rates can often be associated with deterioration in teat health.

As the milking liner is in intimate contact with the teat, a better understanding of how a liner behaves during milking under different circumstances should allow the achievement of both acceptable milking performance and optimal teat health.

LINER DESIGN

The choice of the liner and the vacuum level at which it is used is highly significant when examining machine induced effects on teat condition. How

well a liner fits the teats is critical when choosing a liner for a specific herd, although it is important to recognise that while only one liner will be selected, there will be a wide range of teat size and shape within a typical herd.

Liner design is a complex science and the selection of a suitable liner will require consideration of many factors including liner dimensions, material, wall thickness and tension. For the purpose of this paper, the focus is primarily on how the liner is able to minimise teat congestion while maintaining acceptable milking performance.

When a liner collapses around a teat end during the liner closed (d-phase) of the pulsation cycle, it applies a compressive load to the teat tissues. This is described as liner compression and is the compressive pressure (expressed in kPa above atmospheric pressure) applied to the inner tissues of the teat apex by the liner. This compression is necessary to counteract the effect of vacuum on the teat tissue.

While liner compression is often discussed, one less well known component of liner compression has been defined as over-pressure (2). Over-pressure is the compressive pressure, above that required to just start or stop milk flow from the teat, applied to the inner tissues of the teat apex by the liner during the liner closed (d-phase).

A new method has recently been developed that makes the measurement of over-pressure easier for different liners (3). This measurement can be undertaken during milking and is described as Dynamic over-pressure. This is measured with continuous operation of the pulsator while the pulsation chamber vacuum is increased from zero (liner fully closed) in steps of 2.0 kPa until milk flow is observed.

Recent trial work has highlighted the significant difference in dynamic over-pressure between different liners ranging from 2.0 – 15.0 kPa (4). These trials were carried out on 42 different US and European liners.

Teat congestion

The level of vacuum applied to the teat tissue during milking is one of the main determinants of teat congestion during milking. Congestion is an accumulation of circulatory fluids within the teat and if congestion is severe and persistent, oedema will occur.

It is important to differentiate between teat end congestion and teat barrel congestion. The factors that can lead to each condition can vary and therefore the solution to each condition may be different.

Effective liner collapse and massage helps to reduce the congestion in the teat-end tissues by forcing fluids out of the teat end while teat barrel congestion is closely related to the vacuum in the mouthpiece of the liner.

It is worth noting that the liner applies little or no compression to the teat barrel during milking.

Congestion of teat ends will result in a decrease in the effective diameter of the teat canal and can reduce milking speed. Both teat end and teat-barrel congestion, and particularly oedema, can cause discomfort during milking.

Teat size and shape will have a marked effect on levels of teat end and barrel congestion noted with any particular liner. Short teats do not penetrate into the liner as deeply and therefore they receive less liner compression around the teat apex. Narrow, short teats form a less effective seal between the liner and teat barrel which can result in higher mouthpiece vacuum increasing the risk of congestion and oedema.

Choosing a liner with higher compression will reduce teat end congestion, although most liners in the commercial market apply more compression than is necessary to manage teat-end congestion.

If congestion is occurring in the teat barrel, the solution may be to reduce the vacuum level in the liner mouthpiece. Reducing the milking vacuum level will provide some benefit, although the main factor in mouthpiece vacuum is the size of the liner relative to the size of the teat. Reducing the milking vacuum level may also be detrimental to cluster stability and increase the risk of liner slippage.

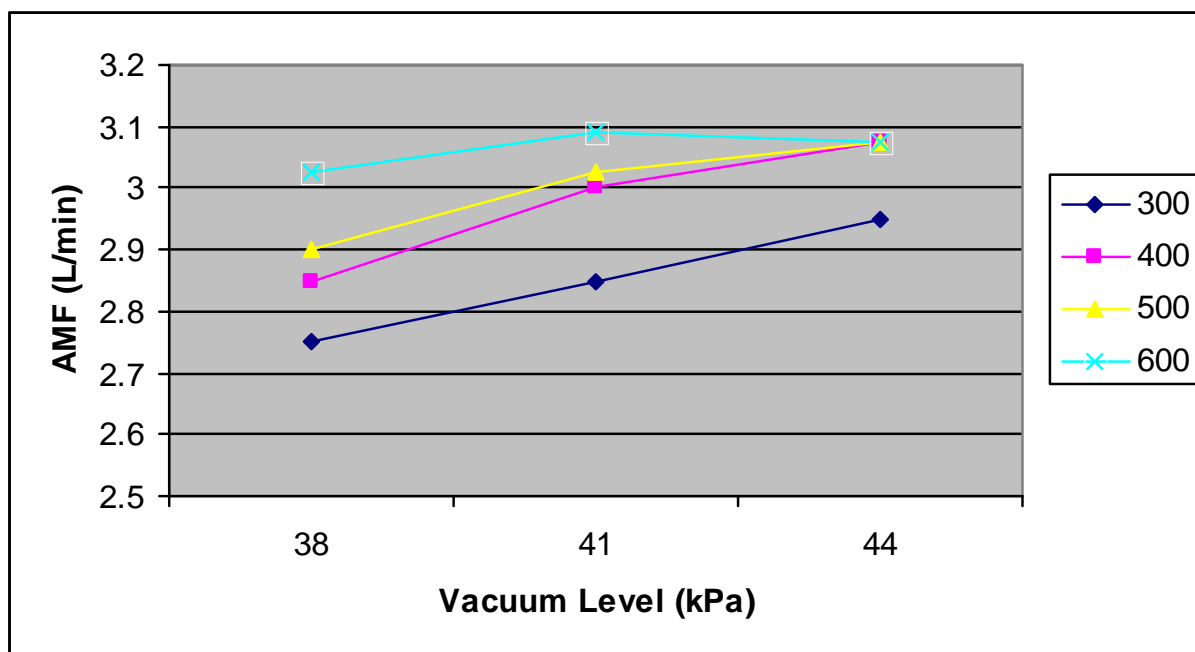
As a general rule, a liner with a shallow mouthpiece depth is more suitable for short teats. A liner with a narrower bore will reduce mouthpiece vacuum for narrower teats. Triangular liners generally produce a higher mouthpiece vacuum than round liners as the seal between the teat and liner barrel is not as good. The higher mouthpiece vacuum will often manifest itself as palpable tissue ringing at the base of the teat.

Another method to reduce mouthpiece vacuum is the addition of an air vent in the liner mouthpiece. Eliminating over-milking with optimised milking routines and higher ACR flow thresholds can also be beneficial in reducing teat barrel congestion as the low flow period is generally the time in which teat barrel congestion develops most rapidly.

Pulsation settings can affect the degree of teat-end congestion. If the liner closed (d-phase) is less than 150 milliseconds, there is insufficient time to provide congestive relief of the teat end. However, although excessively long d-phases (greater than 250 milliseconds) will do no harm to the teat, they can reduce milking speed as a greater percentage of the pulsation cycle will be in a massaging rather than milking phase. When d-phases move beyond 350 milliseconds, there is often an increase in the number of wedged teat ends reported.

As the length of the liner open (b-phase) increases, so does the degree of congestion in the teat end. When this is combined with high milking vacuum, this can manifest itself in a reduction in the rate of increase of average milk flow rates. This is demonstrated in Figure 1.

Figure 1. Average flow rates related to liner b-phase and vacuum level



As the vacuum level increases, the reduction in average milk flow is more marked with the longer b-phase confirming the establishment of teat end congestion.

Work is now being undertaken to develop liner performance maps to provide specific guidance on the balance between vacuum level and b-phase duration for individual liners for various milking performance parameters.

Teat-end hyperkeratosis

Hyperkeratosis is defined as excessive keratin growth. It is a normal physiological response to the forces applied to the teat skin during milking and is a thickening of the skin that surrounds the external teat orifice. Development of hyperkeratosis is multi-factorial and can be influenced by a number of factors including weather, environmental conditions, milking management, herd yield, teat shape and the genetics of individual cows. Teat-end hyperkeratosis can be classed according to the Teat Club International (TCI) scoring system as No Ring (N), Smooth Ring (S), Rough ring (R), and Very Rough Ring (V).

When considering milking management, hyperkeratosis can be reduced by ensuring sufficient prep-lag time in the milking routine, using liners that

apply a lower compressive load and adjusting the threshold settings of ACRs to reduce low milk flow time and shorten average unit on time per cow.

Selection of liners

Again it must be stressed that the selection of a suitable liner needs to take account of the average teat size within a herd. Teats are able to adapt to different liner dimensions while liners have much less ability to adapt to different teat sizes. As there will always be a range of teat size and shape in a herd, the best liner for any herd is the liner that will perform well over the widest range of teat sizes.

In order for the liner to apply compression to the end of the teat and reduce congestion, the teat end must be positioned in the part of the liner that is able to collapse and provide this compression. Teats increase in length by around 40% from their resting length to their milked length when milked in a narrow bore liner.

To apply compression to the lower 25 mm of the teat, a liner with a mouthpiece depth of 30 mm will apply full compression to teats that are longer than about 39 mm in their resting state. There has recently been a general trend towards breeding for short teats and it is not uncommon to see heifers with teats less than 30mm long in their resting state. If the teat does not protrude into the liner barrel beyond the mouthpiece, no compression will be applied to the teat. This explains the high levels of discolouration, oedema and discomfort often noted on heifers' teats after milking. In addition to the problems generated by insufficient liner compression, these short teats will also be milked with high mouthpiece vacuum, as the teat is not long enough to create a seal in the liner barrel.

The diameter of the teat compared to the liner barrel also plays a role in the mouthpiece vacuum during milking. Teats can stretch in both directions: they can get 'fatter' and 'longer'. However, the total volume of the teat in the liner is relatively constant. If teats get 'fatter' they cannot become longer. Wide bore liners (liner bore diameter greater than teat diameter) will cause a teat to get fatter and reduce the ability of the teat to elongate into the zone of effective compression. This decreases the minimum teat length that can be effectively massaged during milking. This has led to a general recommendation that liners should be selected that have a barrel diameter 1mm less than the average teat width in the herd.

Liner Compression and Teat-end Hyperkeratosis

The primary milking machine influence on teat-end hyperkeratosis is liner compression. Liner compression for any individual liner increases with the milking vacuum level because the pressure difference across the liner is increased during the liner closed (d-phase) of a pulsation cycle. While liner compression is associated with hyperkeratosis, over-pressure values of

different liners were highly correlated with teat end hyperkeratosis scores in field studies.

In a survey of commercial farms in Wisconsin (3), liners with the highest over-pressure measurements were responsible for more than 80% of teats having rough or very rough hyperkeratosis scores whilst liners with the lowest over-pressure measurements produced less than 20% of teats that were rough or very rough. From this survey it seems clear that lower over-pressure results in less hyperkeratosis.

Therefore selection of a suitable liner for a dairy herd now involves knowing more than average teat dimensions. An understanding of over-pressure for each liner should now be part of the decision process.

Vacuum Level and Pulsation settings

Once the interaction between liner, vacuum level and pulsation is understood, it becomes possible to select vacuum level and liner open (b-phases) for individual liners. It is now possible to predict the effect of milking vacuum level and b-phase length on milking speed and teat-end congestion for specific liners. This is described as liner performance mapping.

An example of a liner performance map is shown in Figure 2 (a 20 mm bore liner, with a dynamic over-pressure of 5.0 kPa and mouthpiece depth of 27 mm). It must be stressed that the liner performance map illustrated in Figure 2 is for one specific liner only and the specific milk speed and congestion values do not apply to other liners.

Figure 2. Liner performance Map

Claw Vacuum		b-phase (ms)						
kPa	"Hg	300	350	400	450	500	550	600
34	10.0	65%	70%	74%	77%	80%	81%	81%
36	10.5	68%	73%	77%	80%	81%	82%	82%
37	11.0	71%	75%	79%	82%	84%	84%	84%
39	11.5	74%	78%	82%	84%	86%	86%	86%
41	12.0	77%	82%	85%	87%	88%	88%	88%
42	12.5	81%	85%	88%	90%	91%	91%	90%
44	13.0	85%	89%	91%	93%	94%	93%	92%
46	13.5	89%	93%	95%	96%	97%	96%	94%
47	14.0	93%	97%	99%	100%	100%	99%	97%
Congestion for short teats (<3 cm) indicated by colors in the kPa Column		Table numbers indicate % of max average flow rate for this liner						
		Table colors indicate teat congestion for teats >3cm in length			Low	Medium	High	Extreme

Liners with different shapes (round, triangular, square), made from different materials, with and without vents and different dynamic over-pressure values will produce vastly different results. However, there are some general trends that illustrate some basic principles that may apply to all liners. The percentage numbers in the body of the chart relate to the relative milking speed, as indicated by average milk flow rates.

- As claw vacuum increases, so does the milking speed.
- As the b-phase increases, so does milking speed until a point at which milking speed declines due to increasing teat-end congestion.

To explain the liner performance map illustrated in Figure 2 imagine a milking parlour with a working vacuum level of 48.0 kPa. At peak milk flow the vacuum in the clawpiece is likely to be around 42.0 kPa. The vacuum level in the clawpiece approaches the working vacuum level as the flow rates decline towards the end of milking. During this low flow period, clawpiece vacuum would be expected to rise to around 47.0 kPa.

The milking speed should be considered using the expected clawpiece vacuum during the peak flow period of milking (42.0 kPa in this example), as the peak flow period makes up the largest portion of the total milking. The fastest milking condition (91% of the fastest possible condition for this liner) would occur with a b-phase setting of 500-550 msec. However, the risk of teat-end congestion would be relatively high during the peak flow period (bordering between yellow and red).

During the low flow period of milking (claw vacuum of 47.0 kPa) a b-phase between 500 – 550msec would mean the risk of teat-end congestion would be between high and extreme.

If optimising teat condition (gentle milking) was the main priority for the particular farm using this particular liner, reducing the working vacuum level to 42.0 kPa (range of claw vacuum from 41.0 kPa during the low flow period to 36.0 kPa during the peak flow period) and reducing the b-phase duration to 450 msec would reduce teat congestion.

These settings for this particular liner would result in very low teat congestion during the peak flow period and only moderate teat congestion during the low flow period for most cows and would substantially reduce teat-end and teat barrel congestion for cows with short teats.

However, the milking speed for these settings would be 80% of the maximum for this liner. If the average unit on time was previously 4.0 minutes, there would be an increase in the average unit on time of about 26 seconds.

CONCLUSION

The selection of the most appropriate liner for a particular dairy herd can have a significant impact on the effectiveness of milk harvesting on the unit. Inappropriate liner selection can lead to teat congestion and oedema and uncomfortable, agitated cows that fail to milk completely. This is likely to have udder health implications.

Having full performance data for specific liners should ensure liner selection becomes more precise, ensuring optimal equipment performance and healthier herds.

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NOTES

Evaluation of Dipping and Flushing Systems

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SUMMARY

This paper outlines a study investigating the impact of an automated dipping and flushing system on the bulk milk somatic cell count and rate of new intramammary infection in lactation. Data from 84 herds (42 case herds and 42 control herds) was analysed and the rates of new infection and bulk milk somatic cell counts compared between the year before and after installation in case herds and a temporally matched time scale in control herds. Installation of the automatic dipping and flushing system had no significant effect on either the bulk milk somatic cell count or the lactation new infection rate. Of the available parameters, culling rate and average days in milk were found to be most influential in determining the change in bulk milk somatic cell count, whilst the pre-existing lactation new infection rate, the proportion of the herd chronically infected and the proportion of cows calving in with an elevated somatic cell count were most influential in determining the change in lactation new infection rate. This research suggests that automatic dipping and flushing systems potentially offer the modern producer the opportunity to reduce labour input in the parlour and improve cow flow, whilst maintaining udder health.

INTRODUCTION

Recent years have seen a proliferation of automated devices for both the application of post milking teat disinfectant and for the 'backflushing'/disinfection of the liner/milking claw between cows during the milking process. The reasons for these innovations have been multifaceted, but their adoption on farm is usually driven by either a desire to reduce labour in the milking parlour or to improve mastitis control.

Post milking teat disinfection (PMTD) is a cornerstone of the Five Point Plan for mastitis control (5) and is implemented to kill mastitis pathogens left on the surface of the teat at the end of the milking process. Post milking disinfection is primarily directed against the contagious mastitis pathogens and its efficacy in this regard has been well demonstrated (<http://www.nmconline.org/docs/teatbibl.pdf>), though there is some evidence to suggest that it may exacerbate environmental mastitis (8). In contrast, back flushing and cluster disinfection are undertaken with the aim of reducing the bacterial load on the surface of the liner between cows, thereby reducing the risk of contagious transmission of pathogens during the milking process. Studies have demonstrated their efficacy in achieving a

cleaner liner (6). However, in contrast to PMTD, the evidence for back flushing reducing the number of new intramammary infections with major pathogens is limited (3). That said, there are many opportunities for transfer of infection during the milking process and milking liners may act as one of many potential fomites (4).

Given our current understanding of mastitis epidemiology and the transmission dynamics of the major mastitis pathogens, one would reasonably expect PMTD and cluster flushing to be of relatively greater importance in herds with a higher bulk milk somatic cell count (SCC) and a higher prevalence of contagious mastitis pathogens – characteristics perhaps not that commonly found in the modern dairy herd in the UK (1).

The aim of the research outlined in this paper was to investigate the efficacy of the ADF Milking automatic dipping and flushing system in a cohort of UK dairy herds, as measured by its impact on bulk milk SCC and the rate of new intramammary infection during lactation.

MATERIALS & METHODS

A convenience dataset of 252 farms that had installed the ADF Milking's Automatic Dip and Flush System (ADF) were mailed and invited to participate in the study. Sixty one farmers replied and returned data release forms. Milk recording data were requested from the three milk recording organisations and a complete dataset was available for 56 of the 61 farms. Seven farms were excluded during the initial screening process as insufficient data were available (*e.g.* had not recorded in the necessary time period around ADF installation). Finally, seven more farms were lost from the analysis as a result of being unable to identify a suitable control farm (see later) or due to anomalies in the data identified during the initial analysis. As a consequence of the exclusions above, data was available from 42 herds for analysis.

Available data were downloaded into the TotalVet[®] (QMMS/SUM-IT) software for benchmarking and analysis. Initially data from the available herds were benchmarked to the first milk recording date subsequent to the installation of ADF, thereby defining performance in the year prior to installation in each herd. The herd was then benchmarked for a second time to the corresponding milk recording date 12 months later, thereby defining the complete year following installation.

Having benchmarked the case herds, it was necessary to identify herds that had not installed ADF to act as controls (though they may have installed a different system). These herds were selected from an anonymised national dataset of herds according to the procedure outlined below.

Each of the case herds was categorised according to the criteria outlined in Table 1, on the basis of the values obtained in the benchmark at the milk recording immediately after the installation of ADF. These criteria were

selected on the basis that they may impact mastitis susceptibility and control as well as giving a crude measure of the prevalence of infection in the herd. Each herd could therefore fall into one of 27 different categories. The case herds were then temporally matched to control herds by finding herds which fell into the same grouping category and had been benchmarked to a milk recording within 7 days of the milking prior to the installation of ADF.

An equivalent pre- and post-installation year 'benchmark' was then generated, for each of the control herds, using the TotalVet[®] software.

Table 1 Criteria and groupings used to match case and control herds.

Category	Bulk Milk SCC ($\times 10^3$ cells/mL)	Herd Size	305d yield (L) (Lact >1)
1	≤ 150	≤ 150	$\leq 8,000$
2	151 - 300	151 - 300	8,001 - 10,000
3	> 300	> 300	$> 10,000$

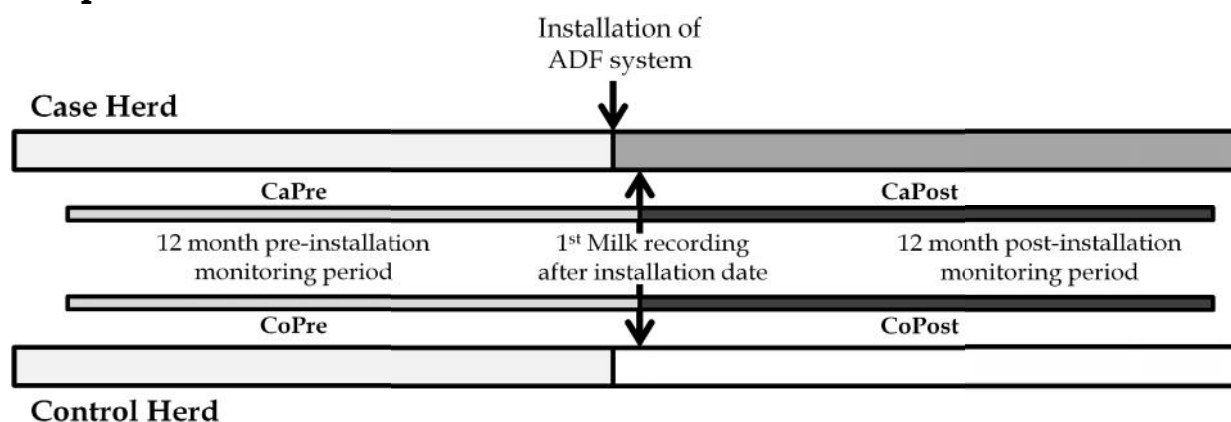
12 month rolling somatic cell count (SCC), production, culling parameters and herd characteristics were then extracted from collated benchmark files for use in the analysis. Such parameters included, but were not limited to, herd size, milk yield, proportion of the herd leaving the herd, mean age and age profile, lactation length, lactation new infection rate, proportion of the herd with a SCC $> 200,000$ cells/mL, proportion of the herd chronically infected, proportion of the herd calving with an elevated somatic cell count.

Data were collated and analysed using Microsoft Excel (Microsoft Corporation) and Minitab (Minitab Inc). Regression analysis was performed to explore the effect of installation of ADF on the rate of new infection in lactation and bulk milk SCC using a backward stepwise procedure. The effects of potentially confounding factors were evaluated in the regression models. Model fit was assessed using conventional residual analysis.

For the purposes of the analysis, relative changes between the year before and after ADF installation were investigated, thereby controlling for what would be a disproportionately large effect from herds with a higher initial bulk milk SCC or lactation new infection rate. More specifically, the relative change in lactation new infection rate and bulk milk SCC between the year before and year after installation of ADF were compared in case and control herds so as to allow for seasonal and annual variation seen in such parameters – the analysis periods and comparisons are outlined in Figure 1 and the equations below.

$$\text{Reldt}(\%) X_{\text{case}} = \frac{(\text{CaPost } X - \text{CaPre } X)}{\text{CaPre } X} \quad \text{Reldt}(\%) X_{\text{control}} = \frac{(\text{CoPost } X - \text{CoPre } X)}{\text{CoPre } X}$$

Figure 1 Schematic illustration of the analysis periods and comparisons



PRELIMINARY RESULTS

Key parameters relating to the case and control herds in the year prior to installation are outlined in Table 2. Herd sizes varied between 82 and 689 cows and calculated bulk milk SCCs between 43 and 506 $\times 10^3$ cells/mL. 305 day yields varied between 5,139 and 10,870 litres. The primary outcome of the 12 month rolling lactation new infection rate varied from between 4.3 and 19.8% of susceptible cows between consecutive recordings and was not significantly different between case and control herds. There was no significant difference in any of the parameters measured, between case and control herds, in the year prior to installation of ADF.

The relative change in lactation new infection rate between the year prior to and after ADF installation in the case herds and the equivalent period in the control herds is illustrated in Figure 2. Analysis of the relative change in bulk milk SCC and lactation new infection rate, between the year prior and the year after ADF installation revealed no significant difference between the case and control herds, as outlined in Table 3.

Multiple regression was also performed to investigate factors other than the installation of ADF associated with bulk milk SCC and lactation new infection rate. The major factors impacting change in bulk milk SCC were the average days in milk of the milking herd and the proportion of cows exiting the herd (*i.e.* being culled), with the proportion exiting being most influential. The results of the multiple regression investigating factors affecting the relative change in lactation new infection rate are outlined in Table 4. With respect to the level of new infection in the year prior to installation, the proportion of the herd chronically infected and the proportion of cows calving with an elevated SCC were influential. Herds with a higher rate of lactation new infection in the year prior to installation experienced a relatively larger fall in lactation new infection rate, whilst an increase in the proportion of cows chronically infected or calving with a high SCC had the opposite effect.

Table 2 Key parameters in case and control herds in the year prior to installation of ADF on the case farm

Parameter	Case Herds				Control Herds			
	Mean	Median	Max	Min	Mean	Median	Max	Min
Herd Size	249	214	689	82	220	190	589	109
Bulk Milk SCC ($\times 10^3$) (12 month rolling)	227	219	473	43	236	228	506	54
305d Yield (L)	8758	8842	10870	5519	8624	8681	10723	5139
Yield/cow/year (L)	10186	10226	12616	6589	9895	9996	11810	6351
Calving Index (d)	400	394	453	365	403	400	461	366
Exit Rate (%)	22.3	22.3	38.3	5.05	22.9	21.9	40.6	10.4
Lactation New Infection Rate (%)	10.5	10.1	19.8	4.5	9.2	9.0	17.5	4.3
% cows > 200 $\times 10^3$ cells /mL	26.4	26.0	47.6	10.4	23.3	22.5	37.1	10.9
% Cows Chronically Infected	17.3	16.0	35.9	4.4	15.1	14.6	25.5	4.1
Fresh Calver Infection Rate (%)	22.4	22.0	38.3	3.8	20.0	19.1	38.7	4.8
Dry Period New Infection Rate (%)	18.8	18.0	36.5	1.1	16.6	16.0	30.9	1.5
Dry Period Cure Rate (%)	72.2	72.0	90.7	52.0	74.1	75.2	90.8	38.2

Table 3 Results of univariable regression analysis of bulk milk SCC and lactation new infection rate between year before and after ADF installation in case compared to control herds

	Coefficient	SE	P value
Outcome: Change in Bulk Milk SCC			
Constant	4.7	12.8	
Relative Change in Bulk Milk SCC for case herds (%) (Reference = Control Herds)	22.2	18.1	0.22
Outcome: Lactation New Infection Rate			
Constant	4.7	4.1	
Relative Change in Lactation New Infection rate for case herds (%) (Reference = Control Herds)	-5.4	5.7	0.35

Figure 2 Graphical illustration of the relative change in lactation new infection rates in case and control herds from the year before to year after ADF installation

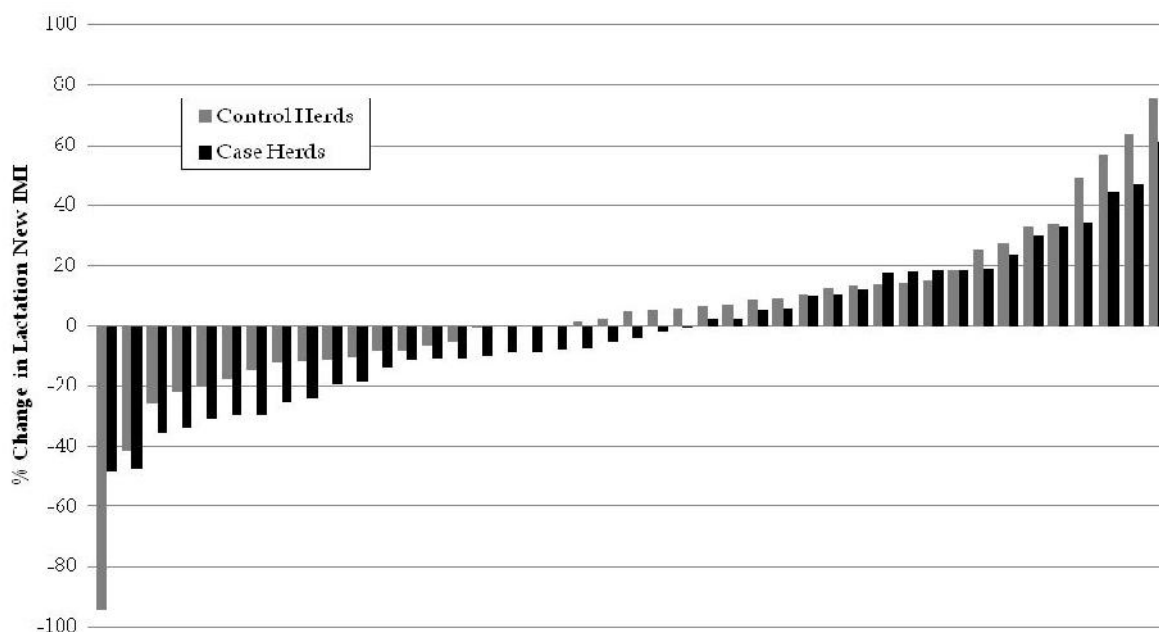


Table 4 Results of multiple regression analysis of the relative change in lactation new infection rate between the year before and after ADF installation

	Coefficient	SE	P value
Outcome: Relative Change in Lactation New Infection Rate			
Constant	13.6	8.3	
Case Herds (Reference = Control Herds)	-0.12	4.69	0.98
Lactation New Infection Rate (%) in year prior to installation	-6.96	1.09	0.000
Percentage of the herd chronically infected	1.98	0.70	0.006
Percentage of the herd calving with an elevated SCC	1.22	0.42	0.005

DISCUSSION

Given our understanding of mastitis epidemiology and transmission during the milking process, one would expect any positive impacts of automatic dipping and flushing systems to be most evident in high cell count herds experiencing difficulties with contagious mastitis control. In addition, to maximise the chances of demonstrating an added benefit, one would also need concurrent poor compliance with PMTD and parlour hygiene and failure to segregate herds. Overall, the above conditions do not epitomise our pre-conception of a well managed modern dairy herd and it is perhaps not unsurprising that we found no added benefit of the ADF system.

Analysis of the data suggests that, at least by the measured parameters, the case and control herds were adequately matched. However the controls were selected from an anonymised national dataset and other than the fact that they had not installed ADF, we knew nothing of their management practices - we could be confident that they had not installed the ADF system, and that no one herd was in both case and control groups as none of the (case and control) herds matched exactly on recording dates or any of the key benchmarking parameters. It could be that some of the control herds also had dipping and flushing systems so it would be more accurate to define our study as one in which farms with and without the ADF system had been compared.

Whilst this study did not demonstrate any apparent increase in the efficacy of the ADF system over other on-farm practices, this study is probably sufficiently large to support the conclusion that installation of the system affords the modern producer the opportunity to reduce labour input in the parlour and improve cow flow whilst maintaining udder health (7).

The interpretation of the findings of this study demonstrate the challenges of conducting retrospective case control studies such as these. In addition, the complex interactions of different factors on the outcomes of bulk milk SCC and lactation new infection rate are a challenge in themselves. It is of interest to note that culling rate and the average days in milk were the major significant determinants of change in bulk milk SCC, both of which are beyond the direct control of a dipping and flushing system. Similarly, the change in lactation new infection rate was most influenced by the pre-existing rate, the level of intramammary infection already in the herd and the proportion of cows entering the herd with an elevated SCC – again, all beyond the direct control of the dipping and flushing system.

This study measured efficacy by assessing new intramammary infection using a SCC proxy method. Clinical mastitis was not included as an outcome, primarily because of the difficulty of getting access to reliable figures. The authors feel this approach was justified, given that the primary impact of automatic dipping and flushing systems is likely to be on the contagious mastitis pathogens, which are easily monitored using SCCs as a proxy.

Perhaps the biggest ‘take home message’ from this research is that it reinforces the multifaceted, complex nature of mastitis control in the modern dairy herd and the importance of addressing control measures according to the predominant patterns of disease in the herd, such as that offered by the DairyCo Mastitis Control Plan (2). It also demonstrates the inadequacy of bulk milk SCC as a measure of mastitis control on farm, given how its main determinants in this study were days in milk and culling, neither of which represents sustainable routes to mastitis control. Finally, the impact of the proportion of cows calving with elevated SCC on the lactation new infection rate demonstrates the importance of getting the fundamentals right in herd mastitis control – *i.e.* calving an uninfected cow.

CONCLUSIONS

Whilst effective mastitis control demands a multifaceted approach, this research suggests that automatic dipping and flushing systems potentially offer the modern producer the opportunity to reduce labour input in the parlour and improve cow flow, whilst maintaining udder health.

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NOTES

IS THERE AN IDEAL BEDDING MATERIAL?

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SUMMARY

This paper considers the needs for bedding materials on dairy farms by discussion of the types of stock which will use the beds, where those beds will be, and when they will be in use. The management and physical characteristics which would be combined in an ideal bedding material are described. The environmental and economic significances of achieving an ideal bed are discussed, as is the essential of good welfare. The conclusion is that there can be no single ideal bedding material, but that managers should strive to give each animal the best possible bed, every day.

INTRODUCTION

Is there an ideal bedding material? For what, where and when?

As this paper is for presentation to a mastitis conference it will be confined to discussion aimed at those interested in keeping cattle for dairy production, although the principles apply to all keepers of livestock.

In seeking to answer the question, and find the ideal bedding material, some definition of need must be established.

What will an ideal material do, for what, and where? When will it be needed, for how long, and what will happen to it once it's prime function is finished? An ideal bedding material will function, without compromise, to meet the needs of the animals which lie on it. It will facilitate normal resting behaviour, measured by posture and duration, while precluding risks of trauma or infection to the skin, muscular-skeletal system and feet, the eyes, respiratory system, alimentary tract, reproductive tract and mammary glands.

An ideal material has to be available, and affordable. It should, at the very least, present no environmental or user risks, and preferably be recyclable.

On any dairy unit there are groups of animals at various stages of the productive cycle. The infrastructure in which these groups live is variable, and the characteristics of an ideal bedding material will be dictated by its association with that infrastructure.

Adult dairy cows should spend more days in milk than dry, and discussions about risk factors for mastitis tend to reflect that balance. We are aware of the risk of dry period infections causing mastitis in lactating cows. Much

effort and investment has been made to improve housing for milking cows to reduce environmental bacterial challenges. Likewise, therapeutic and barrier intra-mammary preparations are brought to the defence of dry cows.

However, transition, when udders become active to prepare for the next lactation, calves are delivered and cows are housed away from the main milking groups is too often a period when attention to hygiene and biosecurity lapses.

These are special cows at their most vulnerable. Every attention should be paid to their needs and protection. The aspiration should be to provide them with near hospital standard cleanliness, yet often we see their beds doubling up as “hospital” accommodation for herd mates likely to introduce pathogens.

Youngstock are an investment for the future of a dairy farm. Rearing costs must be repaid by returns from milk and the sale of stock, either as surplus to other producers or as meat animals on the barren market. Efficient rearing, as measured by the proportion of heifer calves which reach production, the age at which they do so, and their lifetime milk output plays a huge, but sadly, rarely quantified part in profitable and sustainable dairying.

This paper will consider the characteristics of an ideal bedding material, from the perspective of need, for a range of stock and situations ,and leave the reader to assess the suitability of available materials for their circumstances.

Which animals need a bed?

- Calves
- Heifers
- Far off dry cows
- Close up dry cows
- Transition pre calving
- Transition calving
- Transition post calving
- High milking
- Low milking
- Show cows
- Hospital cows:
 - sick
 - lame
 - high cell count
 - isolation
- Bulls

Where will these beds be?

- Pasture
- Paddock
- Yard
- Pen
- Box
- Cubicle

When will the bedding be needed?

- 24/365

Why will the bedding material be needed?

- Welfare
- Efficient production
- Reduced environmental impact
- Staff health and morale
- Economic sustainability

What management characteristics are needed?

- Available
- Affordable:
 - Unit cost
 - Labour
 - Machinery
- Storable pre use
- Spreadable
- Removable
- Storable post use
- Recoverable/Recyclable
- Soil improver
- Environmentally benign

What are the physical characteristics of an ideal bedding material?

- Non slip
- Cushioning
- Conforming/Nesting
- Stable
- Dust free
- Load bearing
- Non-puddling
- Lax/lubricating
- Non abrasive

- Non adhesive
- Pathogen free
- Bactericidal (Bacteriologically inert)
- Chemically inert
- Desiccating/Absorbent/Permeable

Base materials

- Turf
- Soil
- Clay
- Stone/rubble
- Road planings
- Concrete
- Mats
- Mattresses

Bedding materials

- Straw:
 - Wheat
 - Barley
 - Rape
 - Box muck
- Recycled bedding material
- Wood - Forest waste:
 - Sawdust, fresh
 - Sawdust, kiln dried
 - Shavings
 - Recycled joinery waste
 - Recycled wood chipped
- Paper waste:
 - moist
 - dried crumb
 - ash
- Gypsum waste
 - Sand beach
 - quarry
 - washed builders

DISCUSSION

There are many combinations of bedding need, for different groups of stock, in a range of environments on any dairy farm at any time. There is little prospect of one material meeting all those needs. Group by group we should assess the risks, the infrastructure constraints in their environments and match the best available bedding material to the animals' needs.

Losses in calf rearing are dominated by scouring and pneumonia. Providing a clean, dry bed is key to protecting calves from pathogens which cause scours. Ammonia fumes and humid air over damp beds and dust are risk factors for pneumonia.

Post weaning heifer losses are most frequently recorded as accidents. How many of those could be avoided if a better bed was provided?(1)

Poor fertility performance is a major constraint in heifer rearing. Much of this is due to poor early growth, associated with disease (2). Providing the best beds must be part of a strategy to rear heifers efficiently.

The period either side of calving is critical to successful cow management. Multiple physical and metabolic challenges are met. Culling rates in the 60 days post calving are important indicators of how well these challenges are overcome. Overall economic performance of dairy enterprises can be correlated to these culling rates. Infertility and mastitis are major causes of disease and premature culling in dairy herds. Risks of infection of the mammary glands and reproductive tract are high at calving, and bedding should be provided which is hygienic and dry.(3) Calving presents physical risks to cows, and metabolic disturbance, such as milk fever, increases the chances that a cow may become recumbent in the transition area. Bedding must be provided which allows sure footing, grip, and is cushioning and conforming enough to preclude trauma should a cow go down or be recumbent for some time. Deep sand beds are suitable for recumbent cows.

Calves are vulnerable to infection from their environment in the first hours and days of life. Some of these may cause calfood disease, to the individual or by carriage into the calfhouse to infect cohorts. Others, especially *Mycobacterium avium paratuberculosis* (Johnes) but also *Salmonella*, can cause serious disease in later life. Bedding should provide a clean environment into which calves are delivered and spend the first hours of their lives. This is most easily assured in single calving pens from which contaminated bedding can be removed. The compromise of allowing dirty bedding to build up because "it allows the cow to have a safe footing" is unsafe in hygiene terms for both cow and calf. Combinations of sand or ash and straw, woodchip or paper waste are providing safe, hygienic beds on dairy farms.

The majority of cows are likely to be in milk and it is beds for those cows which tend to get most attention. The objectives are simple. Allow the cows to be so comfortable that they exhibit normal lying behaviour while keeping them so clean that they enter the milking parlour with no environmentally derived bacteria or other material on their teats. Cubicles have become the most common way of providing bed space for housed cows because they provide a method of reducing faecal contamination of the lying area, and reducing exposure of teat skin to contamination. This can be assessed by observation, scoring cows according to levels of faecal contamination on

their legs and teats, and by bacteriological sampling of teat swabs and milk samples. It is possible to bed cows in commercially viable systems with very low coliform bacterial counts on teat skin on entry into the milking parlour (Table 1, Table 2).

Table 1. Bulk milk bacteriology as an indicator of hygiene (Farm H)

	Cell count x 1000	TBC / TVC	LPC Thermo-duric	Coliform	Pseudo	S.uberis	Total Staph	Staph aureus
Target	150	5000	<175	<20	<500	<100	<200	<50
Tank 1	218	2000	10	12	640	170	290	58

Table 2. Bacterial counts on unprepped teats pre-milking (Farm H)

Sample	TVC<cfu/ml	Total Staphs, cfu.	Coliforms cfu	Total Streps.
222	>160,000	>160,000	0	>160,000
35	1,900	3,120	0	500
249	3,700	5,600	0	1480
37	4,000	6,600	0	1340

Pasture may be taken as the extreme alternate to cubicle housing, the most natural bed available. Heavily stocked pasture may become contaminated with pathogenic bacteria. For behaviour associated with lying, and that should include the acts of lying down and rising, pasture clearly provides the benchmark. (For risks associated with recumbency, such as pressure sores and abrasions, deep sand beds are better than pasture).

Bedding material should provide sufficient comfort for the cows to lie as long as they want, and provide cushioning to preclude pressure sores and impact bruising. Abrasions on projecting points, such as knees and hocks are a consequence of shearing forces between the bed and the skin. The bedding material should be loose enough to allow it to act as a bearing between the cow and the bed, moving as the cow moves and avoiding frictional forces. Excessively abrasive material can rasp the skin as the cow moves in preparation for rising to stand. The material needs to be non-slip as the forces the cow exerts in the acts of lying and standing have to be resisted or the feet will slide away from the contact point. This results in lateral pressure to be applied to the hocks, which causes inflammation and swelling, which in turn increases the risk of abrasions.

The physical and chemical characteristics of the bedding material should, at least, be benign to the cow. Ideally they would be protective. It should be pathogen-free, both bacterial and fungal mastitis infections can result otherwise. Preferably it should be bactericidal, so that any in use bacterial contamination is killed. It should be chemically inert, to avoid skin damage. These two characteristics tend to be contradictory, but desiccation is a very

good way of reducing bacterial counts, so the material should be permeable over a free draining base, very absorbent, or a desiccating agent (Table 3).

Table 3. Bacteria on bedding

Bedding type	Total bacteria	Coliforms	Staphs	Streps.	pH
Sand	3,500	10	<10	<10	6.9
Straw					
Sawdust					
Gypsum	100,000	9,300			6.5
Ash	<10	<10	<10	<10	9.5
Paper	1,500	120	960	200	6.5
Recycled bedding	>160 x 10 ⁶	20			

Some cows, because of illness or injury, may need to be housed separately from the main milking groups. These “hospital” cows are presumed to have a worthwhile future and in most cases will return to the herd. Some will need long term separation. They need beds which provide comfort and space to compensate for their frailty, and which preclude risks of slipping while they may be lacking in strength. These cows, by the very nature of their need being associated with illness, and therefore likely infection, present a risk to healthy herdmates. Transition cows and newborn calves are particularly vulnerable to infection, and so hospital cows should not be in the transition areas.

Every dairy is required to have an isolation facility. Because this is to confine animals considered to present a risk of spreading serious infectious organisms the bed should be dry and containable, easily removed and destructible.

Some farms have special accommodation for elite cows, maybe a show team. This may allow promotional exhibition, or be required because these cows are physically bigger than the main herd. The bedding must keep them clean and dry, be non-slip and provide excellent comfort. If the show cows are given this special accommodation because they would be compromised by living with the main herd questions should be asked as to whether the beds provided for the main herd are good enough. After all, the workers provide the income for the queens to be kept in luxury.

Many dairy farms keep at least one working bull. These are at risk of injury if expected to work on slippery surfaces. Young bulls often develop foot lesions, either bruising of the soles or tearing of the white lines, when put to work on concrete. Bulls, especially if they have been reared to maximise weight for age assessments, should have a period of living in a part dry bedded, part hard standing area to harden off their feet before going to work. The needs of the animals should be paramount. However, management characteristics are relevant. The material needs to be consistently available.

Many mastitis incidents can be traced back to hygiene breakdowns caused by failure of bedding supplies. The material has to be affordable, not just in unit cost, but in the labour and machinery associated with its use. Consideration will have to be given as to storage requirements pre use. Can it be easily and accurately applied to the beds, and removed from the beds and dung passages? Will it get to the dung stores without blocking grids and channels? Does it present any physical or environmental risks during storage post use? Can it be recovered or recycled? When spread on the land it should be soil improver, and present no toxic chemical or environmental risk.

As the management characteristics have to be considered as potential problems, the upsides of an ideal bedding material are potentially great. Welfare of livestock is important in its own right, but welfare and economic returns should coincide in virtuous mutuality. Efficient production must start with healthy production. The environmental impact of food production is magnified by the extra cost of waste, of animals which do not achieve the productive phase of their life, or do not produce as much as they should, due to disease and other management failures. Staff can become demotivated when they spend too much time resolving problems, and shoveling muck. Economic sustainability will depend upon providing livestock with the nearest possible to an ideal bed.

CONCLUSION

On every livestock farm there are a variety of animals which should be provided with the best possible bed, every day.

Animals will be in different situations at various stages of their productive lives, and on each farm the infrastructure of those situations will be different. Managers should study the needs of their livestock in their situations and aspire to provide the most appropriate bed for each of them, all of the time. No one material is available which could achieve this objective, so managers must review what is available and use that to the best effect.

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The author wishes to thank Roger Blowey for permission to reproduce the data in Table 3.

NOTES

SENSORS FOR MASTITIS MANAGEMENT

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SUMMARY

With the introduction of automated milking in the late 1990ties sensors were needed to automatically monitor milk quality. The first sensors provided were measurements of electrical conductivity, based on the influx of Sodium Chloride in the process of inflammation. At best, the sensitivity of electrical conductivity for mastitis detection is around 30%, and at similar low specificities. There have been developed other means of monitoring milk quality, including on-line counting of white blood cells), spectral analysis, time between milkings, blood, and quarter yield. Latest, an on-line mastitis detection system measuring Lactate DeHydrogenase (LDH) has been introduced, being marketed in both parlour and robotic milking in 11 countries.

INTRODUCTION

With the advent of robotic milking, new technology has emerged in recent years, including recording of electrical conductivity, milking performance (quarter yield, blood, milking interval in robotic milking) and latest mastitis specific parameters in milk (Lactate Dehydrogenase, LDH) in milk, as used in the novel Danish product “Herd Navigator™”).

This presentation will present the present indicators of udder health and milk quality, their advantages and drawbacks in the sense of usability.

RESULTS OF PRIOR AND RECENT INVESTIGATIONS

With the advent of robotic milking in the late 1990ties, a number of new opportunities came to the dairy farmers in terms of monitoring cow performance. Among the selling points were no more milking at 04.00 in the morning, and the opportunity of living a more normal life with the family. European milk producers very quickly adapt to new technologies if they seem to produce better results and/or alleviate work issues.

Along with robotic milking came other focus areas, among these the daily monitoring of cow health and welfare. There are two major reasons for monitoring cows in automated milking: Mastitis detection and milk quality.

Once milk quality cannot be detected manually as in manual milking, there was a need for automated monitoring.

Very soon in the process of moving into automated milking, a number of scientific reports looked into the prospects of using electrical conductivity as a means of monitoring.

Electrical conductivity

The measurement of electrical conductivity, based on very early changes in conductivity due to an influx of Sodium Chloride in udder inflammation has been explored since the 1980ties. Being part of every automated milking equipment since the late 1990ties, electrical conductivity is far from being perfect, as sensitivity is around 30% and specificity around the same value (1). Mein and Rasmussen, however, proposed a sensitivity more than 70% and a specificity of >99% (1) Far from being perfect, measurements add to the awareness of the herdsman as to cows that need attention. Measurements of electrical conductivity are used in Herd Navigator™ (see later) robotic installations to point to the quarter at risk for mastitis. In robotic milking systems the total number of attentions are counted by cow, but still researchers advocate visual checks of alarm cows (2).

Figure 1. Electrical conductivity profiles from a healthy (left panel) and a mastitic cow (right panel). From Norberg et al. 2004 (3).

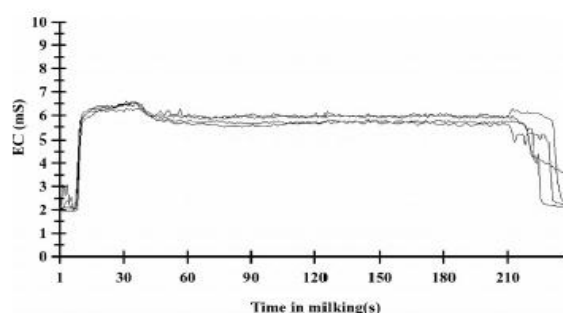


Figure 1. Electrical conductivity (EC) profiles (in milliSiemens [mS]) for all 4 quarters of a healthy cow.

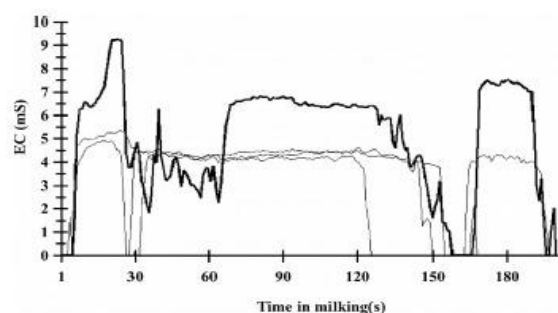


Figure 2. Electrical conductivity (EC) profiles (in milliSiemens [mS]) for all 4 quarters of a cow with clinical mastitis. The bold line indicates the EC profile of the infected quarter.

On-line blood measurements

Blood in milk is a very good indicator of udder injury, including mastitis, and milk should be diverted from the milk line. In Lely and DeLaval milking robots an alarm will appear upon blood being detected, and a diversion protocol can be applied.

On-line Somatic Cell Count

Recently, DeLaval has launched an online Somatic Cell Counter for the DeLaval VMS. The device will measure the somatic cell count at predetermined intervals, and warn of probable mastitis. The device will send a message to the operator if the SCC value is above 200,000, and a further message if the SCC is above 500,000. Also the Lely Astronaut is equipped with a somatic cell count device. So far, no software is available to interpret

the measures available, and therefore it is left to the operator to compare measurement results to the individual cow history (treatments, milk recording records, prior on-line SCC results etc.)

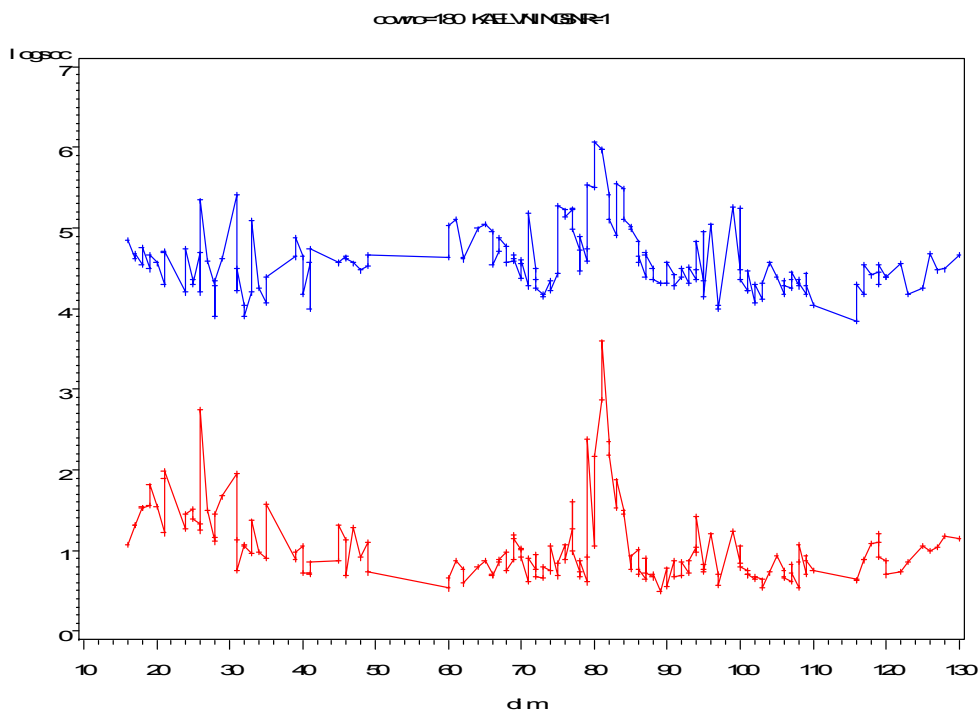
Combined mastitis indices

In all robotic milking systems all available data are used for mastitis detection. This includes electrical conductivity, milking interval, blood, quarter milk yield and milking intervals, but still the sensitivity of the indices are not promising, leaving the farmer with a significant number of false alarms. Steenevold et al. (5) investigated the combined use of electrical conductivity and on-line measurements of somatic cell counts. The addition of somatic cell count data moved the success rate of mastitis detection to 32 %, but moved the specificity to 98.8%. The authors advised visual checks of attention cows to verify clinical mastitis.

Measurement and interpretation of Lactate Dehydrogenase

Recently a new system for the detection of mastitis was developed under the name of Herd Navigator™. The system, being marketed by DeLaval, monitors cow reproduction, ketosis, feeding and mastitis by use of in-line measurements of milk. For mastitis management, measurements of Lactate Dehydrogenase (LDH) is used. Research showed a close relationship between LDH and somatic cell counts (figure 2).

Figure 2. The correlation between Somatic Cell Count (upper line) and LDH lower line) is very high, indicating that LDH is a good indicator of mastitis, base (3), based on 11,893 data records).



The system can be applied in robotic and parlour milking. The measurements of the four parameters in Herd Navigator are validated in biological models which will issue a risk value for a given condition. Once the risk goes beyond a pre-set value, the risk will be shown to the operator on the Herd Management System.

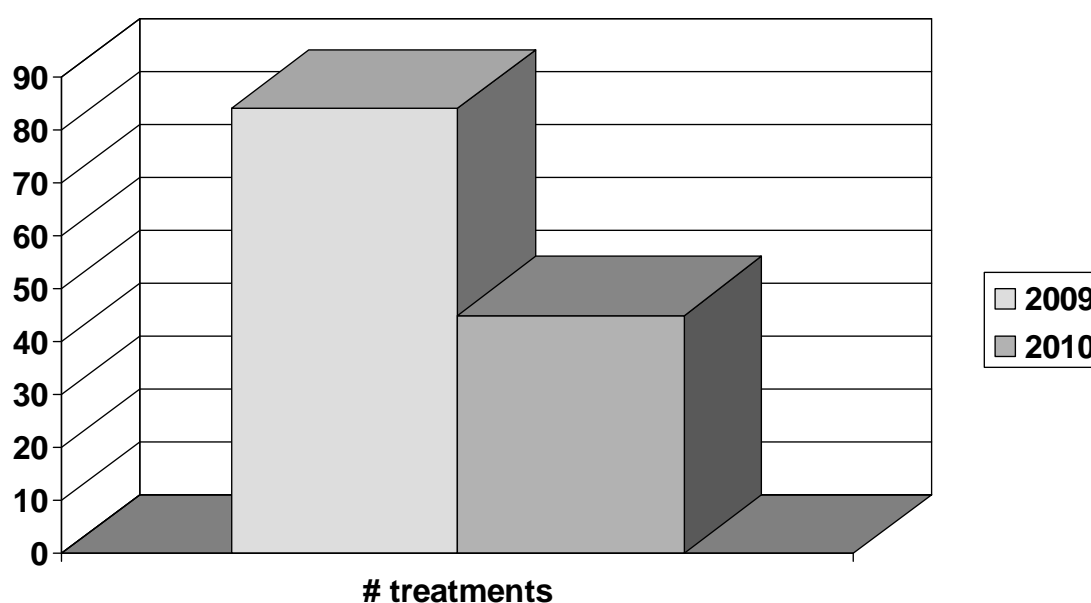
The Herd Navigator™ system monitors mastitis on a regular basis throughout the entire lactation, being very attentive in the early lactation where the risk of mastitis is high. A model to interpret LDH measurements was developed and tested (4,5) and the system is now in use in more than 50 dairy herds in more than 11 countries worldwide.

The system will warn the user of probable mastitis. The sensitivity of the system is above 92% with a specificity of 99% (5).

With Herd Navigator™, Standard Operation Procedures are envisaged, including on-farm or off-farm culturing before any treatment decision is made.

Results from a Danish robotic test farm showed a reduction in both treatment numbers and Bulk Tank Somatic Cell Counts by using the system. The farm has applied on-farm culturing of mastitis bacteria, and if , culture negative, *E. Coli* or Coagulase Negative Bacteria (in the absence of fever/inappetence) treatment is not performed.

Figure 3. Reduction in mastitis treatments in a Danish Herd Navigator™ VMS farm (5 months in the year before use and 5 months in 2010). Before using Herd Navigator™ and applying on-farm culture of mastitis bacteria the treatment rate was 35%, typical of Danish dairy farms.



CONCLUSIONS

Far from being perfect, a number of sensors are now available to both parlour and robotic farms for monitoring udder health and other conditions in the high yielding dairy cow. At the moment systems have been developed for automated milking but also for parlour systems (Herd Navigator™).

Based on prior experience there is still a need for the operator of the dairy farm to do follow-ups on system alarms in order to select cows to be treated for mastitis.

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NOTES

THE NATIONAL MASTITIS SURVEY 2012

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SUMMARY

The Annual UK Dairy National Mastitis Survey is one of the largest surveys of its type and has attracted an average of 1,300 respondents; it is now in its 4th year. The information gleaned from the survey has confirmed much of the expected and accepted farm data and management practices on dairy farms in the UK. The increasing farmer participation over the last two years has resulted in annual responses from around ten per cent of UK dairy herds and is probably representative of a greater proportion of UK dairy cows. The results from each annual survey highlight the variation in farm data, within each year's population of respondents, along with the variations in the application or omissions of certain key udder health control or management practices. The annual repetition of the survey has introduced the added dimension of indicating how these data and application of management practices vary over time. The evidence from the 2012 and previous surveys indicates that some mastitis control procedures are not universally adopted across UK dairy farms

INTRODUCTION

There are many different types of milk production systems in the UK and in common with the changes seen in the dairy industry worldwide there is a degree of on-going polarisation in particularly the approach to nutrition and milk harvesting. This polarisation could be said to be related to milk production levels where extremes have high yielding herds housing their cattle all year, feeding a Total Mixed Ration (TMR) to maximise production and milking through a high capacity, highly automated high tech parlour. At the other extreme low yielding herds are kept in pasture based systems with low input low output and milking though less automated less high tech parlours. These extremes of production systems and all the variations in between along with other husbandry and management variation and variability in personnel aptitude and application will all contribute to a myriad of influences on udder health.

Investigation and advisory systems in the UK as early as the 1960s such as the NIRD 5 point plan and more recently the DairyCo National Mastitis Plan offer advice and control points based on evidence based assumptions relating to mastitis research, epidemiology, incidence and prevalence. Like the uptake of the NIRD 5 point plan over the years since its inception the application of control points via the DairyCo National Mastitis Control Plan approach is far from universal. It was within this system of significant variation that the National Mastitis Survey (NMS) was launched. A paper was presented at British Mastitis Conference 2010 (1) with a summary appendix (2)

HOW VALID IS THE DATA?

Surveys by their nature most often have a degree of bias in the selection of their respondents and this will inevitably be reflected to varying degrees in the outputs. The facts that the data collection campaign for the NMS is linked to the readers of a particular farming publication, is incentivised and requests significant quantities of detailed information will inevitably impose a degree of bias within the dataset. However this could be seen to be mitigated to a certain extent by the fact that headline data such as regional demographic of respondents (Fig 1) and proportion of herds of different herd sizes (Fig 2) remained broadly the same throughout the 4 survey periods.

Figure 1 Respondents by region

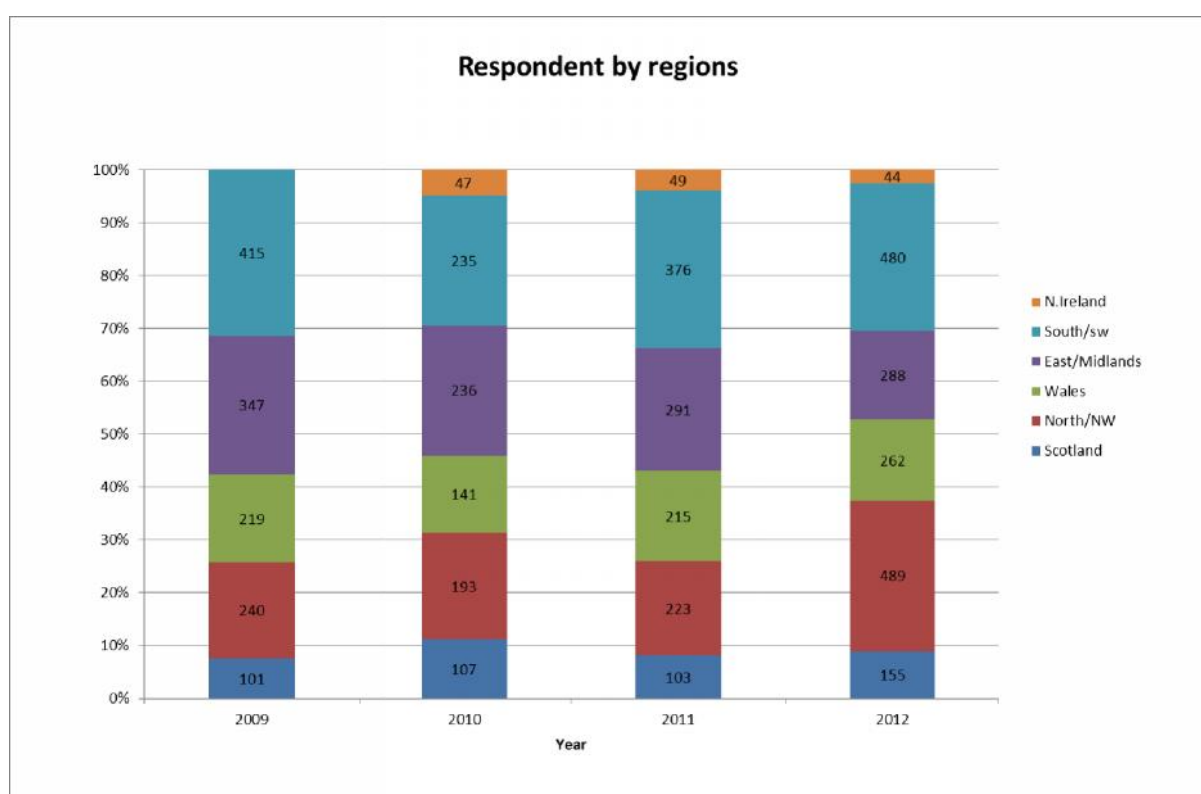
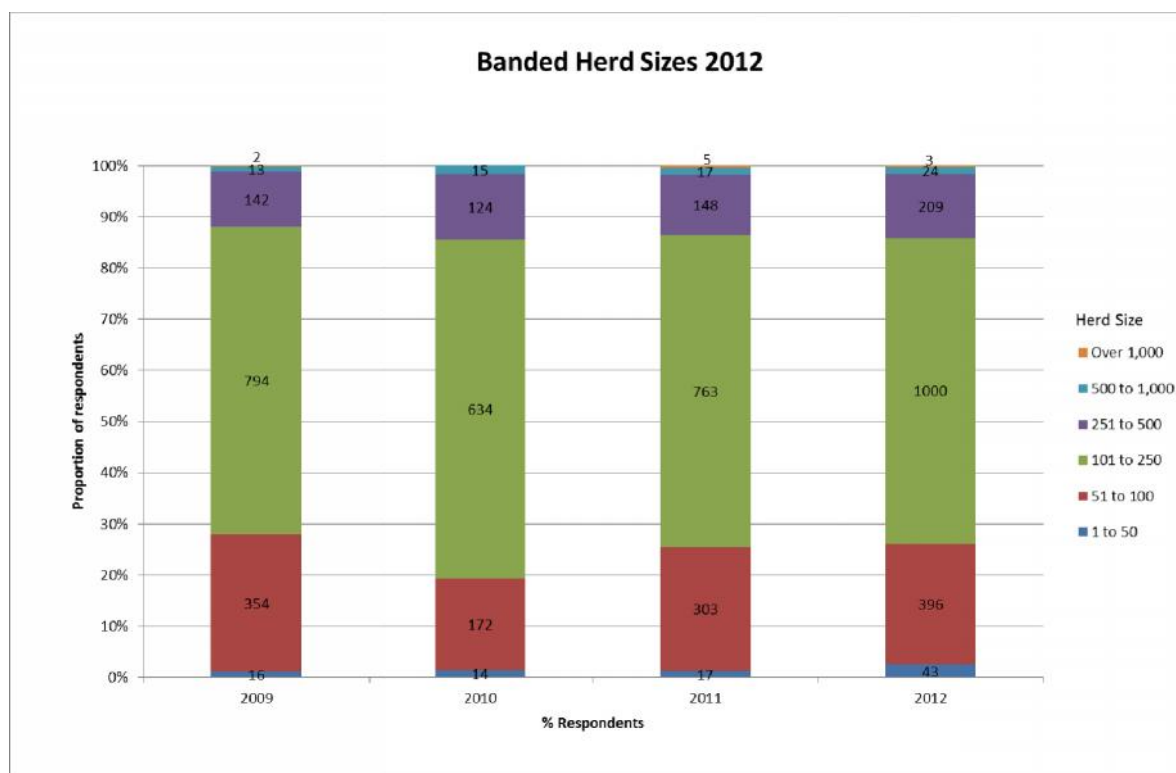


Figure 2 Respondents by banded herd size



Responses to the initial questionnaire in 2009 highlighted the complexities of constructing questions that avoided misinterpretation. The clinical mastitis rate and time spent milking are two examples where a significant amount of data cleansing was needed to remove inappropriate and inaccurate answers. A further check on how well the NMS is representative of the dairy industry was performed by comparing how the proportion of respondents in one of six annual farm milk production bands varied over the four years. (Table 1 and Table 2) The biggest variation in data appears to be in 2010 which had the lowest number of respondents overall and where a significantly lower proportion of herds were in the 500 to 750 thousand litres annual farm production band with a corresponding greater proportion of herds in the 1 to 2 million litres annual farm production band when compared to the other years or the overall average. The effect of the 2010 survey impacts the magnitude of the range from the minimum to maximum of herds in the 500 to 750 thousand litres annual farm production band and the 1 to 2 million litres annual farm production band with both being 8%. The ranges from maximum to minimum in the other four bands are more modest as is the variation in the survey data for 2009, 2011 and 2012. There was a 3% range from the maximum to minimum proportion of herds in the band for up to 500 thousand litres annual herd production, a 4% range in the 750 thousand to 1 million band, a 5% range in the 2 to 5 million band and no significant variation in the small number of herds in the greater than 5 million litres band.

Overall the 2010 data appears to be least representative, often differing from the other 3 years survey data or not following trends between 2009 and 2012.

Table 1 Respondents by annual farm production

Year	<500K	5-750K	750K – 1 Mil	1-2 Mil	2-5 Mil	>5 Mil	Total
2009	78 (6%)	247 (20%)	252 (20%)	521 (41%)	160 (13%)	8 (1%)	1266
2010	46 (5%)	110 (12%)	144 (16%)	449 (49%)	160 (18%)	5 (1%)	914
2011	72 (6%)	201 (17%)	240 (20%)	505 (42%)	168 (14%)	15 (1%)	1201
2012	128 (8%)	247 (15%)	275 (17%)	710 (44%)	257 (16%)	14 (1%)	1631
Grand Total	324	805	911	2185	745	42	5012

Table 2 Variation in annual farm production data

	<500K	5-750K	750K-1 Mil	1-2 Mil	2-5 Mil	>5 Mil
MIN	5%	12%	16%	41%	13%	1%
MAX	8%	20%	20%	49%	18%	1%
AVERAGE	6%	16%	18%	44%	15%	1%
Plus	2%	4%	2%	5%	3%	0%
Minus	1%	4%	2%	3%	2%	0%

The survey questions cover many aspects of the mastitis challenges dairy farmers face and how they manage milk quality and udder health. The detail of a few of the questions was refined between 2009 and 2010 after it became clear that misinterpretation of these questions and therefore answers was possible. A small number of clarification changes were also made between 2010 and 2011. Despite experience also showing that information gleaned from this type of survey inevitably targets those that tend to have better standards than the average farmer the information from each survey as well as year on year comparisons is a very useful resource for the dairy industry.

The number of farmers taking the trouble to fill in the card based questionnaire has ranged from a low of 959 in 2010 to the current high of 1,675 in 2012. As already stated there is likely to be bias towards farmers who are prepared to take the trouble to complete the 27 questions asking for around 50 pieces of data about their farm and farm practices (Fig 3) however this will be mitigated to some extent as the survey responses are from around ten per cent of dairy farms and is likely to represent a higher proportion of dairy cows in the UK.

Figure 3 Postal data collection card

Take part in the 2012 Dairy National Mastitis Survey.....

Only one answer required Multiple answers possible

Name:

Address:

Postcode:

Would you like a copy of the results? By post By email

Email address:

No of cows: Herd annual average yield per cow:

No of times milking/day: Breeds(s):

Main milking cow tube: Secondary milking cow tube:


Which dry cow antibiotic tube(s) do you use?

Which cows receive antibiotic dry cow tubes? All cows Some cows None

Is teat sealant used? All cows Some cows No


Is teat sealant used in combination with antibiotic tube? All cows Some cows No

1. Calving pattern? year round block (time of year)
2. Have you bought in any adult dairy cows in the last 12 months? Yes No
3. What is your usual bulk milk cell count range?
 - 0-50 51-100 101-150 151-200 201-250 251-350 >350
4. Do you record individual cow cell counts? monthly occasionally never
5. What is your usual Bactoscan? 0-10 11-20 21-40 41-60 61-80 81-100 >100
6. Estimate the total number of cases of mastitis you typically treat per month over the year?
 (Do not include treatments for high cell count cows here - average fig for block calving herds)
 - 2-3 4-6 7-10 10+
7. How many tubes do you typically use to treat a clinical case? 0-10% 11-25% 26-50% 51-75% >75%
8. What proportion of cases receive tubes plus antibiotic injections as therapy?
 - first 30 days 30-100 days mid-lactation late lactation
9. When in lactation do you see most clinical mastitis?
 - never 1-2 times/year 3-4 times/year more frequently than 4 times per year
10. How often do you and your vet undertake bacteriology testing?
 - always some milkings some cows never
 - always some milkings some cows never
11. What bacteria do you believe cause mastitis in your herd? (please select one or more)
 - Staph. aureus Strep. uberis E. coli others don't know
12. Estimate the proportion of heifers that get clinical mastitis in their first lactation?
 - 0-5% 6-10% 11-25% 26-50% >50%
13. Do you treat high SCC cows with no clinical signs of mastitis? Yes No
14. Housing system? Bedding type? Bedding conditioner?
15. Do you house milking cows all year round? Yes No
16. How many people usually milk the cows at each milking (average no. for block calving herds)?
17. How long does it take?hrs Do you wear gloves? Yes No Sometimes
18. How many people were involved in milking in last 12 months (incl. relief milkers)?
19. What type of parlour do you have? herringbone rotary abreast auto tandem robot other
20. How many units are in the parlour? How many standings?
21. Teat preparation:
 - a. Do you foremilk all cows? always some milkings some cows never
 - b. Do you wash all cows? always some milkings some cows never
 - If yes, do you dry all teats before units are put on? Yes No
 - c. Do you use any other pre-milking teat preparation before milking? Yes No
 - dry wipe ONLY pre-dip pre-spray a medicated wipe foam other
 - Do you wipe off chemical? Yes No
22. Do you use post-milking disinfection? Yes No
 - post-dip post-spray foam ADF (Automatic Disinfection & Flushing)
23. Do you have ACR's? Yes No
24. Do you use automated cluster disinfection? Yes No
 - If yes, which? cluster flush cotswold air wash ADF
 - If no, do you use manual disinfection? all cows high SCC clinical cases never
 - Which method do you use? dip spray other
25. What is your typical milking machine service interval (months)?
26. What is your typical liner replacement interval (months)?
27. Do you group your cows by (please tick appropriate box)
 - cell count heifer group yield stage of lactation not at all



ACHIEVE MORE

Competition entry rules: 1. The prize draw is open only to GB residents excluding employees and their families of the promoter, MSD Animal Health, their agencies, or anyone professionally connected with the prize draw. 2. No purchase necessary. The draw must be received by Friday 20th March 2012. 3. Only one form is permitted per farm. 4. Areas not open; closed parties are invalid. 5. No responsibility is accepted for incomplete, lost, delayed, damaged or illegible forms. 6. The winners will be picked at random in an independently supervised draw from all the eligible forms and will be notified by Friday 27th April 2012. 7. There are 20 prizes of a Maso jacket to be won. 8. There is no cash or other alternative available in whole or part. 9. A prize of equal or greater value can be substituted at the discretion of the promoter. 10. The winners may be required to participate in publicity arising from the award of the prize. 11. The decision of the promoter is final and binding and no correspondence will be entered into. The winner's name will be available on request. Entry to the competition implies acceptance of these rules.



When attempting to draw conclusions from data collected from farm surveys there is a temptation to come up with outputs that prioritise the most important procedures or management practices that all farmers should adopt to achieve optimum udder health and milk quality. There are a number of pitfalls in adopting such a strategy such as making a potentially erroneous assumption that a particular management practice is the cause of for example a high standard of udder health. There is a need to distinguish or at least be aware that cause and association are not the same. If the majority of herds are performing a certain management task (for example post-milking teat disinfection [PMTD]) and achieving good results (for example low Bulk Milk Somatic Cell Counts [BMSCC]) cause and effect or just association are both possible. However if a higher proportion of herds achieving low BMSCC are performing PMTD compared to those herds that are not using PMTD then it may be evidence enough that the management task has the potential to be causal and one that is to be recommended.

A survey such as the National Mastitis Survey does not have the power to give clear evidence to indicate causation or association between a management practice and data even if there is a biologically plausible argument as to how causation may occur as could be argued in the case of the PMTD and low BMSCC example above. However an association between a management practice such as pre-milking teat disinfection [PRMTD]) and low BMSCC if one existed might be as a result of PRMTD being a proxy measure for a diligent and

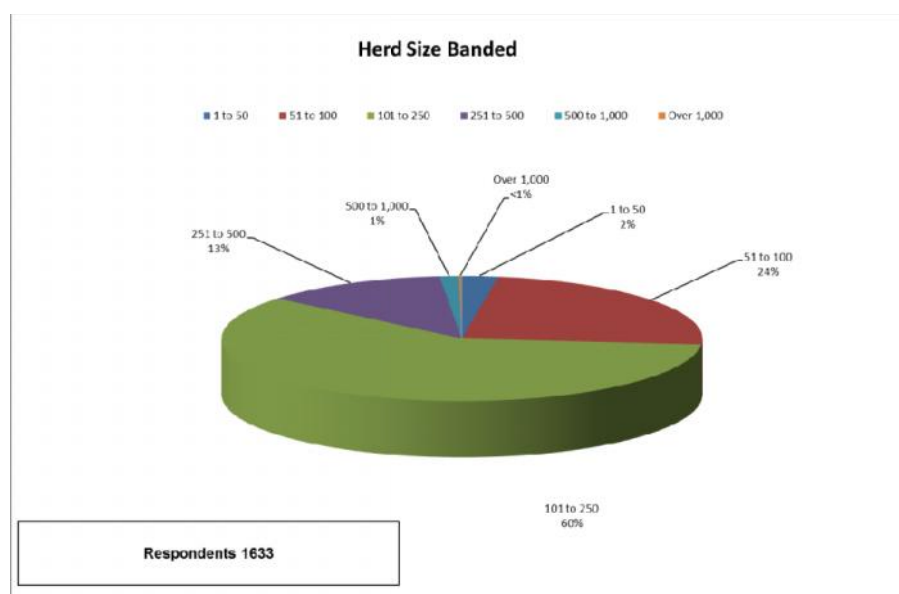
hygienic farmer who perhaps performs many other more significant management tasks truly linked to low BMSCC (including for example PMTD) to a higher standard. Equally the National Mastitis Survey does not have the power to rule out apparent cause and effect for example if there is a biologically plausible argument as to how that causation may occur even if the data appears to suggest one does not exist.

RESULTS

Herd Size

The proportion of herds in the various herd size bands has remained remarkably stable over the four years of the NMS surveys (Fig 2) despite the number of respondents varying from a low of 959 in 2010 to the current high of 1,675 in 2012 (Fig 4) which tends to indicate the dataset has remained representative of the UK dairy industry. The most common herd size band was 101 to 250 cows with approximately 60% of respondents. 25% of respondents had 100 or less cows and less than 15% had more than 250 cows. Over the 4 years a very consistent 30% of herds had purchased cows within the last twelve months

Figure 4 Proportion of respondents by banded herd size 2012



Herd Yield

The proportion of respondents in various annual farm production bands has remained relatively stable over the four years. (Fig 5) The proportion of herds in the various average cow yield bands has also remained remarkably stable over the four years of the NMS surveys although there has been a slight reduction in the proportion of respondents with cow yields of less than 8,000 litres falling from just over 60% in 2009 to just over 50% in 2012. (Fig 6).

Figure 5 Respondents by banded farm production

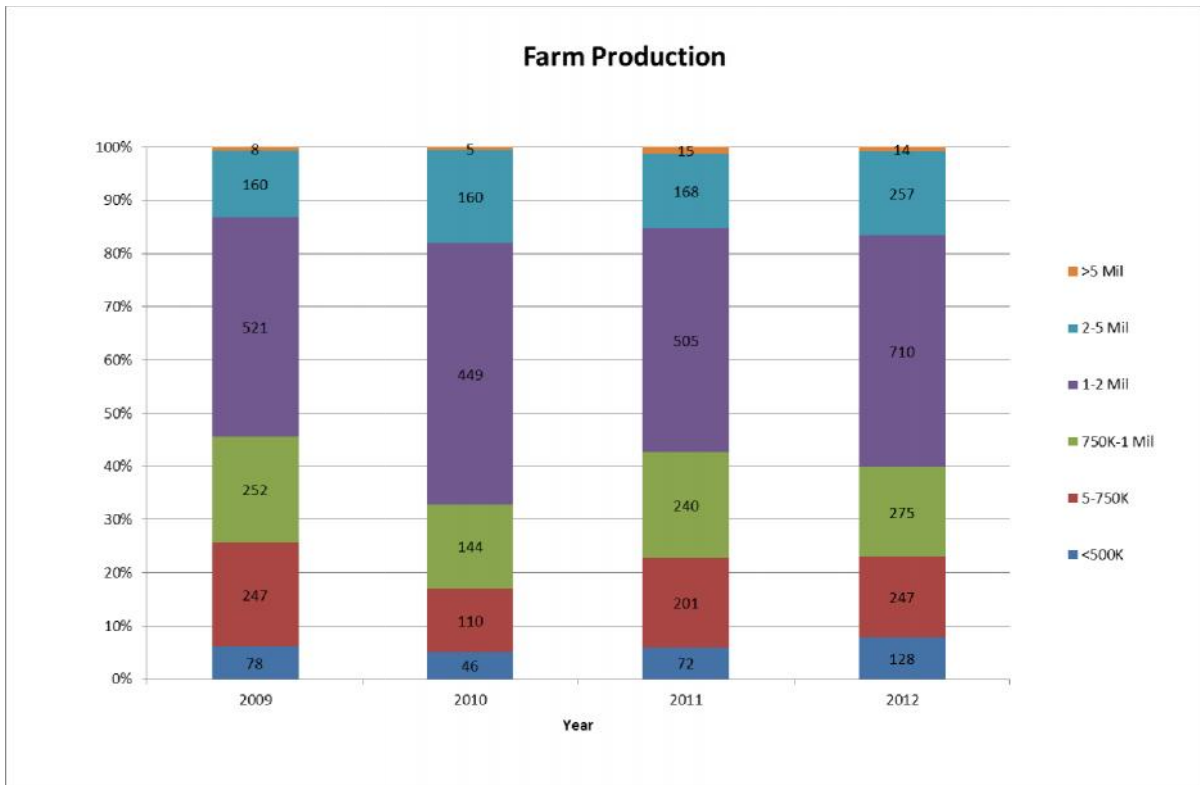
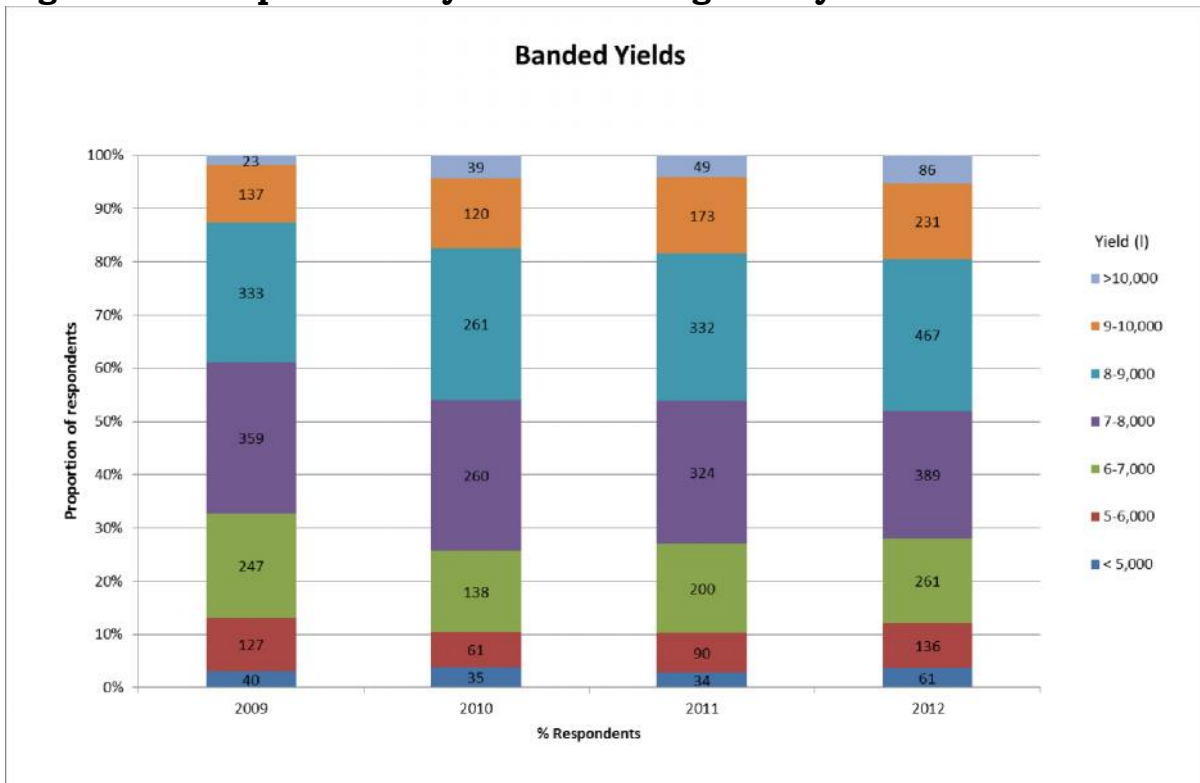


Figure 6 Respondents by banded average cow yield



Clinical Mastitis

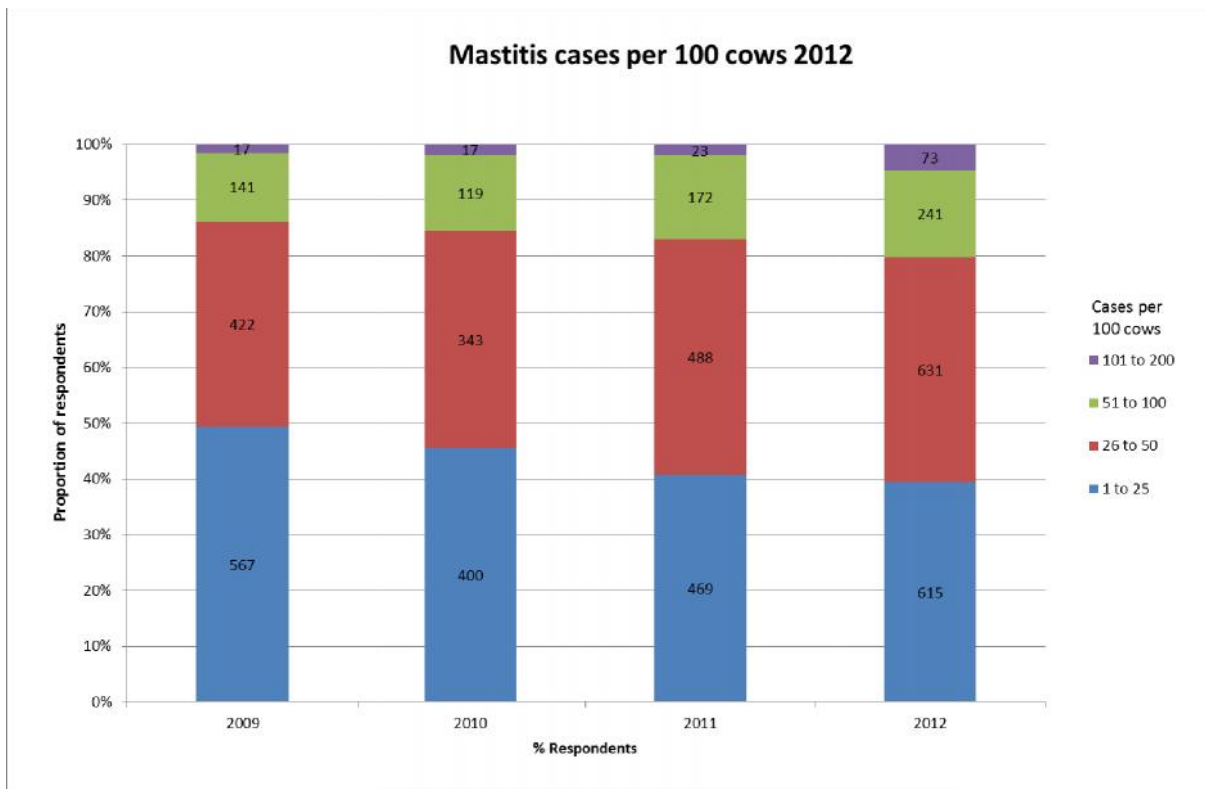
On farm clinical mastitis data is far from universally available with many farms keep mastitis records more for the avoidance of antibiotic violations than epidemiological pattern analysis. The question relating to clinical mastitis also proved it can be difficult to get accurate data and was misinterpreted by

respondents in the 2009 survey resulting in erroneous data that had to be excluded from the dataset. From 2010 onwards the format of the question was altered to ask the average monthly mastitis cases treated excluding the treatment of high SCC cows which has reduced this problem.

The author has highlighted in a previous British Mastitis Conference (3) that veterinary surgeons and milk recording companies can be blamed, in part at least, for the poor clinical mastitis record keeping by farmers. Unless and until clinical mastitis data is shown to be useful in terms of mastitis management and control then the effort of meticulous recording will continue to be seen to outweigh the benefits. Diagnostic approaches utilising pattern analysis of both clinical mastitis and individual cow cell count data should encourage better recording. Concurrent advances in software packages such as Interherd plus and TotalVet, encouragement to record clinical cases by milk recording companies and initiatives such as the DairyCo National Mastitis Control Plan should also help.

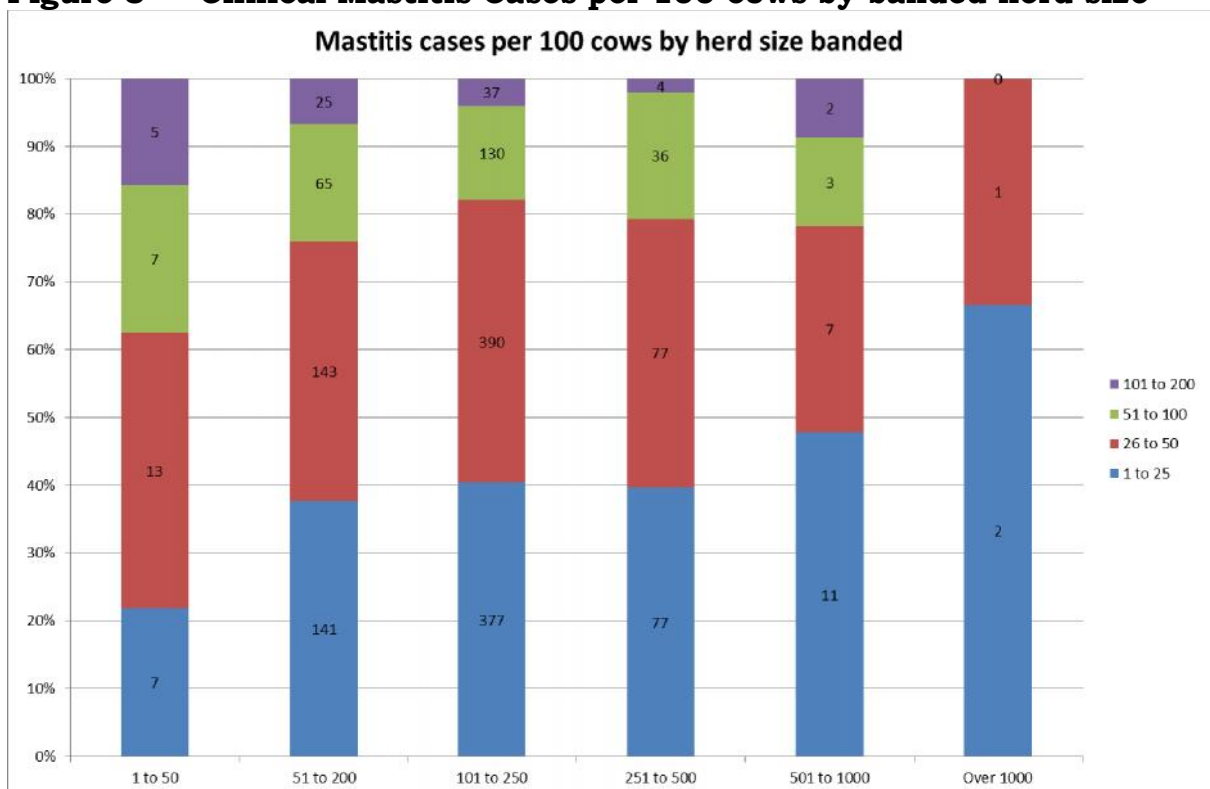
Overall the clinical mastitis incidence has increased slightly over the four survey periods. The proportion of respondents with 25 or fewer cases per 100 cows has fallen from 49% to 39% and from 85% to 80% for herds with 50 cases per 100 cows or fewer (Fig 7). Heifer mastitis remained remarkably stable over the four survey periods with half the respondents reporting less than 5% of heifers succumbing to clinical mastitis and four fifths of respondents less than 10%.

Figure 7 Respondents by banded clinical mastitis cases per 100 cows



When mastitis incidence is compared to herd size the public fears that larger herds have more disease are not borne out and if anything the reverse could be said. (Fig 8)

Figure 8 Clinical Mastitis Cases per 100 cows by banded herd size



Sub-clinical Mastitis

Based on reported Bulk Milk Somatic Cell Count sub-clinical mastitis has improved with nearly 85% of respondents in 2012 having a BMSCC of less than 200,000 cells per ml from around 70% in 2009. (Fig 9). There appears to be a link between sub-clinical and clinical mastitis in the 2012 data where a higher proportion of herds with lower BMSCC had fewer cases of mastitis. (Fig 10) For example 50% of herds with a BMSCC between 51 and 100 have 25 cases of mastitis per 100 cows or fewer whilst the corresponding figure is only 30% of herds with a BMSCC of between 200 and 250.

Figure 9 Banded herd BMSCC

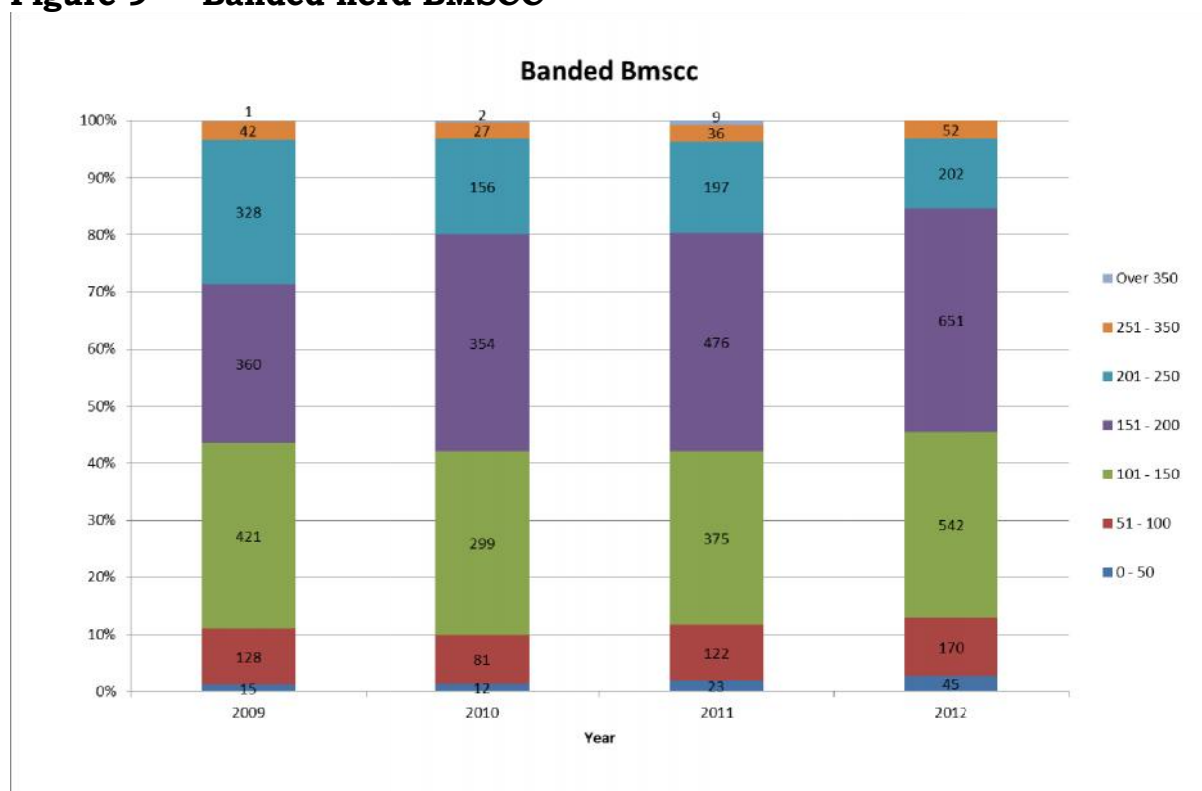
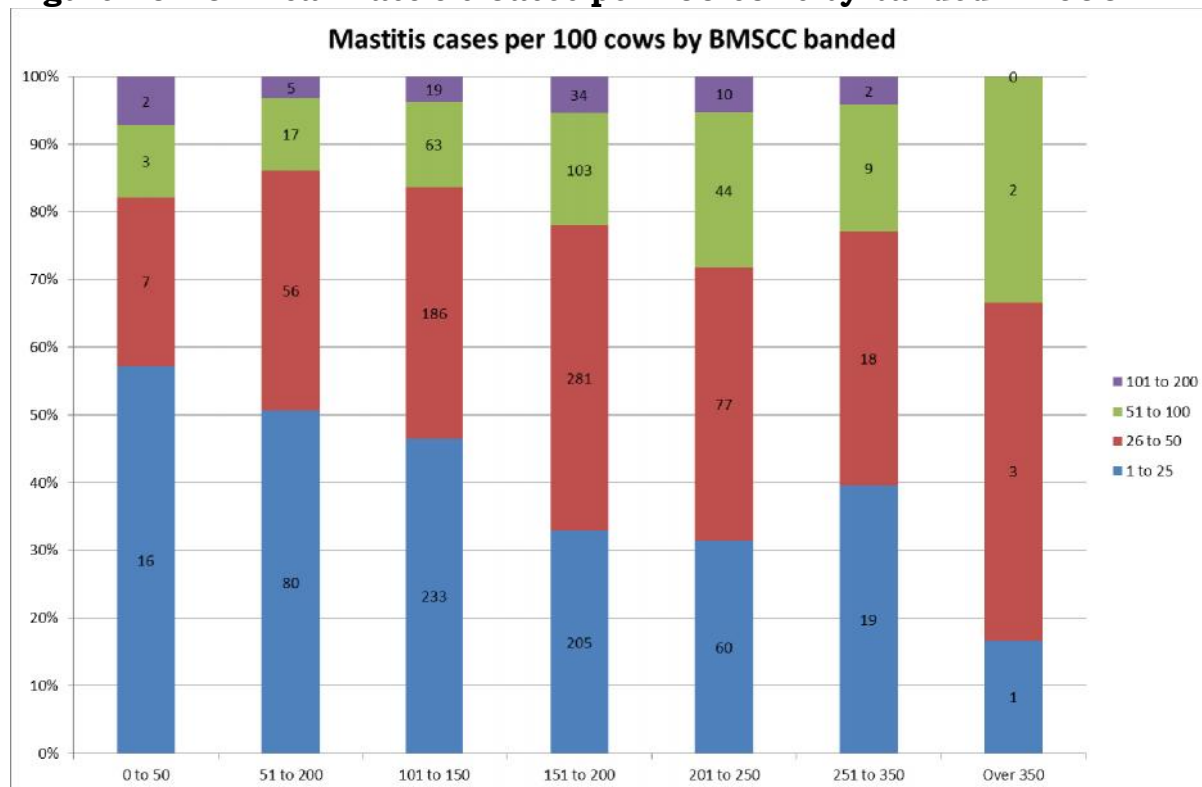


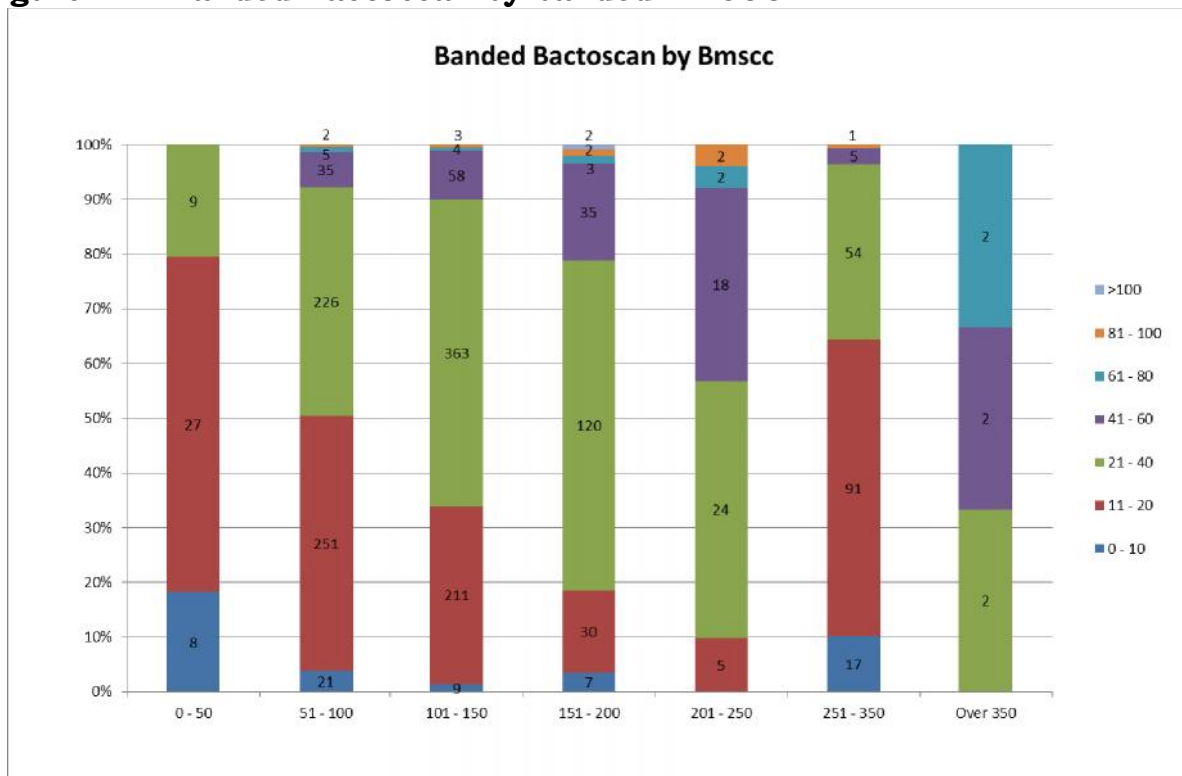
Figure 10 Clinical Mastitis Cases per 100 cows by banded BMSCC



Bactoscan

Although not strictly related to mastitis prevalence (BMSCC) or incidence (clinical mastitis) there appears to be a clear relationship between Bactoscan and BMSCC in the 2012 data (Fig 11) which may be partially related to mastitic pathogen load in bulk milk but will also be in part related to the hygienic milk production that is more likely with producers that achieve low BMSCC milk.

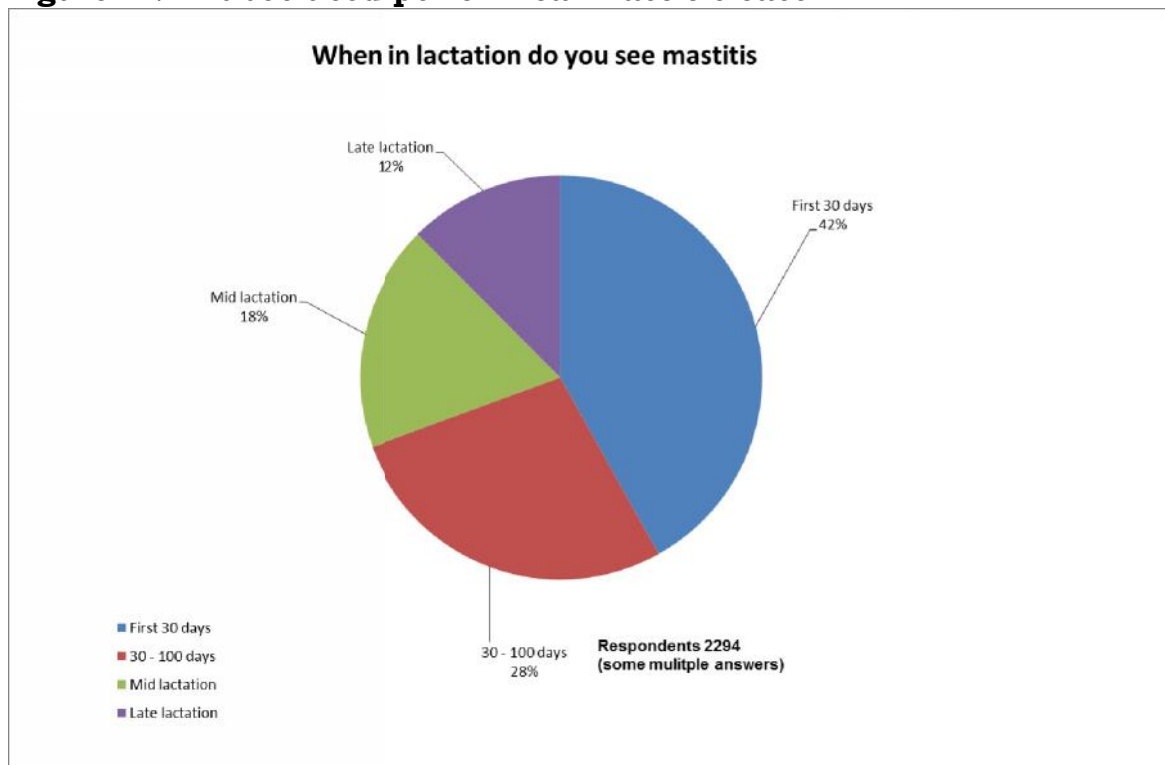
Figure 11 Banded Bactoscan by banded BMSCC



Mastitis treatment

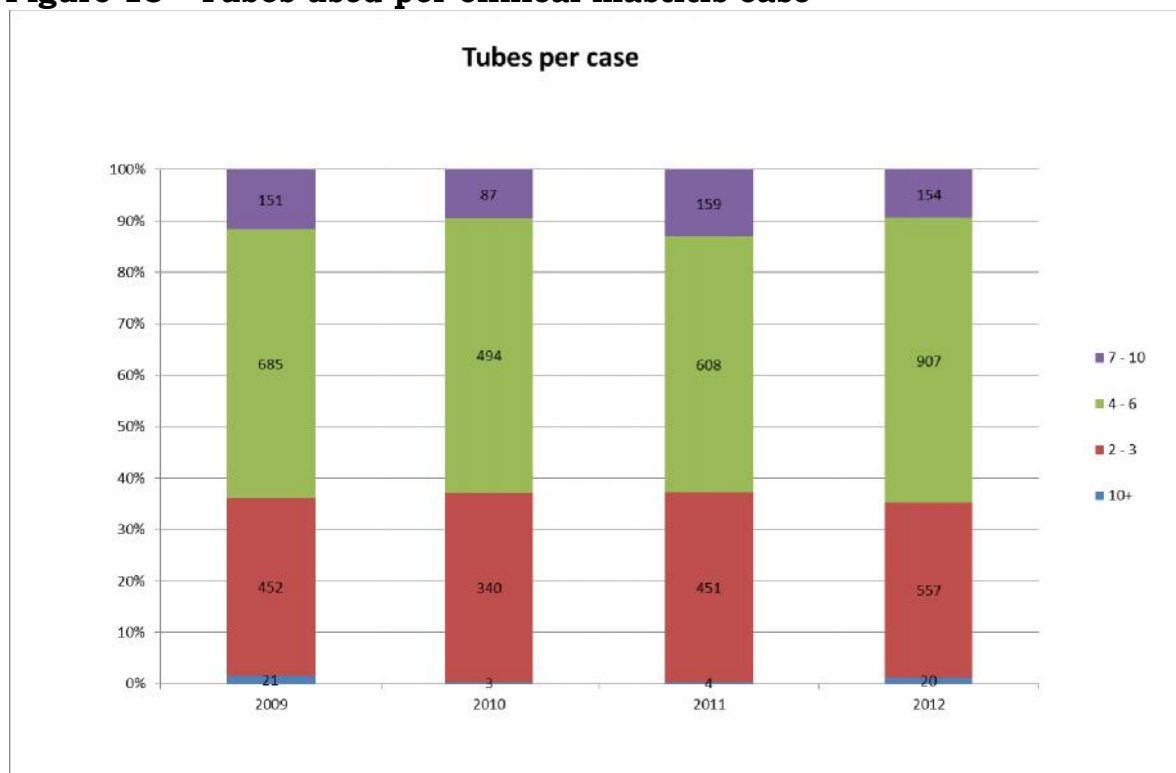
When asked at what stage of lactation was mastitis most commonly seen 42% of respondents in the 2012 survey included within the first 30 days after calving in their answer indicating that fresh calved cows are recognised as a high risk group. (Fig 12)

Figure 12 Tubes used per clinical mastitis case



Respondents were asked about the number of tubes most commonly used to treat clinical cases of mastitis and in all four survey periods over half of respondents used 4 to 6 tubes which is more than the recommended “on-label” treatment. (Fig 13) Producers are presumably using these extended treatment protocols because they find they get improved cure rates however it does raise the issue of how useful and relevant manufacturers “label” withholdings are to producers.

Figure 13 Tubes used per clinical mastitis case

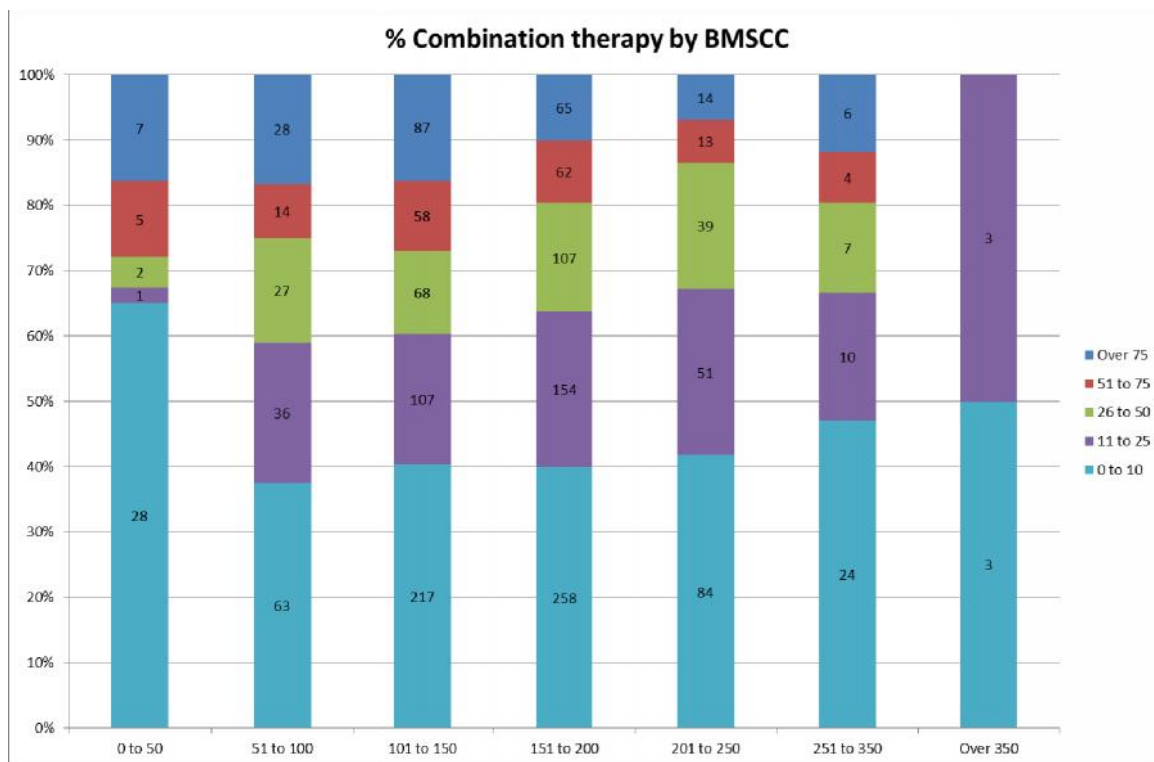


Respondents were asked about the products they used for clinical mastitis, dry cow therapy and internal teat seal. The responses reflect market share data and perhaps gives more of an indication that the respondents are a good cross section of the dairy industry than any particularly useful data.

Respondents answered questions about internal teat seal and antibiotic dry cow therapy. Respondent indicated that about two thirds used internal teat seal on some or all cows and a similar proportion of teat seal users used seal/DCT combination on some or all cows leaving a third of seal users using it alone without antibiotic DCT.

A question was asked about the proportion of clinical cases that received intramammary tubes and antibiotic injection (combination therapy) and it appears that herds which used a greater proportion of combination therapy in 2012 tend to have a lower BMSCC however it is not clear if this is cause and effect or just an association such that producers that are keen to have a low BMSCC are keen to try combination therapy to attempt to achieve better cure rates. (Fig 14)

Figure 14 Proportion of combination therapy by BMSCC



Housing

Housing for dairy cattle was as expected with 85% in cubicles, 11% in straw yards and the remaining 4% in a combination of both. There has been a slight increase in the number for herds housing milking cattle all year. Respondents indicated that 15% housed milkers all year however when this was related to herd size 22% of cattle were housed all year indicating that perhaps larger herds are more likely to house their milking cows or at least their high yielders all year.

Milking facilities

Unsurprisingly 85% of herds are milked through herringbone parlours with 10% abreast and 2% rotary, robot, autotandem and other. Service intervals show nearly two thirds are annual with a further third bi-annually. Liner change interval show that those requiring more frequent liner changes do a better job of changing more often but still not often enough.

Who is milking and for how long?

Nearly two thirds of herds have one operator milking with just over one third have 2 operators however one third of herds have had three operators involved in milking in the previous 12 months. Respondents indicated that just over 70% took 2 hours to milk with a further 17% taking 3 hours and just 4% taking 1 hour.

Litres of milk produced per milking unit

Apart from in herds that group cows according to yield the time taken to milk a herd (per 100 cows) will have a milking time (standing time) which is related to the litres of milk produced and the number of milking units (or standings) and to a certain extent the number of operators. Excessive standing times have the potential to influence the health and productivity by limiting dry matter intake or increasing lameness. Prolonged milking times also make it hard for milking operatives to concentrate for the entire milking as they will spend excessive times in the parlour which could potentially be linked to increased intramammary infections.

The time taken to milk a herd is linked to the volume of milk harvested per unit (milking cluster) which itself tends to increase with increasing average cow yield. The data also shows that larger herds tend to harvest more milk per milking unit. The survey data can't indicate the ideal milk volume to be harvested per milking unit for optimum efficiency and animal health but does show a trend for herds where more cows are attended in the parlour per operator that BMSCC tends to increase. This data could be interpreted as showing that as herds have increased in size there has not been a corresponding increase in parlour capacity or labour resulting in longer milking times, longer standing times and a negative impact on animal health.

Milking routine

Respondents were asked for details of what tasks they performed during milking.

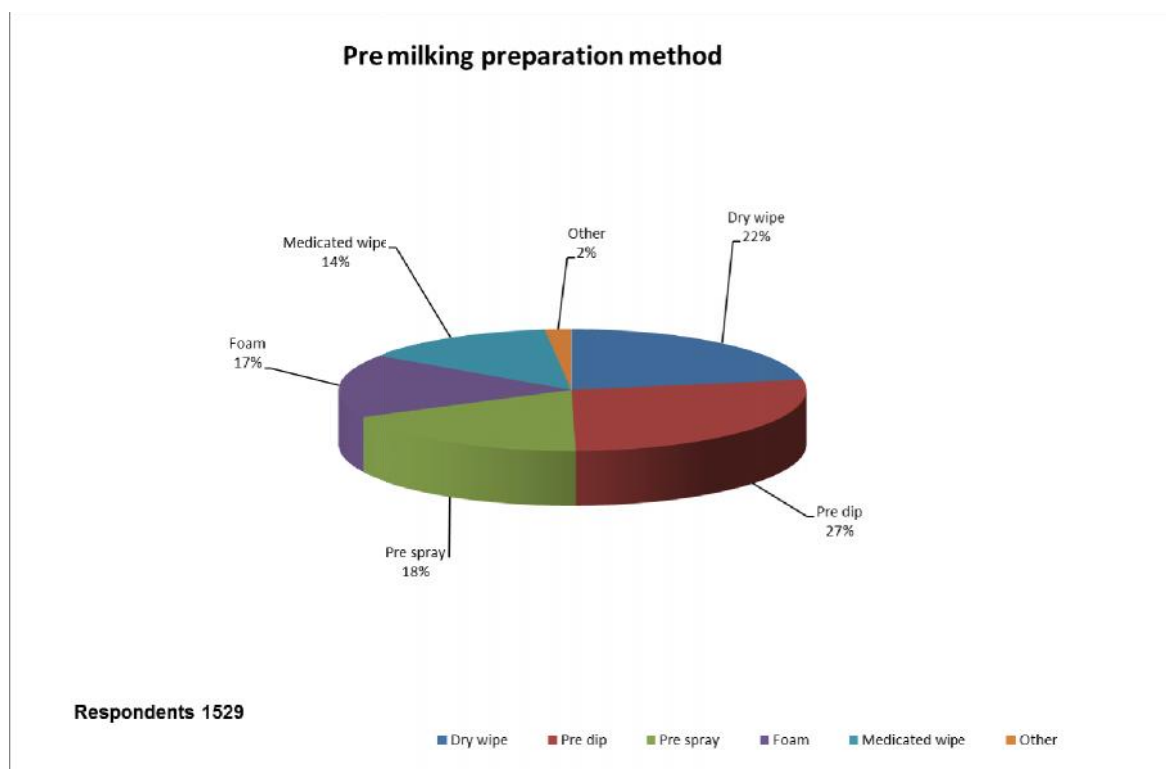
Pre-milking preparation

29% of respondents always wash all teats of all cows and a similar number never wash any teats with 38% washing some cows and 4% at some milkings. Of those that wash 14% do not dry afterwards.

40% of respondents indicated they foremilked all cows all the time with a similar number indicating they foremilked some cows and 14% some milkings with only 8% admitting they never foremilked. A higher proportion of herds with a low BMSCC always foremilk all cows.

Of those 84% of herds performing pre-milking preparation pre-dipping at 27% was the most popular method with dry wiping at 22%, pre-spraying at 18%, foaming at 17% and medicated wipe at 14%. (Fig 15) A higher proportion of herds with a lower Bactoscan pre-milking dip and a higher proportion of herds with a higher Bactoscan dry wipe.

Figure 15 Pre-milking preparation method



Post-milking processes

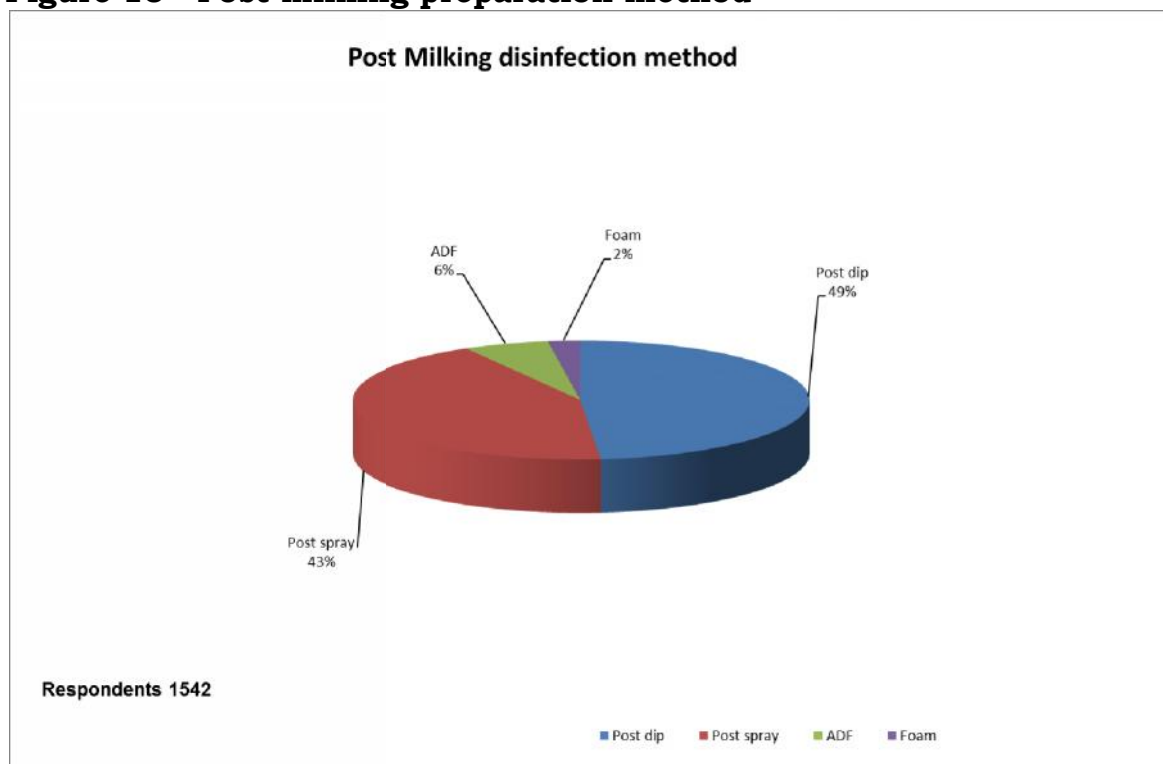
Slightly more herds in 2012 (8%) do not post milking disinfect compared to 2011 at 7%. Of the herds that do post-milking disinfect 49% dip, 43% spray, 6% use Automatic Disinfection and Flushing (ADF) and 2% use a foam. (Fig 16) A higher proportion of herds with lower BMSCC post milking dip and a higher proportion of herd with a higher BMSCC post milking spray.

Of the surprisingly high proportion (16%) of herds that reported using an automatic cluster disinfections system 53% had Clusterflush, 26% ADF, 11% Cotswold and 10% Airwash.

Of those 84% of herds that don't have automatic cluster disinfection 31% disinfect clinical cases, 26% high SCC cows and clinicals, an amazingly high proportion of herds at 24% disinfect all cows, with 15% high SCC cows and only 4% never use cluster disinfection. The method used by 58% of respondents manually disinfecting clusters is dipping, 37% spraying with 5% reported as other.

Of the surprisingly high proportion (16%) of herds that reported using an automatic cluster disinfections system 53% had Clusterflush, 26% ADF, 11% Cotswold and 10% Airwash.

Figure 16 Post-milking preparation method



Of those 84% of herds that don't have automatic cluster disinfection 31% disinfect clinical cases, 26% high SCC cows and clinicals, an amazingly high proportion of herds at 24% disinfect all cows, with 15% high SCC cows and only 4% never use cluster disinfection. The method used by 58% of respondents manually disinfecting clusters is dipping, 37% spraying with 5% reported as other.

Surprisingly there are still 13% of respondents that never wear gloves and a further 9% that only wear gloves sometimes which is perhaps not appropriate for a process producing food for human consumption. It also seems bizarre when the much more tedious task of manual cluster disinfection is only never performed by 4% of respondents with 24% disinfecting all cows at every milking.

DISCUSSION

Despite the fact that many of the key points and trends that can be gleaned from the National Mastitis Survey data follow conventional wisdom or data that is already known some are less well known or available.

Although it is well known that dairy herds are generally getting bigger across the UK the respondents to this survey have remained markedly stable in terms of proportions in a number of banded herd sizes. Whilst there may be public concern that larger herds have more disease than smaller herds this does not seem to be the case with clinical mastitis however the number of cases experienced by dairy herds in general seems to be increasing slightly. Perhaps more enlightening is that herds with higher cell counts tend to have more clinical mastitis which may be exacerbated by the fact that more cows "looked

after” in the parlour per operative is associated with a higher cell count. This might pose the question at what point is it justified to increase the number of operatives to speed up the milking of a herd? There will be both the welfare of the cows in terms of the time standing and not eating or lying down whilst they are waiting to be milked and the operatives in terms of prolonged time spent working in the parlour. There may be potential disease cost benefits to consider when the time to milk a herd becomes longer which then needs to be weighed against the extra labour cost of increasing the number of operatives to speed up milking. The National Mastitis Survey cannot give the answers however it does seem from the data collected that as herds expand the parlours in which they are milked often do not and as the litres of milk harvested per milking unit increases the pressure on both cow and operative might have deleterious effects on both.

CONCLUSIONS

The National Mastitis Survey has now taken place over four consecutive years with only the first year having significant variation in the questions posed. The resulting dataset has been developed into a contemporary and large scale survey for its type giving a useful and unparalleled insight into the range of milk quality and mastitis management practices which are present in a representative proportion of the UK dairy farms. The results from the four years of the National Mastitis Survey can indicate not only the presence, variation and prevalence of data within a year but also how that data has or has not changed over time. The validity of the data can only become stronger as the survey is repeated each year.

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NOTES

ANTIBIOTIC RESISTANCE – FACT OR FICTION?

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SUMMARY

Antibiotics are used in food animals to treat or prevent disease and resistance emerges from their use in animals. Resistance is becoming an increasingly concerning issue, impacting on both animal and human health. Consequently, the EU is considering sheltering some key antibiotics from veterinary use to protect their efficacy in human medicine.

In recent years methicillin-resistant *Staphylococcus aureus* (MRSA) has been isolated from milk. Regulators have recommended that fluoroquinolones and 3rd to 4th generation cephalosporins are second line antibiotics to be reserved for conditions that have responded poorly or are likely to respond poorly to other classes of antibiotics. A recent survey of antibiotic usage on dairy farms found that compound preparations (more than one antibiotic) and a fourth-generation cephalosporin were the most common lactating cow treatments.

Vets and farmers must be prepared to take the lead not only to demonstrate responsible use of antibiotics on farm but use science and system development to reduce veterinary interventions. The key principles of responsible use need to be implemented

INTRODUCTION

Antibiotics are used in food animals to treat or prevent disease. Therapeutic treatments are intended for animals that are suffering from disease. Prophylactic antibiotic treatments are typically used during high-risk periods for infectious disease. This paper will focus on the use of antibiotics for mastitis.

Table 1 Types of antibiotics used in mastitis

	Type	Route of administration	Administration
Therapeutic	Therapy	Intramammary Intramammary and injection	Individual animals
Prevention	Disease prevention	Intramammary	Individual animals or Group

Primary decision making about antibiotic use ideally rests with veterinarians, who can diagnose diseases on the bases of symptoms and appropriate laboratory tests, including culture and susceptibility testing as they pertain to individual animals or groups.

Antibiotic resistance emerges from the use of antibiotics in animals and the subsequent transfer of resistance genes and bacteria among animals and animal products and the environment.

RESISTANCE

Antibiotic resistance exists. However, the development between the use of an antibiotic and the subsequent emergence of a resistant bacterium is poorly understood.

Resistance is becoming an increasingly concerning issue, impacting on both animal and human health. The use of antibiotics in agriculture is often cited as a major source of antibiotic resistance in pathogenic bacteria of humans. In the EU, a reported 25,000 deaths are put down to antibiotic resistance and the passing of bacteria such as *Escherichia coli* from farm to fork. How many, if any, of the 25,000 deaths were related to the fact an antibiotic produced in an animal led to resistant bacteria being transferred to a human? Reid (1) reported that data on *Salmonella typhimurium* DT104 isolated between 1990 and 2004 in Scotland were used to investigate the patterns and diversity of resistance. Whilst ecologically connected, animal and humans have distinguishable DT104 communities, differing in prevalence, linkage and diversity. It is unlikely that the local population is responsible for the diversity of resistance phenotypes observed in humans. However, this does not let us off the hook. We need to be seen to use antibiotics responsibly.

POLITICS

The EU is considering sheltering some key antibiotics from veterinary use to protect their efficacy in human medicine. Yet (Reid, 2012) indicates the link between on-farm use and the development of resistance in human pathogens is unlikely. However, the reality is that this issue is now driven by politics.

The Dutch Government has set a target of 70 per cent reduction in antibiotic used between 2009 and 2015.

In order to avoid the imposition of knee-jerk legislation vets and farmers must be prepared to take the lead not only to demonstrate responsible use of antibiotics on farm but use science and system development to reduce veterinary interventions

PRESENT SITUATION

A survey of the prevalence of antibiotic resistance among bacterial pathogens isolated from cattle in different European countries for the period 2002 to 2004 (2) found that for *S. aureus* from bovine mastitis major differences were apparent in the occurrence of resistance between countries and between the different antibiotic agents tested. The highest frequency of resistance was observed for penicillin.

Table 2 Occurrence of penicillin resistance among *S. aureus* from bovine mastitis in different European countries (2)

Year	DK	E	F	I	LV	NL	N	ES	S
2002	29.7	46.0	4.7			10.0		45.0	7.0
2003	23.1	36.0	3.0	43.0		24.3	5.0	40.1	
2004		38.0			49.0	12.1		33.0	

DK – Denmark; E – England, F – France; I – Italy; LV – Latvia; NL – The Netherlands; P – Portugal; N – Norway; ES – Spain; S – Sweden.

In recent years methicillin-resistant *S. aureus* (MRSA) has been isolated from milk. Haenni (3) found that the prevalence of MRS isolated from French bovine mastitis is very low (1%). Vanderhaeghen (4) detected methicillin-resistance in eleven (9.3%) of the 118 *S. aureus* isolates, indicating that nearly 10% of the Belgian farms suffering from *S. aureus* mastitis have an MRSA problem.

Garcia-Alvarez *et al.* (5) identified a new strain of MRSA which occurs both in human and dairy cow populations. This was met with headlines in the press of *MRSA: New strain of superbug found in cows* and the Soil Association called for a complete ban on routine use of antibiotics in farming.

The CVMP (Committee for Medicinal Products for Veterinary Use) Strategy on antibiotics for the period 2011 to 2015 (6) states that fluoroquinolones and 3rd to 4th generation cephalosporins are second line antibiotics to be reserved for conditions that have responded poorly or are likely to respond poorly to other classes of antibiotics. However, a recent survey of antibiotic usage on dairy farms in England and Wales (7) found that the most frequently used first-choice lactating cow antibiotic tube contained the active ingredients dihydrostreptomycin, neomycin, novobiocin and procaine penicillin (37 per cent). Cefquinome, a fourth-generation cephalosporin, was the active ingredient in the second most frequently used tubes (29 per cent). Where respondents stated a second-choice tube tubes containing cefquinome were most frequently used (25 per cent) followed by tubes containing dihydrostreptomycin, neomycin, novobiocin and procaine penicillin (21 per cent).

Compound preparations (more than one antibiotic) are of doubtful value and often not successful in eliminating infection. Moreover, the concentration achieved by any one antibiotic is likely to be lower than the optimum required and could lead to the development of resistance (8). Unless the antibiotics in a combination preparation act synergistically (Table 3) the use of compound preparations should be avoided.

Table 3 Clinically useful antibiotic drug combinations in veterinary medicine (9)

Indication	Drug combination	Comment
Bovine <i>S. aureus</i> mastitis	Penicillin-streptomycin	Synergistic combination
	Amoxicillin-clavulanic acid	Potentiated combination

THE WAY FORWARD

Antibiotics are only one tool in the mastitis control program. Reducing the contamination of equipment and taking environmental factors, such as stocking density and ventilation, into account can help to reduce the incidence of mastitis. They should not be used to compensate for poor hygiene.

Health and Good Management

The use of a proactive health plan and measuring the annual antibiotic usage per year for each animal, as well as having an increasing focus on animal husbandry, will help veterinarians and farmers to tackle the antibiotic resistance problem.

Responsible Use

Antibiotics should be used responsibly which means:

- Farms should be managed so that the risk of disease developing is minimised. Good animal husbandry is essential to reduce the disease challenge.
- When animals become ill they should be treated in accordance with instructions from the farm's veterinary surgeon and follow any specific protocol laid down.
- Antibiotics should only be used as prescribed by the farm's veterinary surgeon and the full course of treatment should be given.
- Critically important antibiotics should not be used preventively or as first time treatment unless there is clear scientific justification to do so.
- Use according to the label.

All medicines on farm should be used as little as possible or as much as necessary.

RUMA (the Responsible Use of Medicines in Agriculture Alliance) has produced detailed guidelines to show best practice.

Reducing dosages or the length of treatment simply to use less antibiotics to meet arbitrary reduction targets is not responsible use. It could encourage the development of antibiotic resistance and compromise animal health and welfare.

CONCLUSIONS

Antibiotic resistance is a key issue in the politics today. Vet and farmers need to implement good animal husbandry plus responsible use of antibiotics or face the risk of arbitrary targets for reduction in use as well as more stringent legislation.

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NOTES

MASTITIS CONTROL PROGRAMMES-THE IRISH EXPERIENCE

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SUMMARY

Traditionally in Ireland, regulatory animal health issues (such as TB, Brucellosis and FMD) have been the responsibility of the government, with little or no coordination around non-regulatory animal diseases. However, the establishment of Animal Health Ireland (AHI), is helping to address this gap. AHI has identified mastitis as one of seven priority disease areas, and a national udder health programme called CellCheck was initiated at the end of 2010. The objectives of the CellCheck programme are setting goals, building awareness, establishing best practice, building capacity and evaluating change. The key strengths of CellCheck are its multidisciplinary and collaborative nature, involving all relevant industry bodies in both the development and delivery of the programme.

INTRODUCTION

Traditionally in Ireland, regulatory animal health issues (such as TB, Brucellosis and FMD) have been the responsibility of the government, with little or no coordination around non-regulatory animal diseases. However, the establishment of Animal Health Ireland (AHI) in 2009, is helping to address this gap. AHI is a not-for-profit, partnership-based organisation providing national leadership and coordination of non-regulatory animal health issues in Ireland. Its mission is to improve the profitability, sustainability and competitiveness of Irish livestock producers and related industries, through superior animal health. AHI is a partnership between producers, processors, service providers and government, and is co-funded by these stakeholders. AHI provides benefits to livestock producers and processors by providing the knowledge, education and coordination required to establish effective control strategies, both on-farm and nationally.

One of the first Animal Health Ireland activities in 2010, was to identify priority disease areas, through a policy Delphi study with experts, and farmer surveys. Seven diseases were prioritised, and a Technical Working Group (TWG) was established in each of these disease areas. These TWGs are made up of industry experts in that field, from all disciplines. Their remit is to bring together the most up-to-date science and research in their area of expertise, to provide clear, consistent and independent information for the industry. Mastitis was identified by farmers and industry experts as one of the priority diseases. Thus, CellCheck was initiated at the end of 2010, as the AHI-led, national udder health programme.

WHAT DRIVES MILK QUALITY IN IRELAND?

Although Ireland is a relatively small dairy producer in global terms, accounting for less than 1% of world dairy production, the Irish dairy industry has a global reach, with 80% of its dairy produce being exported. Over the last two decades, Ireland has become one of the world's leading producers of infant formula, now supplying in excess of 15% of the international market. In 2011, the value of exported dairy products and ingredients reached €2.7 billion, a 17% increase on the previous year. The Irish government's strategy for the agri-food sector, Food Harvest 2020, highlights a promising future for the dairy sector in Ireland (Department of Agriculture, Food and the Marine, 2010).

The expected abolition of milk quotas in 2015 will offer Irish farmers an opportunity for expansion. However it will also result in Irish dairy farmers facing a less regulated global trading environment with more price volatility than before, and an ever-increasing demand for higher standards of milk quality. Superior animal health and milk quality has an important role to play in ensuring competitiveness, meeting consumer demand and improving profitability.

2010 data from Irish milk recording herds (34% of dairy herds in Ireland), shows that over 80% of herds have an annual average herd SCC in excess of 200,000 cells/ml. Using this information as a proxy for the national herd, it is clear that there are opportunities to improve udder health nationally. A coordinated approach to improving udder health, such as CellCheck could provide many benefits for the Irish dairy industry, and individual farmers.

THE DEVELOPMENT OF CELLCHECK

CellCheck has been shaped by both national and international research and experience. Previous research in Ireland, such as the EuroMilk pilot mastitis control programme, has helped to identify some of the obstacles to improving udder health, that exist at farm level. EuroMilk focussed on facilitating farmers to create multidisciplinary teams with their local service providers (vets, farm advisors, milking machine technicians and/or co-op milk quality advisors), to work together to improve udder health. The main objectives of this pilot study were to identify the drivers and constraints to improving milk quality, from the perspective of participating farmers and other team members, and to determine if a team-based approach to mastitis control could be implementable and effective on Irish farms.

Learnings from EuroMilk identified inconsistent advice, a lack of a coordinated or "joined up" approach to mastitis control and a "normalisation" of high herd SCC as some of the obstacles to change at farm level. Other findings such the motivators to improve milk quality, and challenges to implementation of a programme such as this on a wider scale have helped guide the development of CellCheck.

CellCheck has convened two important working groups. Firstly the Technical Working Group (TWG), which is a group of industry experts from various disciplines, with skills and expertise in the area of udder health and mastitis control. Their remit is to bring together the known and agreed science around mastitis control, to provide clear and consistent information for the industry. Secondly, the Industry Consultation Group (ICG), which is a diverse group of individuals with an intimate working knowledge of the Irish dairy industry. They represent the industry groups with the ability to influence change at both farm and industry level. The role of the ICG is to provide industry support, guidance and expertise to assist the development and delivery of the CellCheck programme.

The objectives of the CellCheck programme are:

- setting goals
- building awareness
- establishing best practice
- building capacity
- evaluating change

The first year of CellCheck has focused on the agreement of clear, consistent, science-based, information on mastitis control. Close collaboration with Dairy Australia has been invaluable in the development of CellCheck, providing among other things access to existing technical resources. The TWG reviewed these resources, updating and adapting them as necessary for the Irish industry. The *CellCheck Farm Guidelines for Mastitis Control* were published in February 2012, and are available to all farmers and their service providers. Since March 2011 a communications strategy, which includes monthly articles in farming media, co-op and client newsletters etc. has helped to build awareness about the CellCheck programme and the value of improved udder health and provides key practical recommendations.

Building the awareness of service providers of the CellCheck programme, the *Farm Guidelines for Mastitis Control* and their enthusiasm for milk quality started in February 2012 with a series of nationwide, multidisciplinary Service Provider Seminars. These seminars, which have aimed to achieve active learning in an enjoyable environment, have been open to all disciplines-veterinary practitioners, milking machine technicians, farm advisors, co-op milk quality advisors, commercial sales people etc. Almost 500 service providers attended, and for many, this was their first opportunity to meet people from other disciplines.

The delivery of farmer workshops commenced in September 2012. The objective of this workshop is to deliver best science and practice information around mastitis control to farmers, and to encourage the uptake and improve the standards of key best practices in everyday milking routines. Teams of local service providers are the frontline in delivery of these workshops to their farmers.

Economic research has also been completed, which looks at the impact of mastitis on farm profitability, as indicated by various bulk tank SCC ranges. This is important to highlight to farmers the value of improving mastitis control, which is often underestimated, or based purely on penalties incurred or cases treated. The economic work continues, now looking at the cost of mastitis to the processing industry. This information will be important in informing discussions within the ICG, around issues such as milk payment policies and motivating change at a higher industry level.

WHAT HAVE WE LEARNT SO FAR?

Social science research has been an important component of the CellCheck programme. To date, the social science aspect of CellCheck has included two key components. The first was a process called ‘terrain mapping’ – obtaining a clear understanding of the landscape of the Irish dairy industry. This work with members of the ICG has helped identify drivers and constraints at an industry level to improving milk quality. Results from this process showed that within the industry, while there is agreement on the value of enhanced milk quality, reaching a consensus on how to achieve this is contestable. The industry bodies represented in the ICG see themselves with varying levels of responsibility in the process of change. This presents a challenge for understanding the roles they can play in achieving change.

The process has also identified the need to clearly communicate the objectives and scope of the programme, in order to manage expectations at all levels within the industry. For example, providing solutions to some challenges that have been identified, such as milk payment policies, are beyond the scope of CellCheck. However, the programme can facilitate industry discussion and collaboration on these issues, in order to explore solutions.

With 12 different milk processors and another 20 milk buyers in Ireland, encouraging collaboration and ensuring that farmers receive consistent quality signals is not easy! This emphasises the importance of the partnership structure of AHI, and the value of the Industry Consultation Group. Through the ICG, CellCheck can encourage and facilitate an otherwise fragmented industry to discuss and progress issues such as collating national SCC data and agreeing on common industry targets. The conscious decision made to underpin all Animal Health Ireland work by science, including the social sciences, has also been important for enabling stakeholders to reach a consensus and make informed decisions for a greater industry good, rather than primarily for personal gain.

The second social science component of CellCheck involved the use of a farmer survey as part of a pilot series of farmer workshops in June 2011. This survey was to determine the extent to which key best practices were being implemented on farms. A key finding from this survey is that a

significant gap exists between the routine practices and behaviours that people report, and the standard to which those practices are done. For example, almost all farmers that participated in the pilot series of workshops reported that they carried out teat disinfection after every milking. However, data collected showed that approximately 50% of surveyed farmers used less than half the recommended amount of teat disinfectant. This would indicate that the quality of the teat disinfection, and teat coverage achieved is poor. Supporting results from EuroMilk and other Irish research, this suggests that though practices may be implemented on the farm, it is necessary to review the quality of implementation and farmers' understanding of why such practices are important.

CONCLUSION

Mastitis control is achievable-it is not just an inevitable part of farming. The solutions lie in understanding that mastitis is multifactorial in nature, and implementing existing science and knowledge, rather than waiting patiently for a "silver bullet". The key strengths of CellCheck are its multidisciplinary and collaborative nature, involving all relevant industry bodies in both the development and delivery of the programme. While the science behind the CellCheck programme is not new, the approach to disseminating and encouraging adoption of this science is.

NOTES

HEIFER MASTITIS

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SUMMARY

Mastitis, in conjunction with lameness and fertility, represents one of the major health issues associated with dairy farming. Whilst many control measures have been introduced for cows, often less attention is paid to heifers. This paper examines predisposing factors and control options available. Control options relate primarily to environmental conditions and include attention to calving paddocks, straw yards, and bedding materials; teat hygiene factors such as teat dipping precalving, teat seals and fly control; and management factors such as feeding, milk let down and post calving integration.

STAGES IN THE DEVELOPMENT OF A NEW CASE OF MASTITIS

Before considering control measures, it is important that we fully understand how a new case of mastitis develops. The stages of the disease are:

- i. Arrival of the reservoir of infection. This “new arrival” may be the purchase of an infected animal or may be simply a change in the environment leading to increased exposure to environmental bacteria.
- ii. Transfer of the organism from the reservoir to the teat end.
- iii. Establishment of a colony at the teat end (for contagious organisms).
- iv. Penetration of the teat canal.
- v. Ability of the invading pathogen to overcome immune defences.

Infection can enter the udder of the heifer both pre-calving and during lactation. Whereas with adult cows dry period infections occur in the first two weeks of the dry period and in the two weeks prior to calving, in heifers it is just the two weeks prior to calving when they are especially susceptible. Then as they enter the main herd a further risk period develops.

While we commonly assume that exposure to a pathogen is the major risk for mastitis, it should be remembered that immune response is also very important. For example, in the data from Green et al (2002), of the 745 cows that developed a new coliform infection during the dry period, only 8% of them went on to develop a clinical coliform mastitis. This means that 92% must have undergone a self-cure. Hence it may be better to concentrate on an understanding of how the 92% were able to overcome infection, rather than the 8% that developed clinical disease. It is well known that all animals suffer immune suppression around the time of calving. This is why, for example, animals that have been latently carrying

salmonella for several months may develop clinical disease around the time of calving. White blood cell function is also suppressed. The reasons for the periparturient immuno-suppression are not fully understood, but suggested factors include:

- i. The foetus is antigenically different from the dam so if foetal fluid leaked into maternal circulation during the birth process an anaphylactic reaction might develop.
- ii. There will be inherent trauma to the birth canal during parturition and immuno-suppression could prevent over-reaction of the dam to the trauma.
- iii. Concentration of immuno-globulins into the colostrum leads to reduced circulating Ig levels in the dam around calving.

In support of the above hypothesis, Menzies et al (2003) showed that cows that developed milk fever showed 21% increase in the risk of toxic mastitis around the time of calving and cows with difficult calvings showed an 11% increase.

In addition to the above, there are numerous studies to show that the level of bacterial teat contamination is directly related to the level of mastitis and it is well accepted that the level of teat contamination will be directly related to hygiene within the environment. An excellent paper by Phil Francis and John Sumner at one of the early British Mastitis Conferences (1989) produced data confirming this. Kristula et al (2007) summarised the position very well by stating that

Hence in the control of mastitis in heifers we need to consider both environmental factors and factors likely to be associated with the heifer response, i.e. immune suppression. Many of these factors apply both pre- and post-calving, but there are a few that are specific to each stage.

CONTROL MEASURES

In the following an attempt has been made to subdivide the control measures into pre-calving and post-calving issues, although a proportion, especially those relating to environmental hygiene, will apply both pre- and post-calving. At a mastitis conference many years ago, Andy Johnson the 'udder doctor', stated that the most important area on the farm in terms of mastitis control was the 4 sq mm area at the teat ends. I would agree with this, and hence environmental hygiene is discussed in some detail in relation to heifer mastitis control.

Calving paddocks

Whether heifers calve outdoors or indoors, a build-up of infection in the environment during the two to three weeks pre-calving is of extreme importance in the development of new clinical cases. In the summer especially, cattle like to lie in a group, often under the same tree and this leads to a build-up of *Streptococcus uberis*, because the organism is naturally found in many sites in the body (Bramley 2001). The tree, of course, produces shade, and due to the transpiration and evaporation of water from its leaves it produces a cooling effect. The build-up of infection needs to be controlled and for this reason Bradley and Green recommended that the calving paddock should be changed every two weeks and animals should not return to that paddock for a further four weeks, when levels of *Streptococcus uberis* on the pasture will be reduced. Dirty calving paddocks in the autumn, with animals standing or lying in mud, will also represent a risk.

Straw yards

Heifers are commonly kept in straw yards for two or three weeks pre-calving and sometimes for a week or so post-calving, until they are ready to join the main herd. Straw yards are undoubtedly extremely comfortable, but due to the inherent fermentation of the bed they are also a high risk, especially for *Streptococcus uberis* mastitis. If the beds get heavily contaminated then coliform mastitis is also a risk. Bedded yards for pre- and immediately post-calving animals should be liberally bedded, e.g. using 15-20kgs of dry straw per animal per day. The yards should ideally be cleaned out every two to three weeks and if a layer of builders lime or lime ash is put over the base of the yard prior to the straw, this will retard fermentation. An alternative is to put down a layer of chopped rape straw, with barley straw on top. The rape straw allows better drainage of urine and liquid faeces and keeps the yard surface drier. Building design features such as good drainage and preventing leaking gutters from flooding the yard, are obviously vital.

Ventilation

High yielding cows are incredibly wet creatures, producing 50-60 litres of water per cow/day in the urine, faeces, breath and sweat. This water needs to be removed from the building and hence good ventilation is vital. If buildings are enclosed and humid, then this predisposes to bacterial proliferation and an increased risk of mastitis. If you can smell cows when you stand in the building, then there is clearly a problem. Ventilation is also important in the summer to prevent heat stress. Stressed cows spend more time standing, especially standing in groups round the water trough, and this significantly increases both the risk of lameness and mastitis.

Alternative beddings

It is well known that sand has a lower bacteriological count than sawdust and straw, and hence the use of deep sand cubicles for cows close to and immediately after calving will be highly beneficial. Straw yards probably remain ideal the calving process itself, but the shorter the period that the cows spend in the straw yard pre-calving the better. Recently alternative beddings such as mixtures of lime ash and sand, or lime ash and straw have been used. The lime ash has a high pH and this inhibits the growth of both *E.coli* and *Streptococcus uberis*. Swiss research has shown that if the pH of the bedding was above 9.5 then this inhibited the growth of *Streptococcus uberis*. Lime ash has a very high pH, e.g. between 11 and 12, and is the only bedding known to me that has a totally zero bacterial growth. If the lime ash is mixed 50:50 by volume (25:75 by weight) with sand or sawdust, then the fine lime ash particles are absorbed onto the larger particles of sand or sawdust and the risk of teat burn becomes minimal. This is especially the case if pre-dipping and wiping are carried out effectively, and of course both measures will reduce the level of mastitis. Trials have shown that the addition of cultures of coliforms and *Streptococcus uberis* to mixtures of lime ash and sand or lime ash and sawdust result in a rapid lowering of bacterial numbers compared to the use of sand and sawdust alone. Further details of this work will be presented in a Poster.

Fly control

This is an important pre-calving measure and is especially important in the control of summer mastitis. Pour-on preparations spread over the body in the flow of sebum, but as there are no sebaceous glands or hair follicles on teat skin, the teats are not well protected by pour-on products. If there is a high risk of summer mastitis, then it is essential that fly repellent is applied to the udder itself. In high risk areas, farmers commonly apply Stockholm tar or similar to the heifer teats each week prior to calving. Attention to fly control throughout rearing will also help to reduce the numbers of heifers that develop warts.

Teat dipping prior to calving

An increasing proportion of farmers run their heifers with the transition cows and then put them through the parlour two or three times a week to apply teat dip. This has the advantage of getting the heifers used to knowing about the parlour, it makes the milking parlour a much less threatening and less frightening experience for them in later life, and regular application of a disinfectant should help to reduce new dry period infections. Regular foot bathing for the prevention of digital dermatitis and necrobacillosis can also be carried out. Many people use a thick barrier dip which they hope will have a longer persistence.

Teat seals

Teat seals have been used in heifers, both externally e.g. Dryflex and internally, e.g. Orbeseal. Both have been shown to be effective, but in my experience neither is particularly popular. External teat seals work well if they are applied well, but the regular cleaning of the teats of pre-calving heifers, and the need to apply the external sealant every week, requires a high labour and management input. Internal teat sealants have been shown to be effective in heifers, but again I have little practical experience of this. My main concern about the use of internal teat sealants in heifers is that in many heifers the natural seal may be removed during the process of infusing the wax sealant. Clearly it will be much more difficult to infuse wax sealant in heifers than in cows and hence the risk of compromised hygiene and introducing new infections that actually cause mastitis will be much greater.

Antibiotic tubing prior to calving

There are certainly careful scientific studies that have shown this to be effective and that it reduces the incidence of mastitis. The disadvantages are similar those relating to the infusion of internal teat sealants. The teat canal in heifers is smaller and the infusion is much more difficult to carry out, and there is therefore a significant risk that infection will be introduced at the same time as the antibiotic, thus leading to an increase, rather than a decrease in mastitis.

Feeding and heifer mastitis

Correct feeding of heifers pre-calving is essential to minimise the risk of mastitis. If heifers are overfed or if they are too old at calving, then there is an increased risk of udder oedema. Udder oedema increases udder discomfort, leading to poor let-down and an increased risk of mastitis. The poor let-down has a secondary effect, in that there will be an increased risk of milk leakage and milk leakage onto a conventional bed produces a huge increase in mastitis risk. Whereas levels of faecal bacteria in freshly calved cows are around 10^6 per gram if there is mixture of milk and faeces in the bed bacterial levels can easily rise to 10^9 per gram. Milk leakage pre-calving also means that the natural teat end keratin seal has been lost and this further increases the risk of new infections in pre-calving heifers.

Milk let-down in heifers

This is almost a separate subject in itself and I hope will generate a good deal of debate, but of course poor let-down means there will be an increased risk of milk leakage and an increased risk of heifer mastitis (Blowey and Edmondson 2010). The following procedures should help to improve milk let-down in heifers.

- i. Accustom the heifers to coming into the parlour in the transition group pre-calving. If they are introduced into the main herd for the first time that they go through the parlour, it is likely that they will stand at the back of the collecting yard until the very end of milking (thus increasing the risk of lameness). They may then be brought into the parlour perhaps by the herdsman on his own when his patience is at its lowest point. A heifer that has to be forcibly pushed into the parlour is less likely to achieve milk let-down.
- ii. When in the parlour, provide good stimulation to achieve good let-down, e.g. pre-dip, foremilk and wipe, then leave a good minute prior to unit application.
- iii. If let-down is not achieved, then massaging the udder, perhaps with a warm damp towel, will help. Occasional farms use vaginal inflation with a polythene pipe, as vaginal dilation stimulates the release of oxytocin.
- iv. If milk let-down does not occur at the first milking, then do not leave the unit on too long, as this will lead to pain. Probably three minutes is enough, then simply take the unit off and hope for a better response at the next milking.
- v. Oxytocin or Reprocine can be used, but ideally it should only be used as a last resort due to the risk of habituation.

Post-calving heifer management

The introduction of a freshly calved heifer into the main herd is undoubtedly a stressful process. Studies in Wisconsin showed that when a heifer was introduced into a new group there were approximately ten aggressive interactions every hour, five of these being physical and five being threatening. This is likely to lead to increased walking and therefore increased risk of splashing and udder contamination. If a separate heifer group can be maintained, this is likely to reduce the level of aggression.

Feed space

There is clearly a huge increase in standing times to feed in the immediate post-calving period and if insufficient feeding space is available for heifers there is a risk of increased standing and increased teat contamination if they are having to push their way into a feed area. Ideally feed space needs to be at least 0.6m (2 feet) per animal or greater in the early lactation period.

Tail-trimming

This is an extremely easy procedure to perform, it produces a considerable decrease in mastitis risk, and yet it is not practiced by many farms, and in others it is not done until after calving. Ideally not only the end of the tail should be trimmed, but the hair along the side of the tail is also best

removed. Cow cleanliness overall can be recorded in cleanliness scores. The scoring system I use in parlour audits is based on a simple 30, 60, 90 scoring, where the amount of contamination on the leg is scored as 30 if foot to hock is affected, 60 if foot to stifle is affected and 90 if the whole length of the leg is affected. I would not wish to see more than a maximum of 10% score 90 cows and preferably zero.

CONCLUSION

Heifer mastitis can be controlled and most of the control procedures are simple management factors. Often treatment is not particularly effective and there is no doubt that prevention is much better than control by treatment. If a heifer becomes infected precalving there is a risk that she will remain infected until the end of the lactation and as such she may have repeated cases of mastitis and will spread infection to the other animals in the herd.

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NOTES

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PAPER SLUDGE ASH AS A BEDDING DESICCANT

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Numerous papers have shown that increased bacterial contamination of teat ends leads to increased mastitis. By acting as a desiccant, ash bedding (also known as PSA, paper sludge ash) leads to a marked reduction in the bacterial load both in the environment and on the teat end, and those herds where it has been used for several years have reported a marked decrease in the incidence of mastitis.

Bacteria have four growth requirements, namely food, warmth, moisture and a moderate pH.

If any of these factors are removed, bacterial growth is inhibited. Sand was introduced as inorganic bedding, and its big advantage over sawdust and straw was that, when clean, it did not support bacterial growth. However, it does not absorb much moisture, and when it gets wet and/or contaminated with faeces, bacterial growth – and subsequent teat end contamination – can be high.

BACTERIAL LOADS

Samples of various bedding types, and mixes of bedding (by volume), were cultured to assess their bacterial load.

Bedding	Total bacteria	Coliforms	Total Staphs	Total Streps	pH
Sand	900	<10	<10	<10	6.9
Straw	1.3m	79,000	n/d	800	7.2
Sawdust	51,000	4,000	4,800	2,000	5.0
Gypsum	7.8m	20,270	>160,000	>160,000	7.0
Paper	1,500	120	960	200	6.5
digestate	12.9m	<10	9,500	21,200	8.5
Recycled manure	160m	20	4,800	160,000	6.8
Ash	10	<10	<10	<10	11.7
25:75 ash:sand	68	<10	<10	<10	11.7
25:75 ash:sawdust	21,000	170	87	170	11.5

The low coliform count but high streptococcal counts of digestate and recycled manure are surprising. Addition of 25% lime ash to sand or sawdust leads to a marked reduction in their bacterial counts.

CHALLENGE TRIALS

Challenge cultures of a known bacterial concentration of streptococcus uberis (328cfu/ml) were then added to different bedding types to assess survival or multiplication of the organism at time zero and at 48hours at room temperature.

Sample	Strep uberis cfu/ml at time zero after mixing	Mean value at 48 hrs
Straw	25800	74,000
Sawdust	600	124,000
Gypsum	1600	5,000
Sand	200	3,300
Straw / Ash 50/50	< 50	2,653
Sawdust /Ash 50/50	< 50	<20
Sand / Ash 50/50	< 50	<20

In these trials Streptococcus uberis multiplied when added to all basic bedding, but use of 50:50 ash:sand or ash:sawdust lead to an elimination of the challenge culture. Similar results were obtained using a coliform challenge model.

CONCLUSION

Use of lime ash as a bedding desiccant reduces the bacterial load of bedding and as such should reduce the mastitis risk.

PRACTICAL USE OF LACTOCORDER AND VADIA TO INVESTIGATE MILKING MACHINE PERFORMANCE

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The milking machine is regarded as a significant influence on the rate of intramammary infection (IMI) on a dairy farm. Measurement of vacuum behaviour during the milking process, the “dynamic” test, is a well established process for evaluating performance. Measurement of milk flow rate is also a useful technique for reviewing milking routine, and, again, to investigate how various factors influence cow behaviour and milk let-down.

Lactocorder (WMB AG) is a Swiss-made milk recording device. One of its functions is to measure milk flow rate during milking, which can be used to generate a graphical output. This facility greatly enables explanation and discussion of factors affecting the milk let-down reflex, milking speed, and cluster removal at the cessation of milk flow.

VaDia (BioControl) is a relatively recent addition to the milking machine tester's armoury. It is a vacuum measuring device, which can be easily installed on clusters for multiple point vacuum measurement. Miniaturization and robust construction, at a relatively inexpensive price, has opened opportunities for dynamic machine testing.

Both devices provide electronic data, which can be used to generate a graphical output. Simultaneous use of the 2 devices, with the aid of straightforward manipulation of the graphs produced, enables the investigator to demonstrate the effects of vacuum dysfunction on milk flow rate. This has proved to be a useful tool in convincing farmers and milking staff of the benefits of, for example, a change in milking machine liners, to improve herd milking performance, and ultimately reduce IMI.

MASTITIS VACCINATION: A META-ANALYSIS OF CASE-CONTROL TRIALS

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Mastitis is the 1st cause of economic loss in the dairy sector. The efficacy of the vaccines against mastitis existent in the market is questioned by several authors. It is the aim of this study to bring some light to this question. A meta-analysis was conducted on 16 field trials found available, including in total 8324 cows (4515 vaccinated, 3812 controls).

The outcome measure considered was the logarithm of the risk ratio (RR). The residual heterogeneity (I^2) was found to be 0.69. 95%CI [0.287; 2.438]. Data was found to be heterogeneous (Cochran's $Q=81.87$, $df=13$, $P<0.001$), and an initial mixed effects model was used. The covariate moderators used were: "absolute latitude of the location of the trial" (to add for climatic effect); "year of publication of the communication" (to add for genetic and technological advances); and "duration" (to add for the temporal effect due to different durations of the trials). The factor moderators used were: "vaccine agent" (*S. aureus*, *E. coli*, and multiple), "booster" (0, 1 or 2) and "exposed" (trials using heifers never exposed to mastitis or undifferentiated age pre exposed). As none of the moderators was found to be significant ($P>0.05$), a random effects (RE) model was finally used.

The RE model was adjusted and found significant ($P<0.01$). RR between vaccinated cows and controls was found to have a value of 0.50 as shown in the forest plot in the figure. The rank correlation test for asymmetry (Kendall's T) was found to be significant ($P<0.05$), exposing a publication bias. The RR after correction of asymmetry is 0.60, 95%CI [0.37; 0.98].

It was concluded that a short advantage favours the vaccine, but the economic advantage of its use depends on the weight between its cost and its short advantage, and therefore the traditional preventive measures have still a very important role to play.

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ANALYSING THE RELATIONSHIP BETWEEN LIKELIHOOD OF MASTITIS AND ASSOCIATED RISK FACTORS

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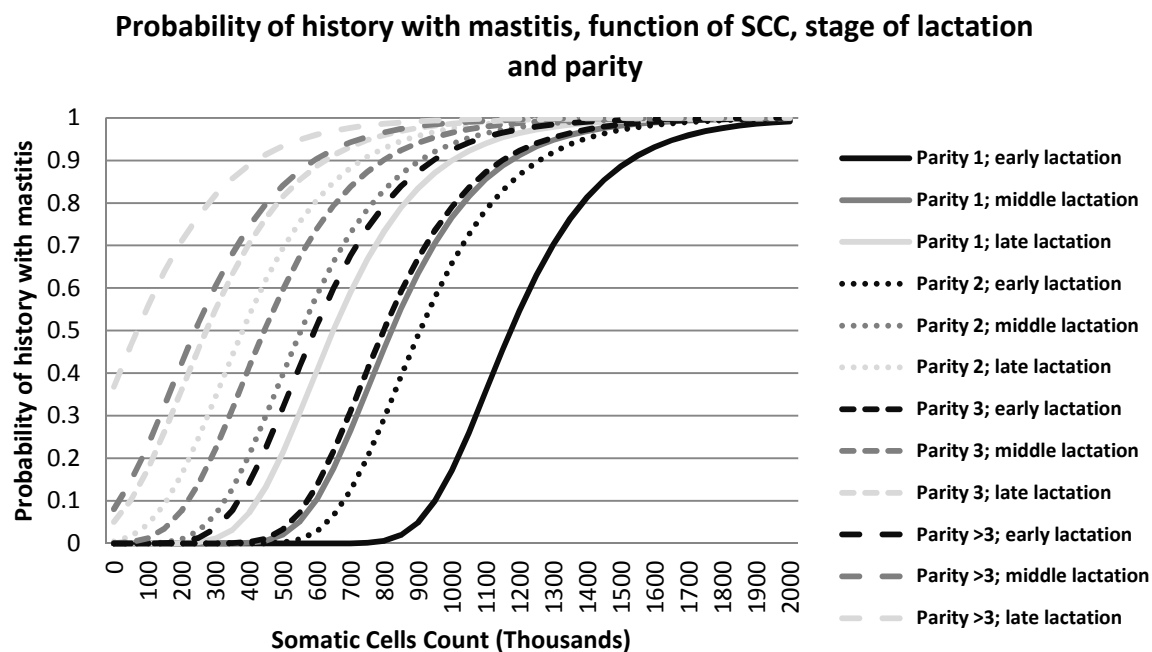
Mastitis is the most common inflammatory disease in the dairy cows in the UK. It has a big economic impact on the dairy industry (Nielsen *et al.*, 2010) due to loss of milk production and treatment cost (Hogeveen, 2011). It also has massive impact on the health and welfare of the cows. About 2 million cases of clinical mastitis are reported every year in the UK (NMC, 2009). Although it is unrealistic that mastitis will ever be eradicated completely, there is a potential to prevent its occurrence through the understanding of risk factors and their contribution to the occurrence of this disease.

A Retrospective study was done in 60 randomly selected cows at the Hartpury Home Farm to analyse the relationship between the likelihood of mastitis and associated risk factors. A generalised linear model from the binomial family with a negative log log link was fitted to the dichotomic variable “history of mastitis” (yes, no). The Risk factors “stage of lactation” (early, middle and late) and parity (1, 2, 3, >3), and the covariates “somatic cells count (SCC)” and “milk production” were tested in the model using a backward stepwise process.

The factors parity (X_1) and stage of lactation (X_2) and the covariate SCC (X_3) were found significant ($p < 0.05$). The model of probability of mastitis is represented by 12 equations, combination of the 4 x 3 levels of the significant factors. The parameter values of the equations graphed bellow are found in the table. The generic negative log log equations will be:
 $P(\text{mastitis}) = \exp(-\exp(\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3))$

Parameter	β	Parameter	β
Parity =1	3.11	Stage early	2.81
Parity =2	1.67	Stage middle	0.92
Parity =3	1.10	Stage late	0
Parity >3	0	SCC	-5.36x10 ⁻⁶

In conclusion, the results from this study revealed the existence of variables that can predict the likelihood of a mastitis infection to occur. It was found that two factors: parity and stage of lactation, and the covariate SCC, have a positive relation with the history of mastitis as the number of incidences increases together with these variables.



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NEW TECHNOLOGY FOR MILKING VACUUM DIAGNOSTICS HELPS VETERINARIANS BETTER UNDERSTAND AND MANAGE UDDER HEALTH PROBLEMS

Epi Postma

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Udder health problems are often related to the milking equipment, many times in combination with inadequate milking routines. Notorious are teat-end vacuum fluctuations due to insufficient vacuum capacity, pathogens reaching the teat-end due to 'back-spray' and of course insufficient preparation before milking.

Most veterinarians are familiar with the Milking Time Test, or 'wet test'. In the wet test the milking vacuum and pulsation are recorded during milking which gives a good indication of how the milking equipment and milking routines perform in real life: when milking cows. Veterinarians understand the high value of this wet test because it helps them indicate if an udder-health problem is animal related or equipment related.

Despite this, many veterinarians are reluctant to do a wet test because of the perceived complexity and time this consumes. When normally performing a wet test, the veterinarian is wired to the milking point, meaning that the milking routines can't be observed; also the vet's presence disturbs the milking. To get a good overview, data of quite a few cow milkings should be recorded which implies that the vet is trapped in the milking parlour and can't spend his valuable time on anything else in the meantime.

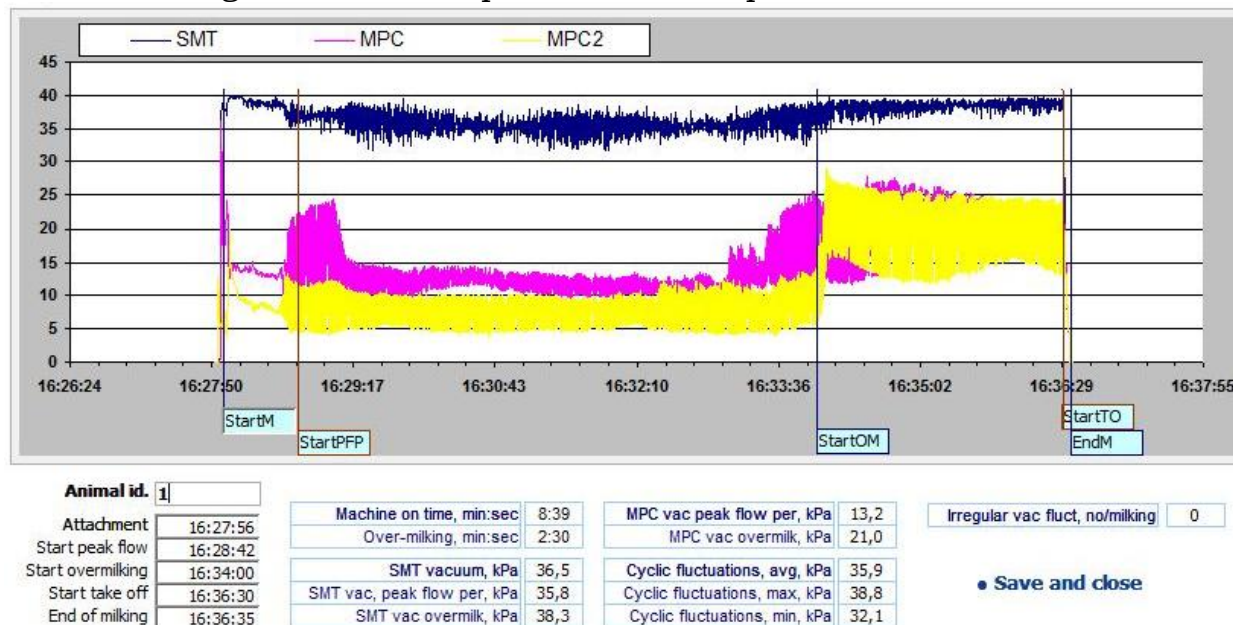
This poster is about experiences of European veterinarians and advisers with a new battery operated data logger that logs the vacuum autonomously at 4 points during milking. This data logger ([VaDia](#)) is small and light enough to be taped to a teat-cup and makes wet testing much easier, faster and hands- and eyes-free.



VaDia data logger records the vacuum at 4 points in the milking cluster

USED CALCULATION METHODS AND ALGORITHMS

VaDia is connected to the Pulsation Tube, Short Milk Tube (SMT), Mouth Piece Chamber front (MPC) and Mouth Piece Chamber rear (MPC2). An example of recorded and analysed vacuum data is shown in below figure. Calculation algorithms will be presented in the poster.



Example of analysing software for detailed vacuum diagnostics.

Each individual cow milking is divided into four phases. Marker lines are used to separate these phases, these marker lines can be set manually or automatically. Vacuum diagnostics software calculates a.o. Cyclic Vacuum Fluctuations and Irregular Vacuum Fluctuations.

CONCLUSION

This new technology helps milking technicians and advisors to better log, analyse and understand the milking vacuum during the milking (dynamic test).

The used calculation methods and algorithms result in a 'snap-shot' summary of the current milking situation, enabling the advisors to present an overview that is a starting point for discussion with the farmer.

This new technology helps the advisor to better log, analyse and understand: Vacuum level and fluctuations, Liner aptness to the teat size, Take-off settings, Backspray and Vacuum and pulsation settings.

REFERENCES

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GB MASTITIS BACTERIOLOGY

Guda van der Burgt¹ and Elizabeth Berry²

¹ Veterinary Investigation Officer, Animal Health and Veterinary Laboratories Agency (AHVLA), Luddington, Stratford upon Avon, Warwickshire, CV37 9SJ, UK; ² Head of Knowledge Transfer, DairyCo, Agriculture & Horticulture Development Board, Stoneleigh Park, Kenilworth, Warwickshire, CV8 2TL, UK.

INTRODUCTION

The National Mastitis Group provides a forum for organisations involved in the diagnosis, surveillance and control of mastitis and the production of high quality milk. Members include farmers, research institutes, pharmaceutical, veterinary and Government bodies.

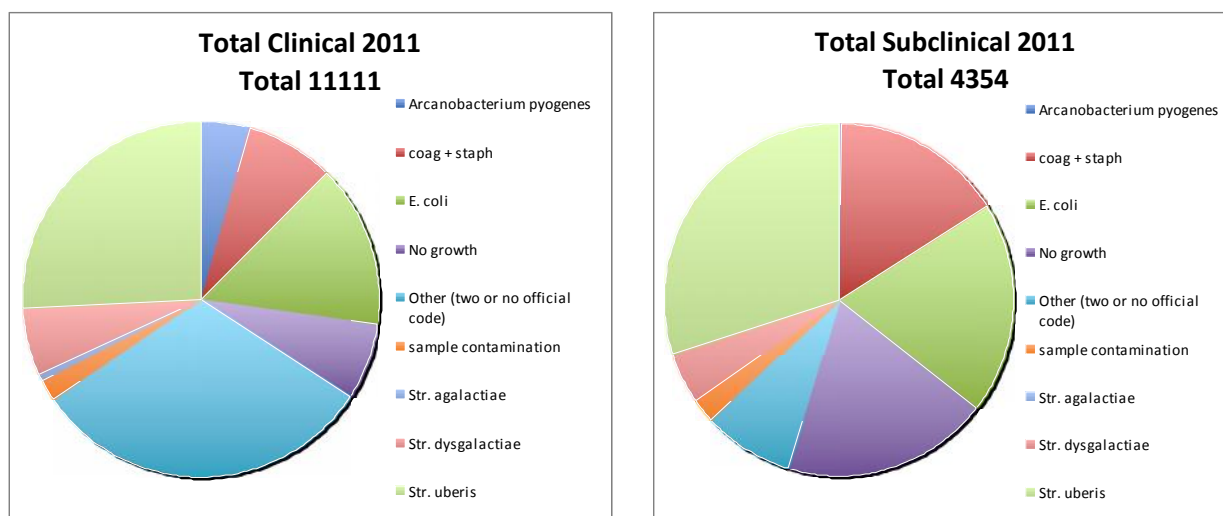
Presently VIDA (AHVLA/SAC) data are the only mastitis bacteriology data available and the aim was to increase sample size and feed information back to the industry and government. All major milk bacteriology labs in the UK were approached and six readily agreed to share data (Gloucester Laboratories, Vale Laboratories, National Milk Laboratories, Biobest, SAC and AHVLA).

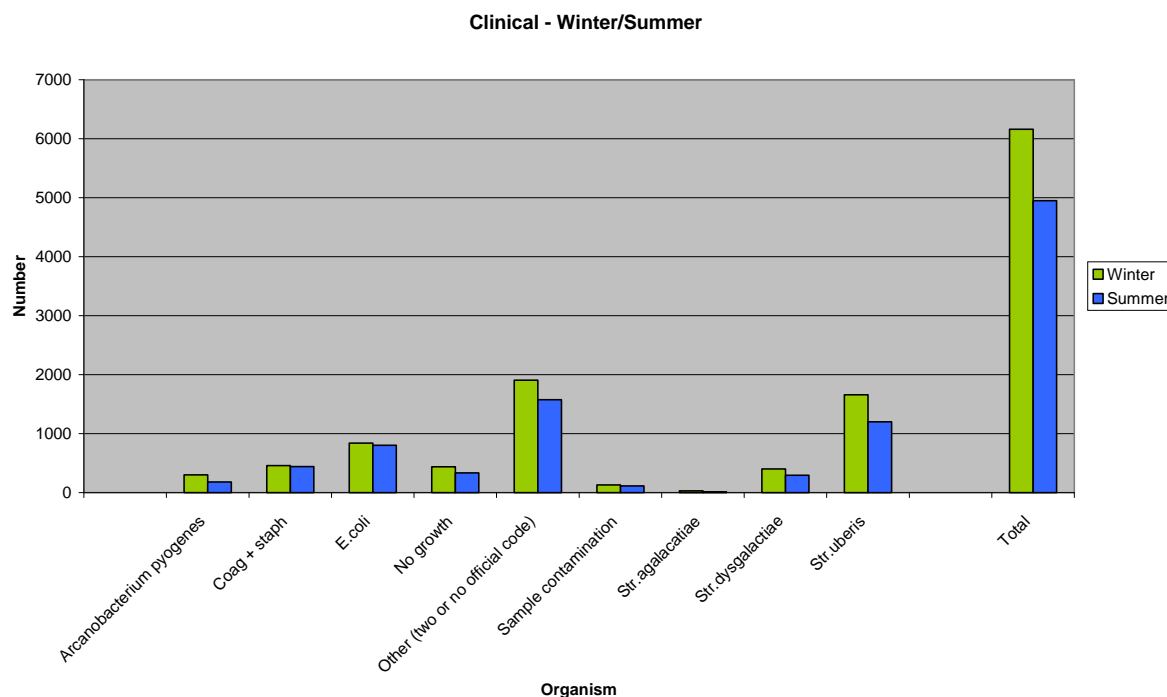
MATERIALS AND METHODS

All labs work to their own SOPs and some use conventional culture methods whereas others use PCR. Bacteriology results were sent to DairyCo quarterly for anonymous data collation. Samples were classed as “clinical mastitis” or “subclinical mastitis”, non-identified samples were classed as subclinical.

RESULTS

So far data for 12 months (2011) have been collated:





CONCLUSIONS

- This study increased the sample size for the surveillance of bovine mastitis
- This work highlights the possibility of further action/control programmes, e.g. the very low incidence of *S. agalactiae* may make eradication a feasible option
- The levy body (DairyCo) acted as impartial party assuring anonymity and is a vehicle to feed information back to the industry.

WHAT DO 48 MILLION MILK SAMPLES TELL US ABOUT UK MILK QUALITY OVER TIME?

James D Hanks

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A database was created containing the somatic cell count of every milk sample processed by National Milk records (NMR) between 1st August 2005 and 30th June 2012. The total number of samples was in excess of 47million.

A threshold of 200,000 cells / ml milk was used to distinguish between LOW and HIGH cell count samples, as an indicator of udder health.

A Herd Companion category (New, First, Repeat, Chronic) was computed for each HIGH SCC sample, according to the previous SCC history of the cow in her current lactation. CHRONIC signifies a high cell count sample from a cow that also had a high SCC at the previous monthly recording in the same lactation. Chronic is taken as an indicator of the level of persistent infection.

Analysing the data by year of sampling (August to July) shows three clear results:

1. **Milk is getting cleaner:** The overall average somatic cell count is declining by year. In 2012 the average SCC of all samples in the year was 206,000 cells/ml milk. This represented the third successive year of improvement.
2. **Fewer high SCC samples:** In 2012 the percentage of clean (low SCC) milk samples increased for the fourth consecutive year, to 76.8% of all samples.
3. **Fewer persistent infections:** In 2012 the percentage of HIGH SCC samples that originated from chronically infected cows declined for the second consecutive year.

In conclusion, milk is **getting cleaner, with fewer high SCC samples and fewer persistent infections.**

THE DAIRYCO MASTITIS CONTROL PLAN – REPORT ON THREE YEAR DELIVERY PROGRAMME 2009-2012

H. Black¹, A. Bradley², J.Breen³, M .Green³, C.Hudson³

¹ DairyCo, AHDB, Stoneleigh Park, Kenilworth, Warwickshire, UK; ² Quality Milk Management Services, Cedar Barn, Easton, Wells, Somerset, UK; ³ University of Nottingham, Sutton Bonington, Nottinghamshire

RATIONALE BEHIND THE FORMULATION OF THE DAIRYCO MASTITIS CONTROL PLAN INITIATIVE

Having formulated a structured mastitis control plan that was found, in a research setting, to result in important clinical benefits, the next aim was to make the Plan available for widespread use and meet the challenge of rolling out the DairyCo Mastitis Control Plan (DMCP) to a large proportion of the national dairy herd.

STRUCTURE AND MAIN FEATURES OF THE DMCP

Implementation of the DMCP comprises three main elements; i) assessment of herd patterns of mastitis and categorisation of each herd according to those patterns; ii) assessment of the current farm management practices and, based on deficiencies identified, prioritisation of the most important management changes required (this is conducted using an electronic tool) and iii) monitoring of the farm data to assess the subsequent impact on clinical mastitis and SCC.

2009-2012

The DairyCo Mastitis Control Plan has been in use on dairy farms since 2009, with over 250 vets and mastitis consultants trained to go onto farm and deliver the plan. So far they have registered delivery of the plans on over 950 farms. These visits are to identify the patterns of mastitis occurring, assess the current management practices affecting mastitis and prioritise a small number of carefully targeted changes that will reduce clinical cases and somatic cell counts.

A review of the plans begun between 2009 and 2011* shows:

- In 47% of herds most mastitis cases related to environmental pathogens predominantly of the dry period – typically seen as clinical cases occurring during the first 30 days of lactation. This was a higher proportion than vets expected to see in this category.
- In 43% of herds most mastitis cases resulted from environmental pathogens picked up during lactation.
- Contagious pathogens, spread from cow to cow, often at milking, were a significant problem in just 6% of herds.
- Directing management changes to reduce environmental dry period infections, where this was the greatest risk area, saw an 16% reduction

in clinical cases when more than two-thirds of recommended actions were put into practice.

- The knock on effect of tackling environmental dry period infections (as above) was a further 5% reduction in cases picked up during lactation. This was possibly because cows calved with lower somatic cell counts, reducing the challenge to the milking herd.
- When most cases were environmental and of lactation origin, addressing more than two-thirds of the recommended management changes saw a 20% reduction in cases.

**Plans results were reviewed by the University of Nottingham Vet School and Quality Milk Management Services.*

NEXT STEPS

The DairyCo Mastitis Control will continue to be delivered across the country via Plan Deliverers under the identity of the Plan.

Acknowledgement of Plan Deliverer feedback has fed into a KT delivery programme whereby DairyCo team work with Deliverers to get the key messages of the Plan embedded into the industry.

CONCLUSION

The importance of having and using on-farm data relating to clinical and sub-clinical mastitis underpins the Plan.

Compliance levels varied across farms – this may be down to a number of factors, which need further investigation.

The key to reduction in mastitis levels is making the correct diagnosis and thus actioning the points highlighted.

REFERENCE

DairyCo Mastitis Control Plan Final Report 2012 - Bradley, Green, Breen, Hudson

ACKNOWLEDGEMENT

DairyCo wishes to thank the Plan Deliverers who have taken the principles of the Plan and delivered this with their clients, feeding back the on-farm data to aid with tracking the Plan's impact.

NOTES

NOTES

APPENDICES
NATIONAL MASTITIS SURVEY

NATIONAL MASTITIS SURVEY RESULTS

Andrew Biggs¹, MSD Animal Health²

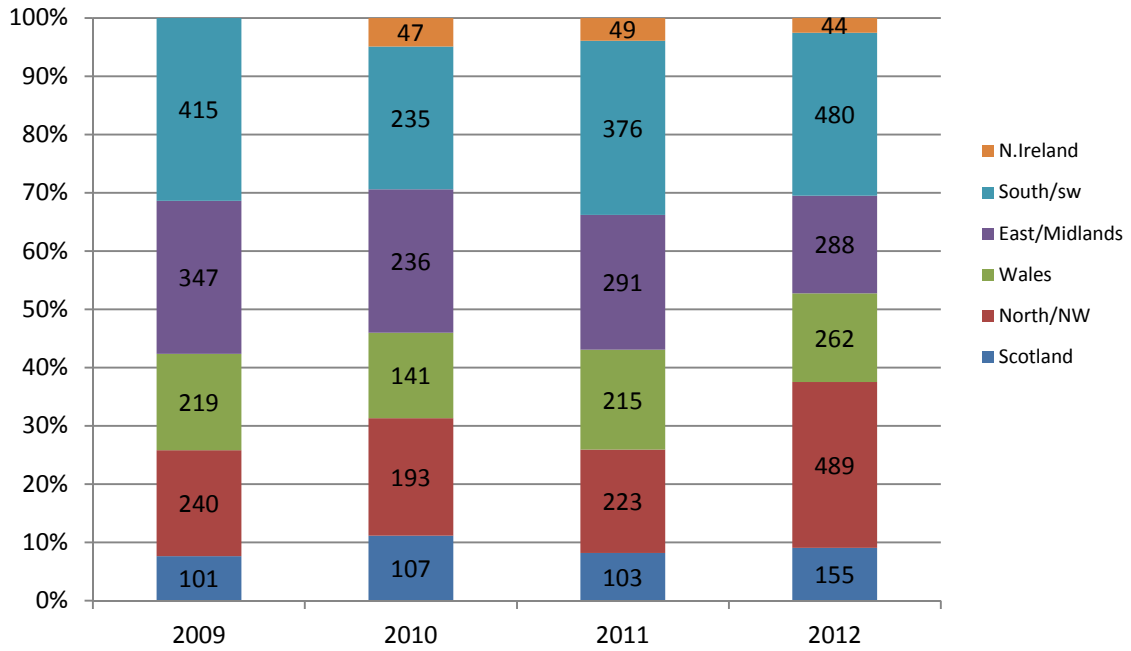
¹ The Vale Veterinary Group, The Laurels, Station Road, Tiverton, Devon, X16 4LF, UK. e-mail: ValeLab@btinternet.com; ² Walton Manor, Walton, Milton Keynes, MK7 7AJ, UK.

The annual UK National Mastitis Survey is one of the largest surveys of its type and has attracted an average of 1,300 respondents; it is now in its 4th year. The survey aims to establish a true representation of the on- farm situation and challenges faced by farmers on a daily basis by asking 27 questions requesting around 50 pieces of data about their farm and farm practices.

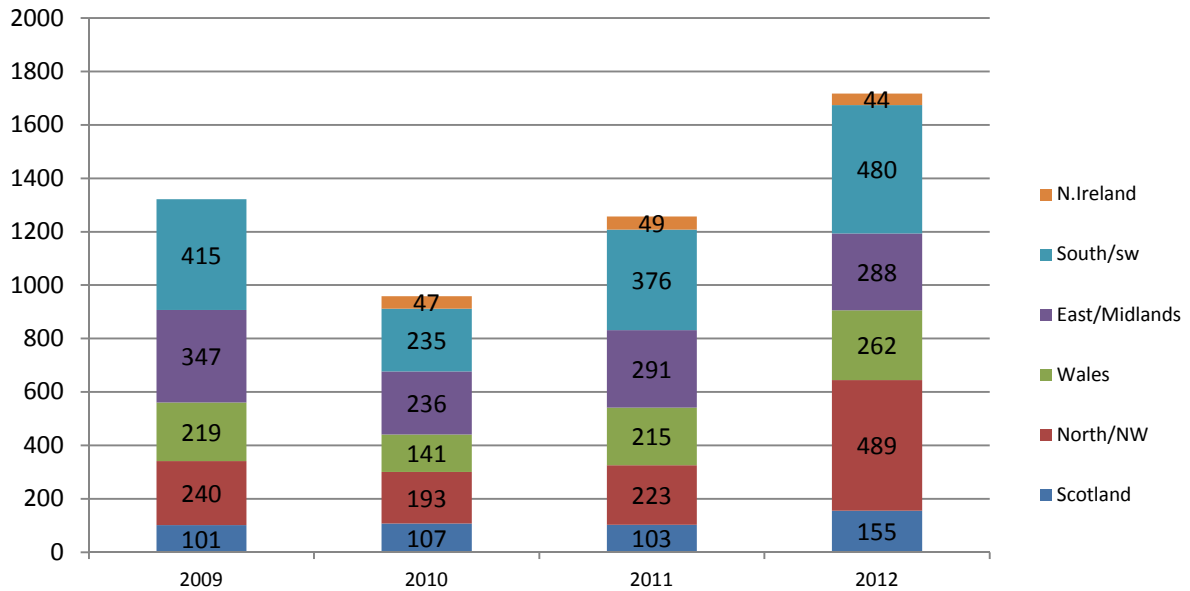
Key findings

- Mastitis remains a significant challenge on the majority of dairy farms
- More respondents in 2012 but herd size spread is broadly the same
- More herds in low BMSCC bands
- Fewer herds in lower mastitis incidence bands
- Higher SCC herds have more mastitis
- Lower SCC herds tend to use more combination therapy (cause and effect or association)
- More cows “looked after” per milker is associated with a higher BMSCC
- A higher proportion of herds with a lower SCC always foremilk all cows at every milking
- A higher proportion of herds with a lower Bactoscan pre milking dip whilst a higher proportion of herds with a high Bactoscan dry wipe
- A higher proportion of herds with a lower BMSCC post milking dip whilst a higher proportion of herds with a higher BMSCC post spray
- Still 1 in 7 (13%) do not wear gloves while milking, however 24% of those without automatic cluster disinfection manually cluster dips all cows at all milkings
- Bacteriology rates are still low
- Fresh calved cows are recognised at high risk for mastitis

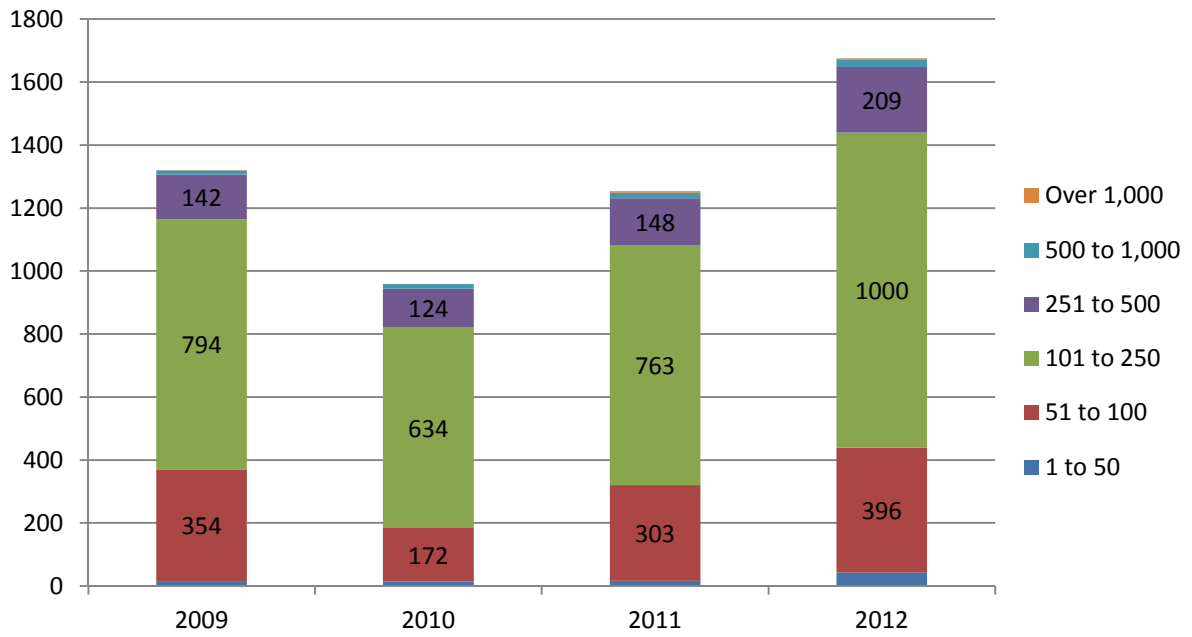
Respondent by Regions



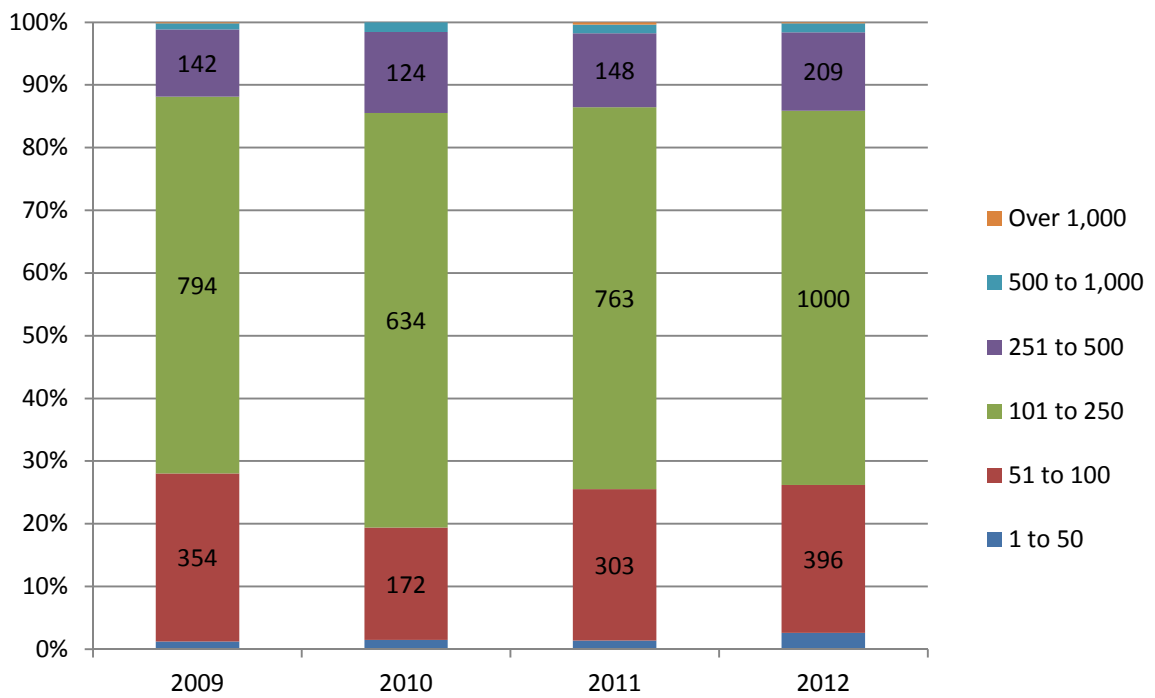
Respondent by Regions



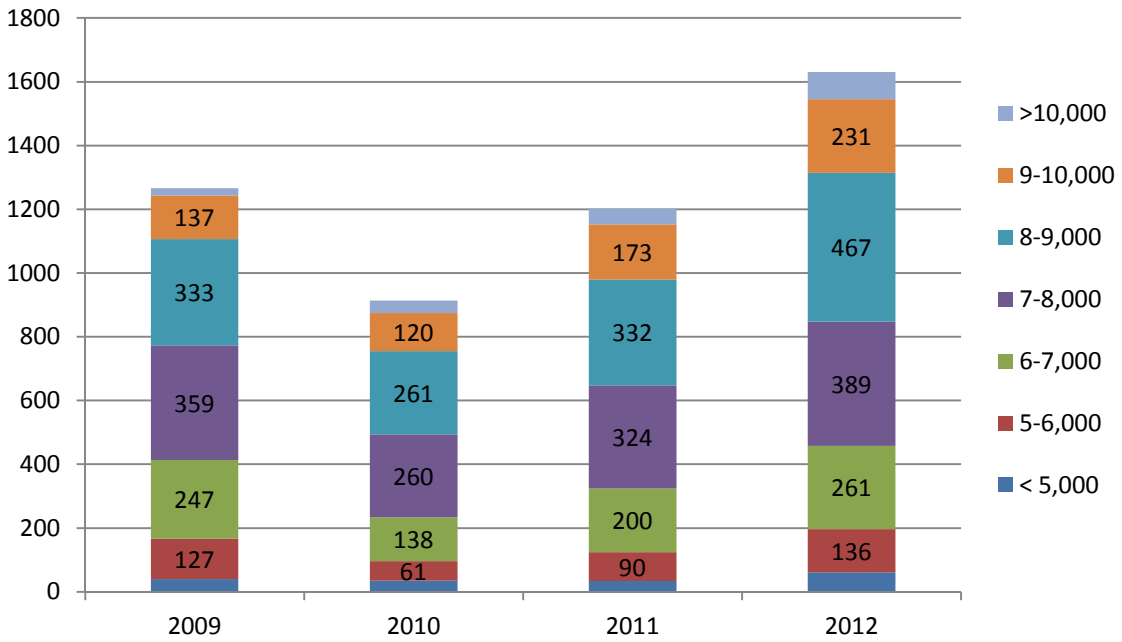
Banded Herd Sizes



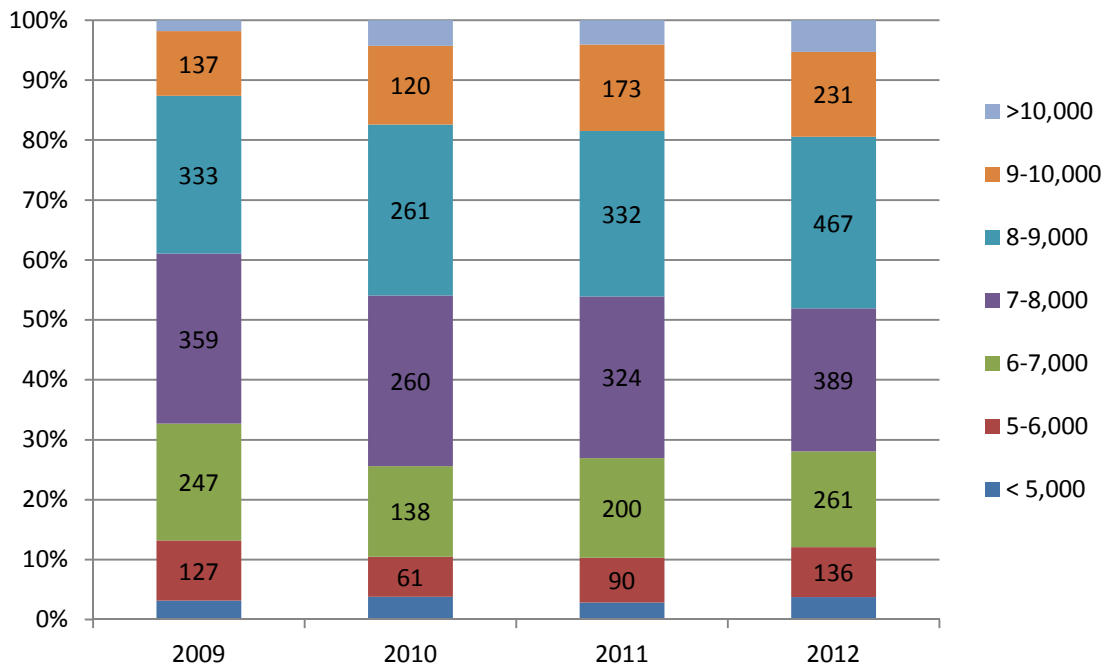
Banded Herd Sizes

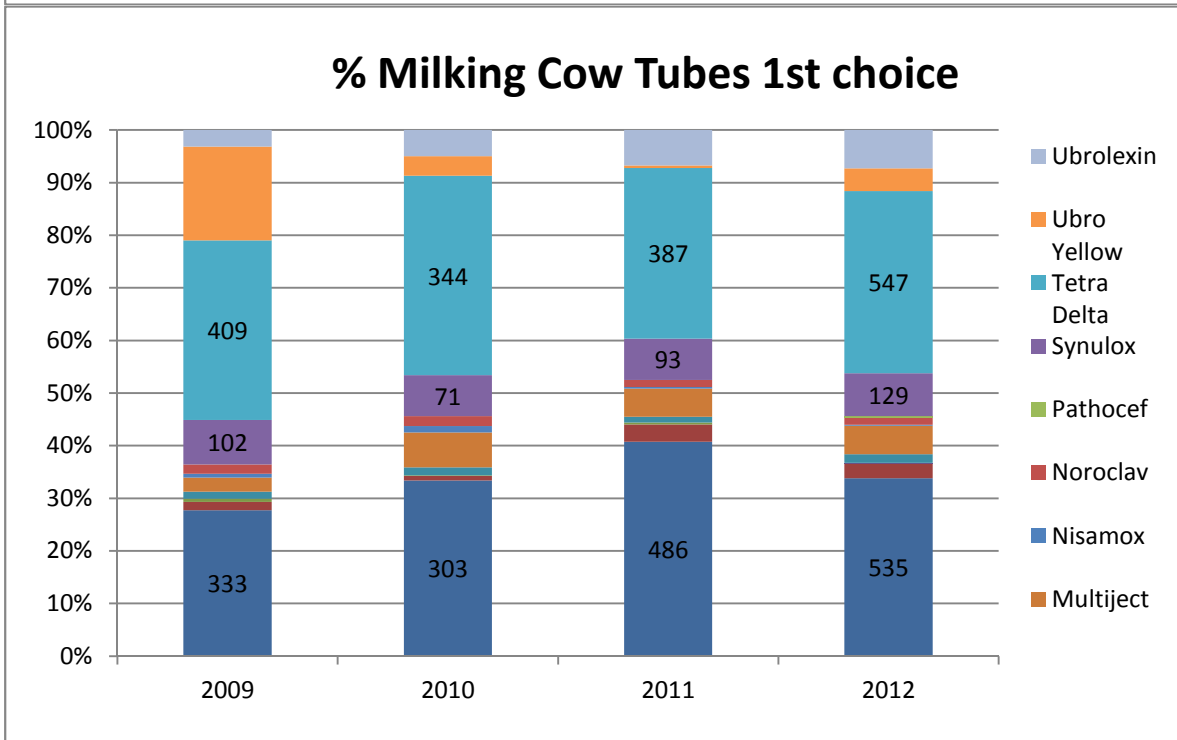
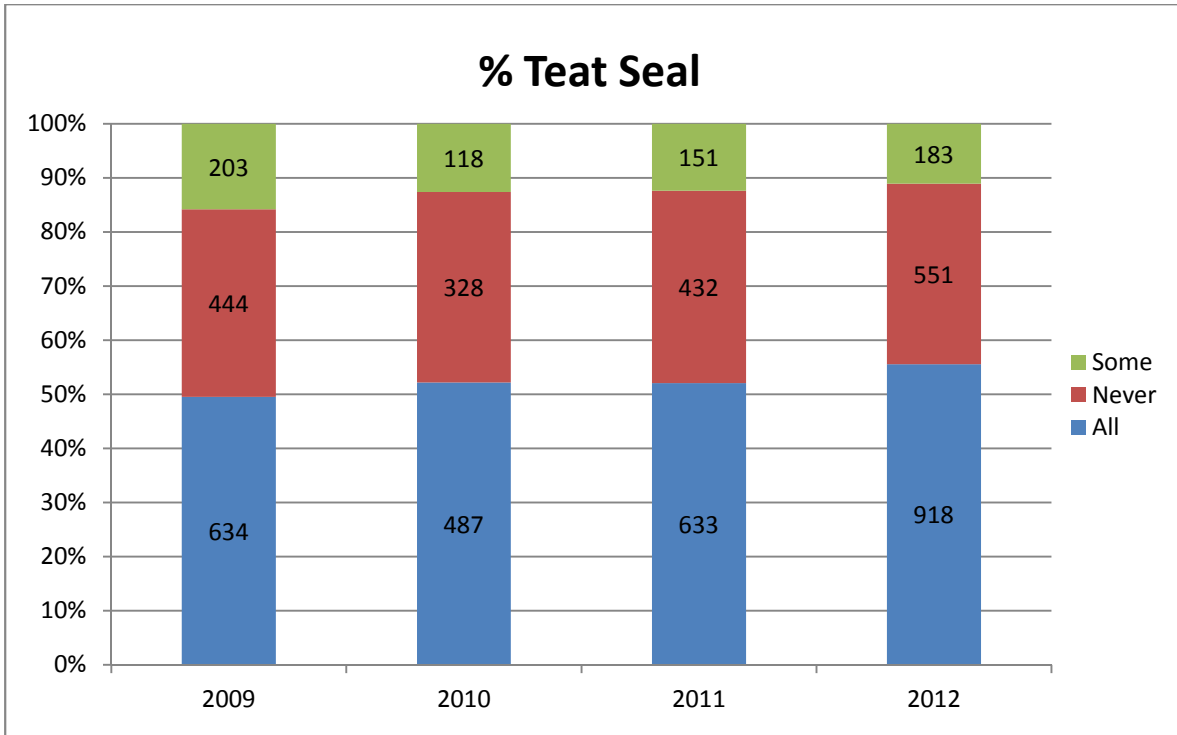


Banded Yields

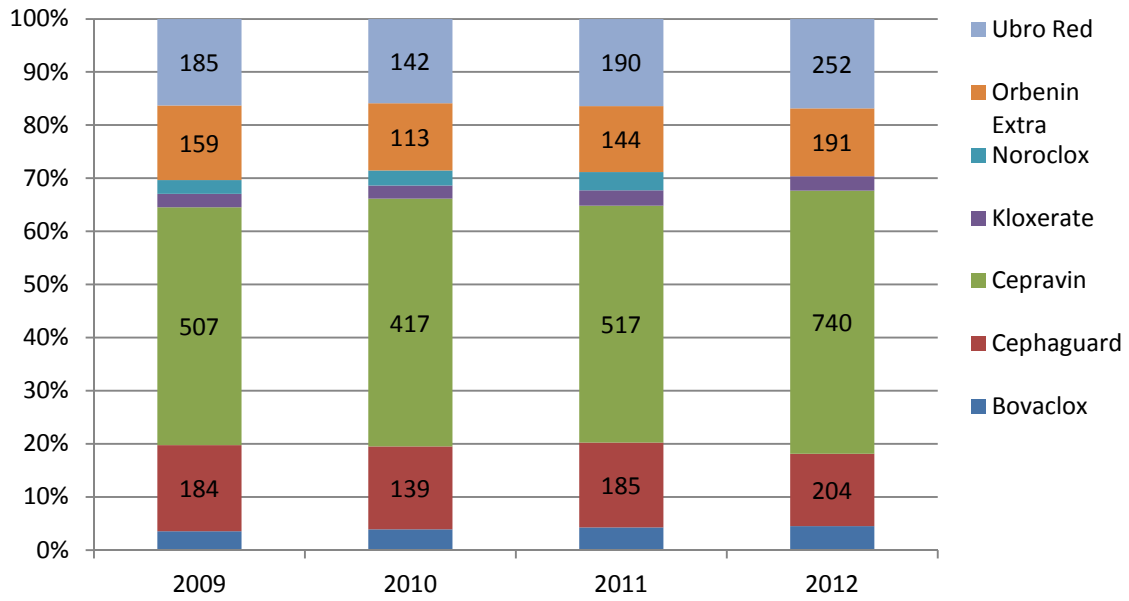


Banded Yields



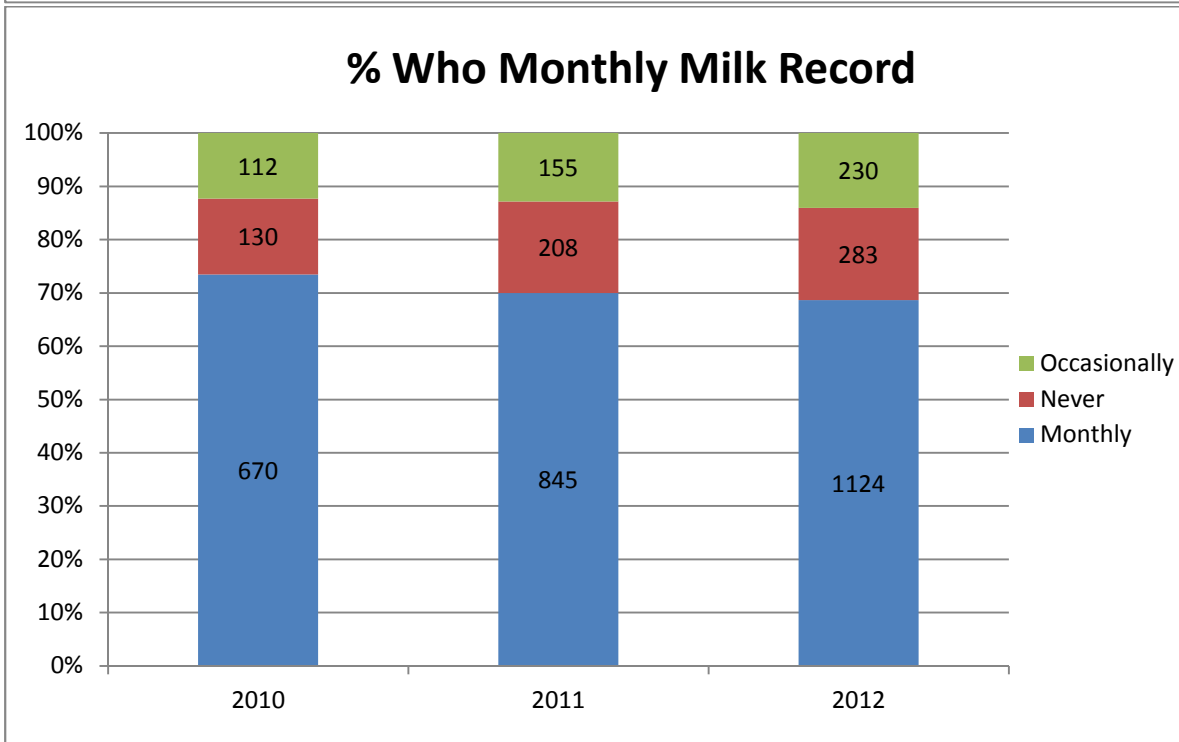
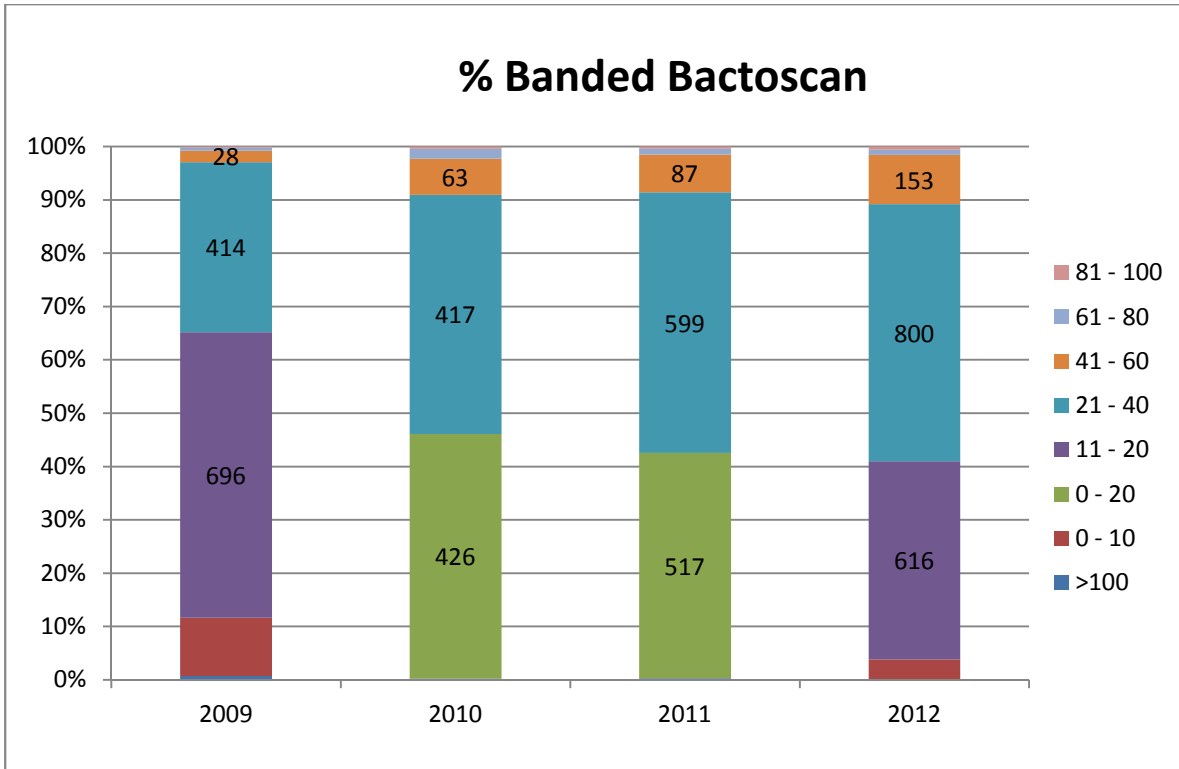


% Dry Cow Tubes 1st choice

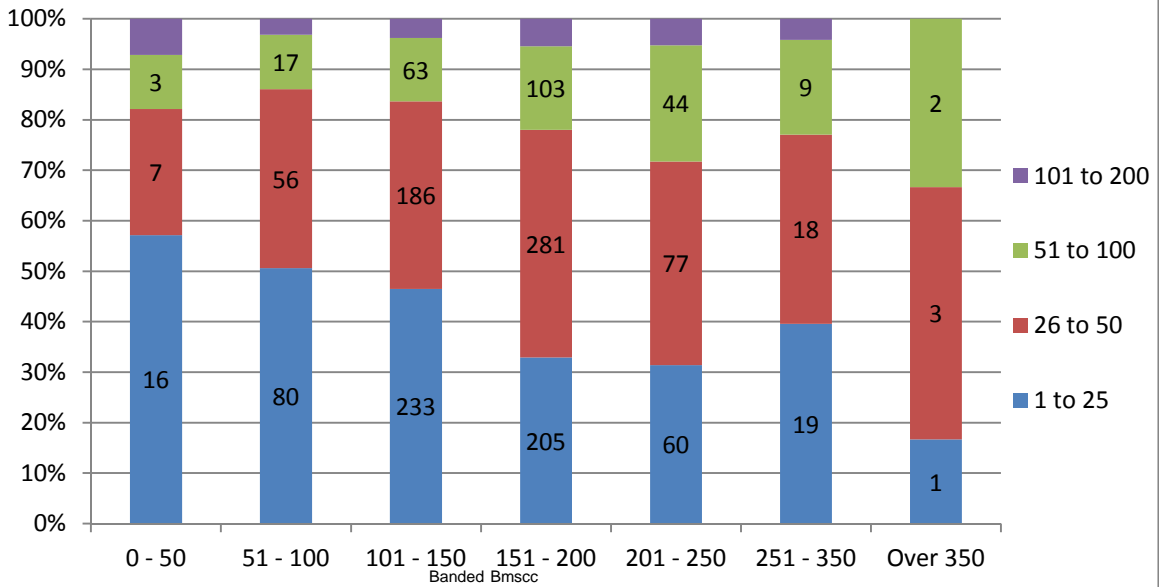


% Banded Bmscc



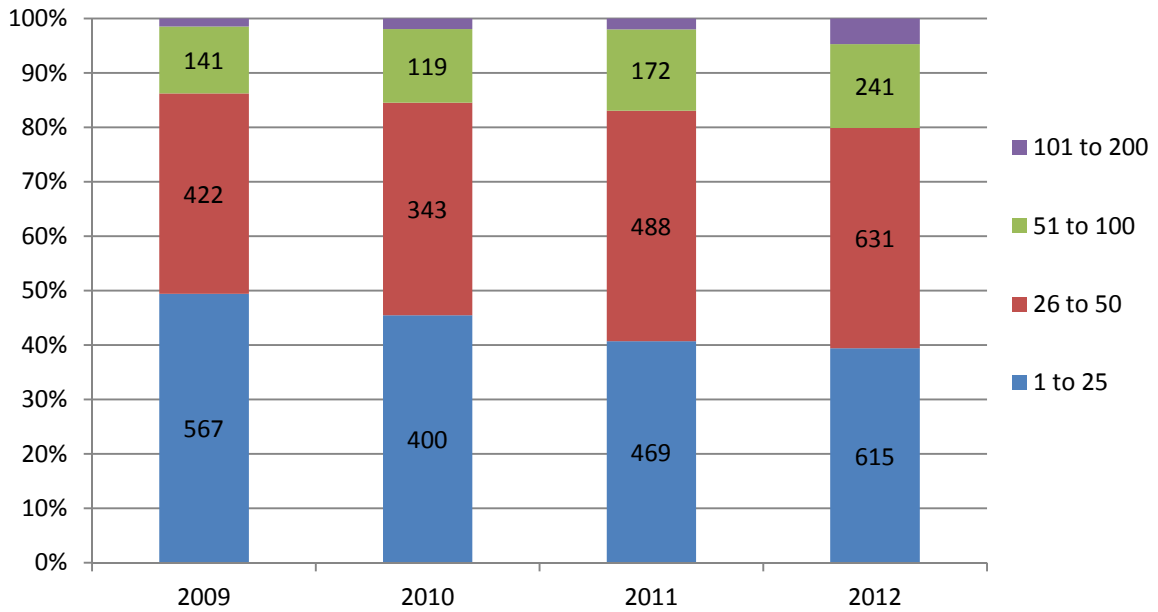


2012 Mastitis cases per 100 cows by Bmscc banded



Respondents 1555

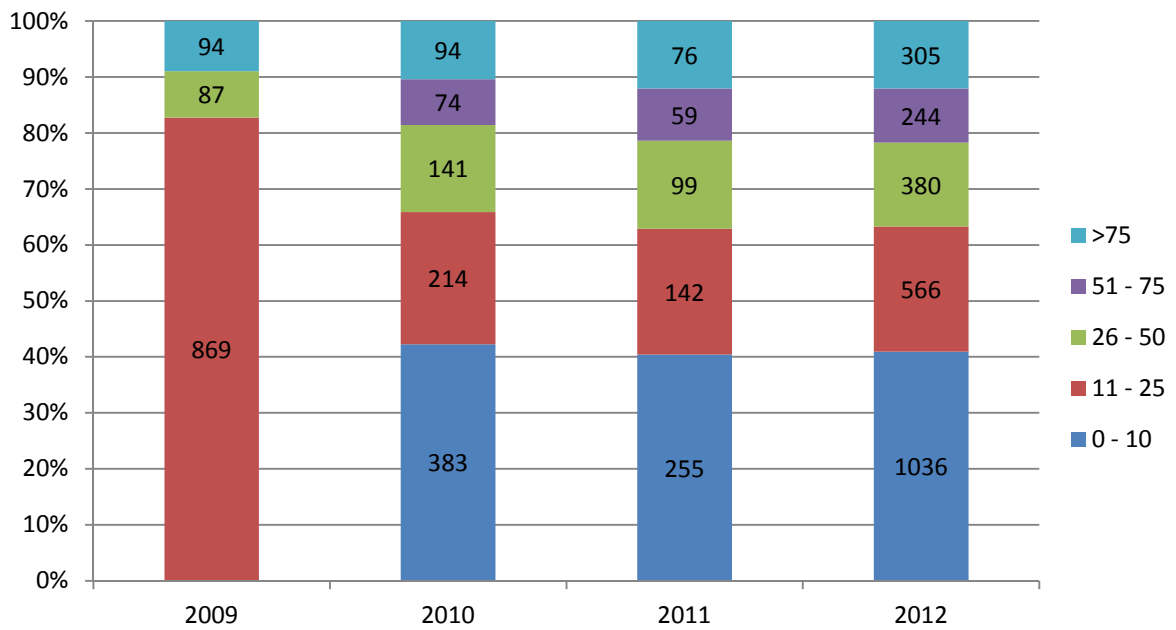
% Mastitis cases per 100 cows



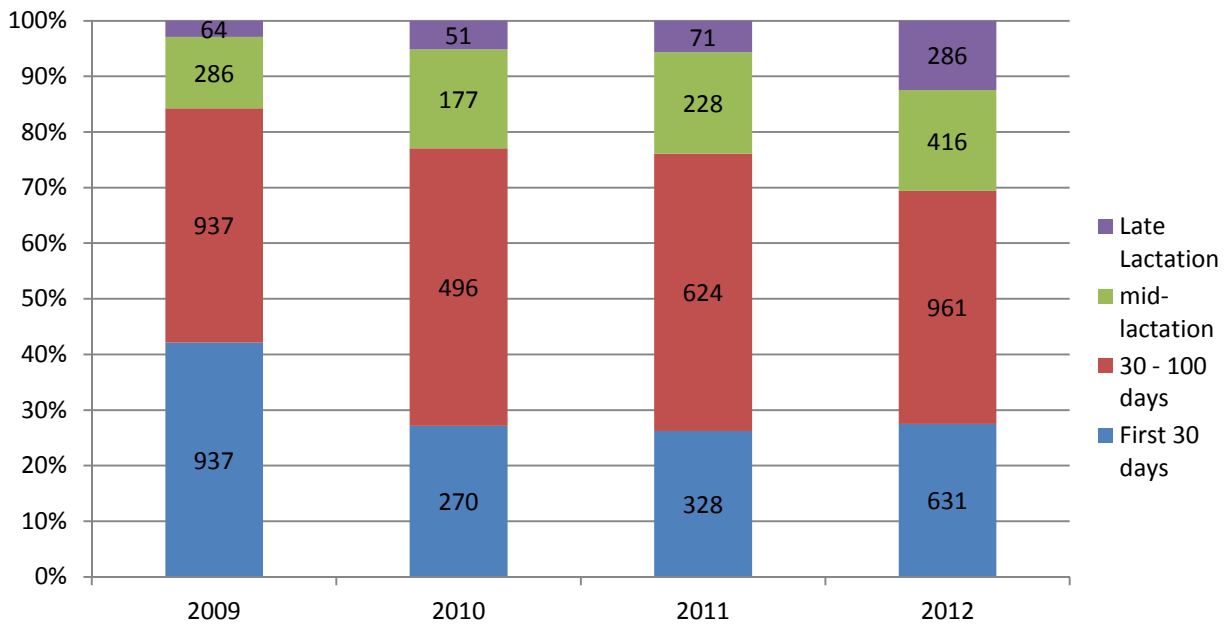
%Tubes per mastitis case



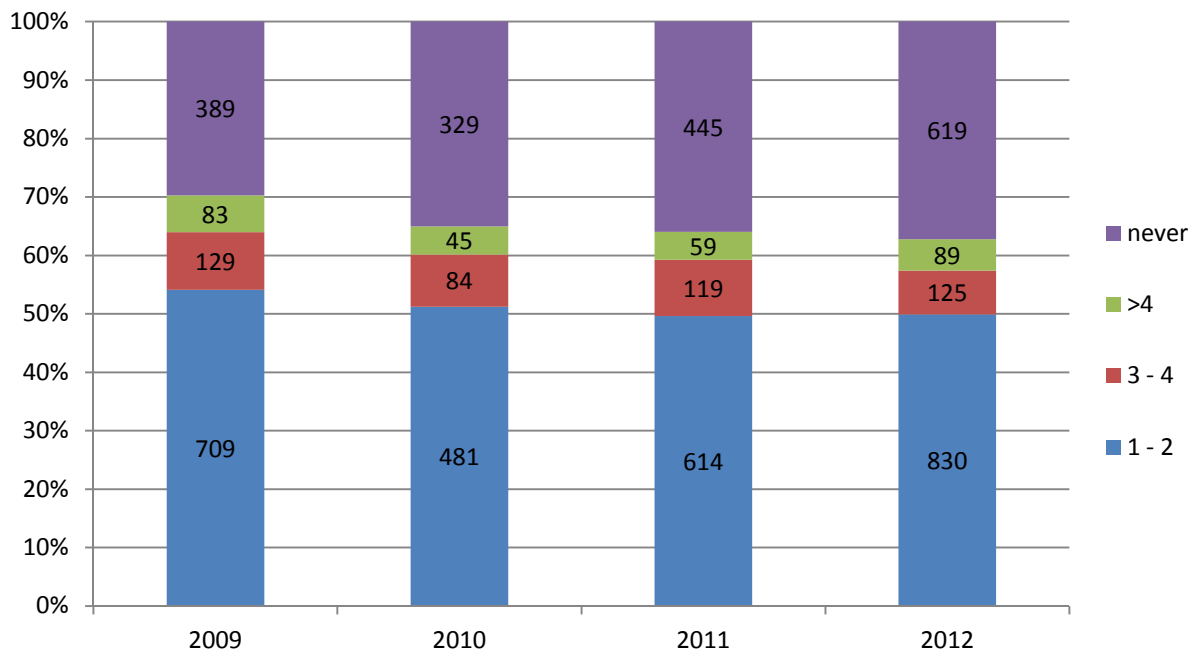
% Cases that recieve combination therapy



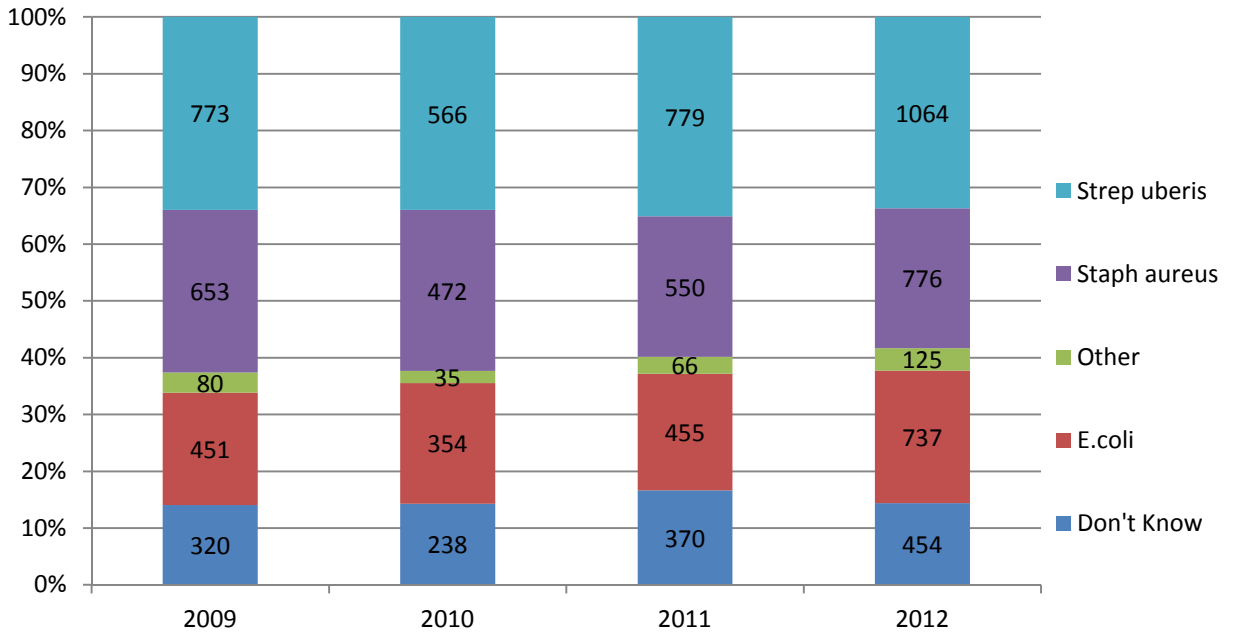
% When in lactation you see mastitis



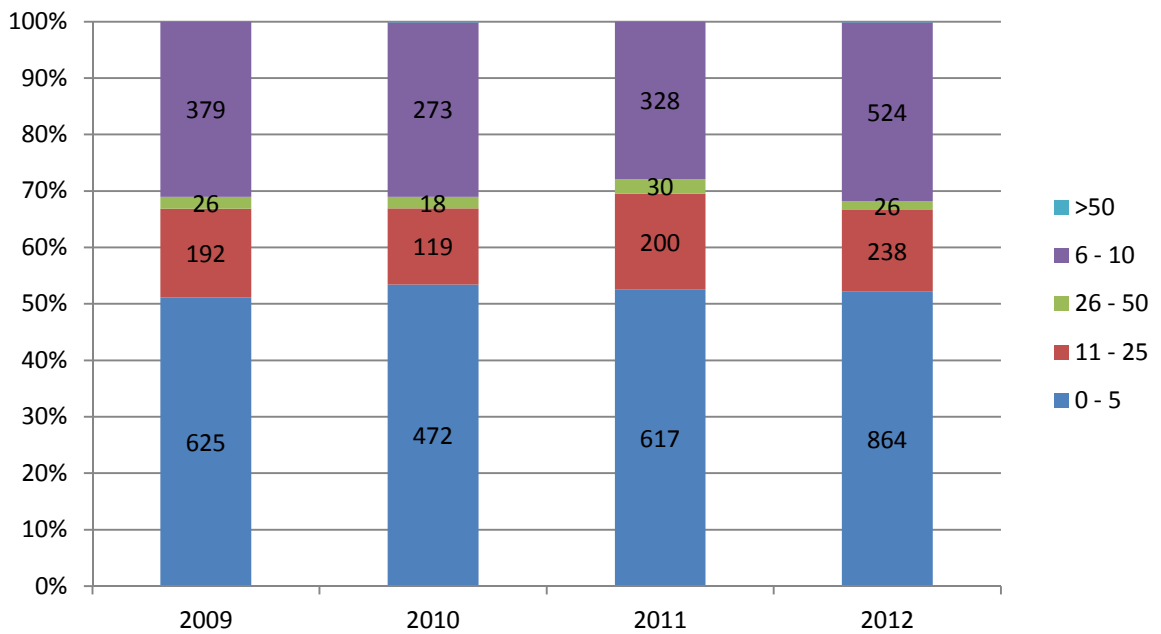
% How many times per year do you take milk samples



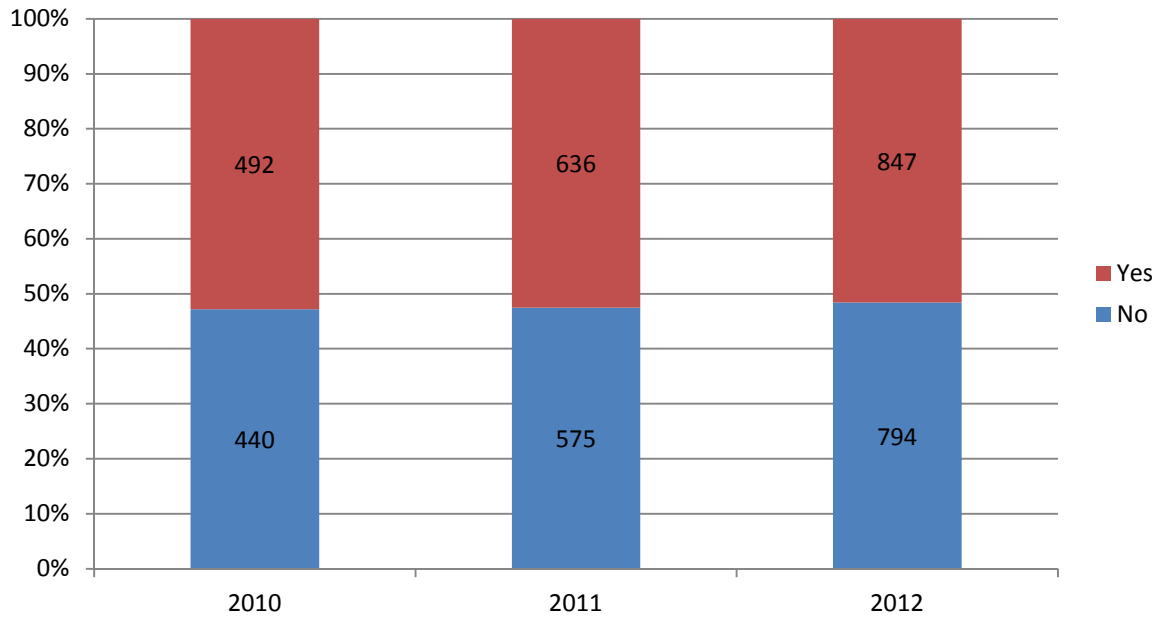
Bacteria types



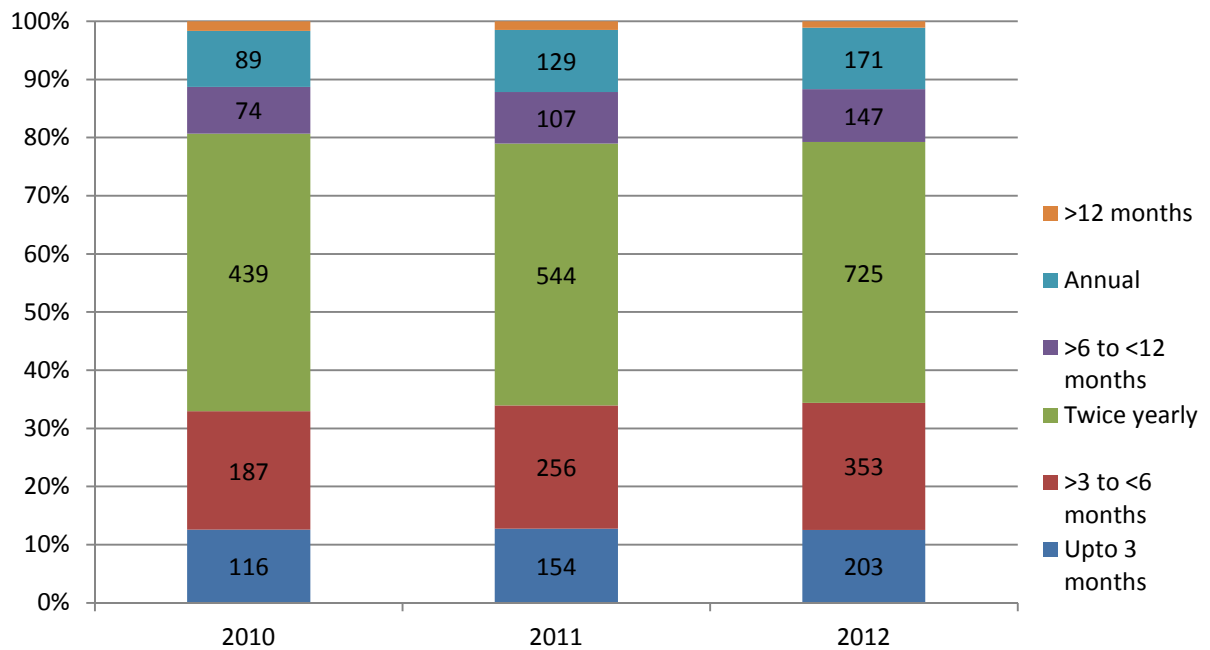
% Heifers getting mastitis



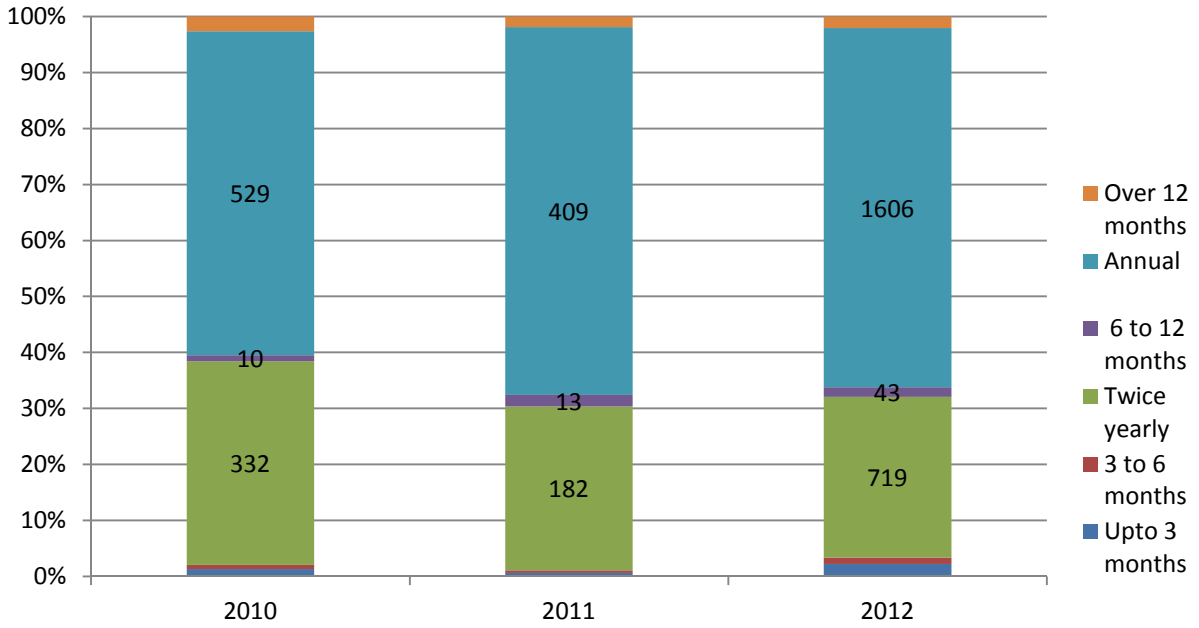
% who treat Hssc cows without clinical signs



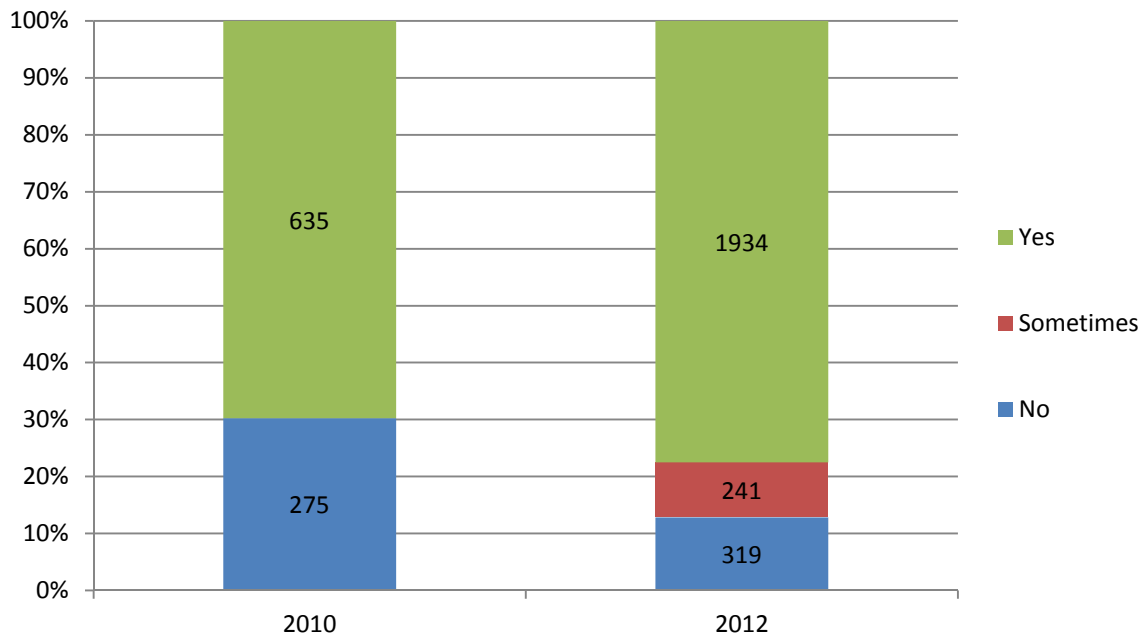
% Liner replacement intervals



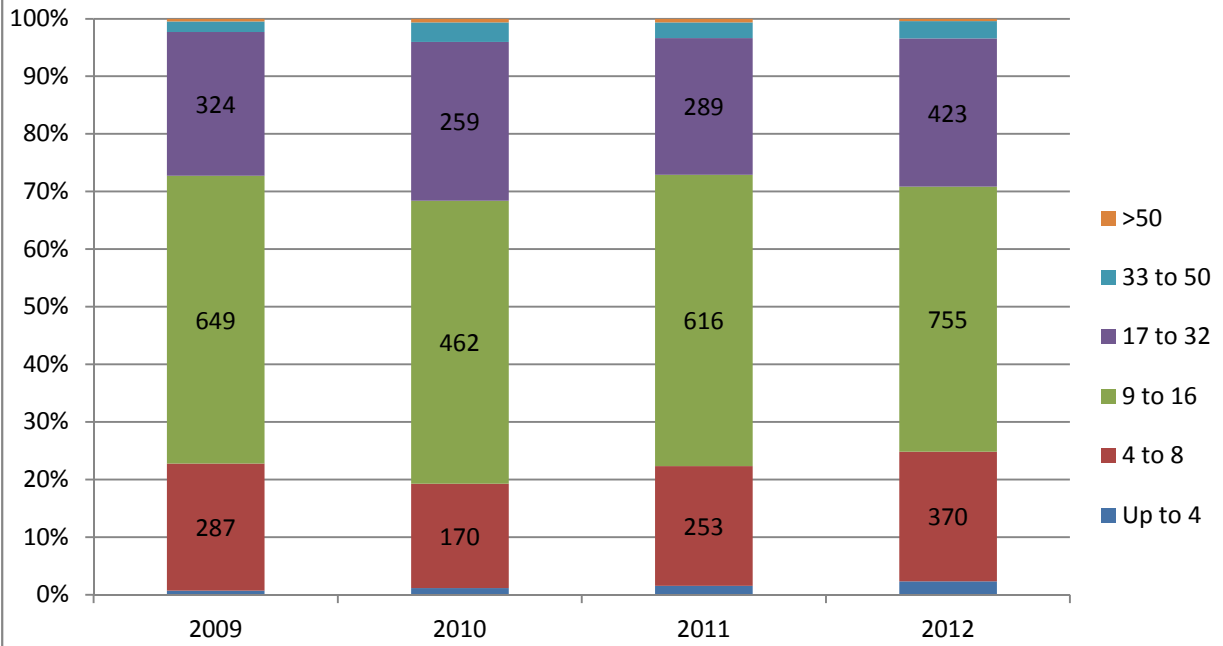
% Milking machine banded service intervals



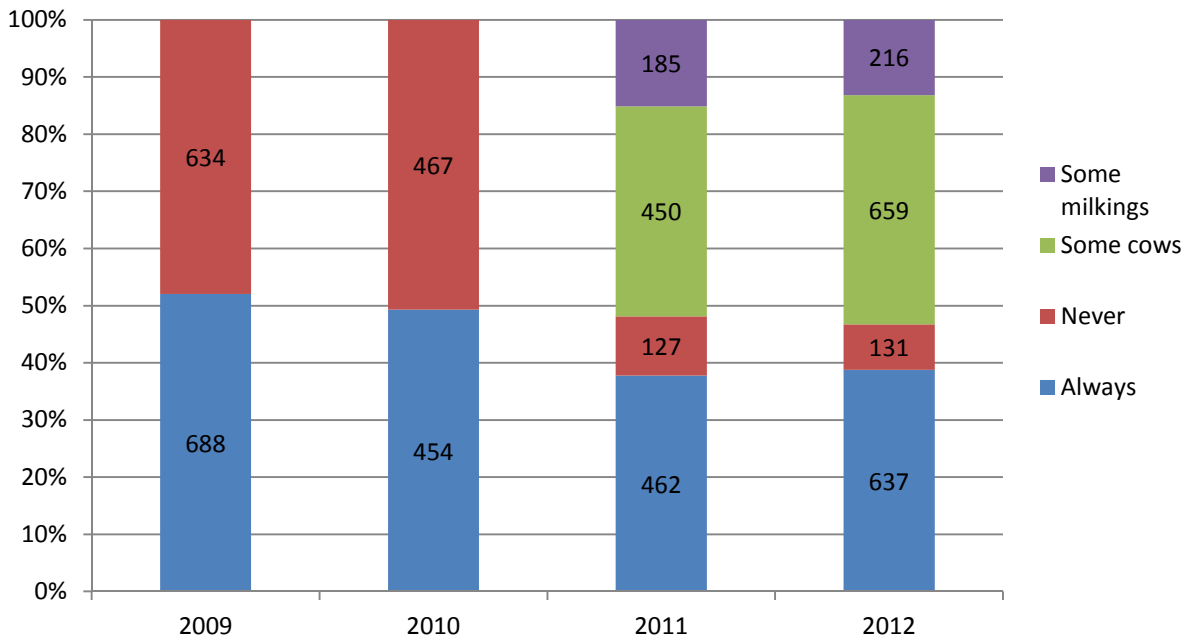
% Wear Gloves during milking



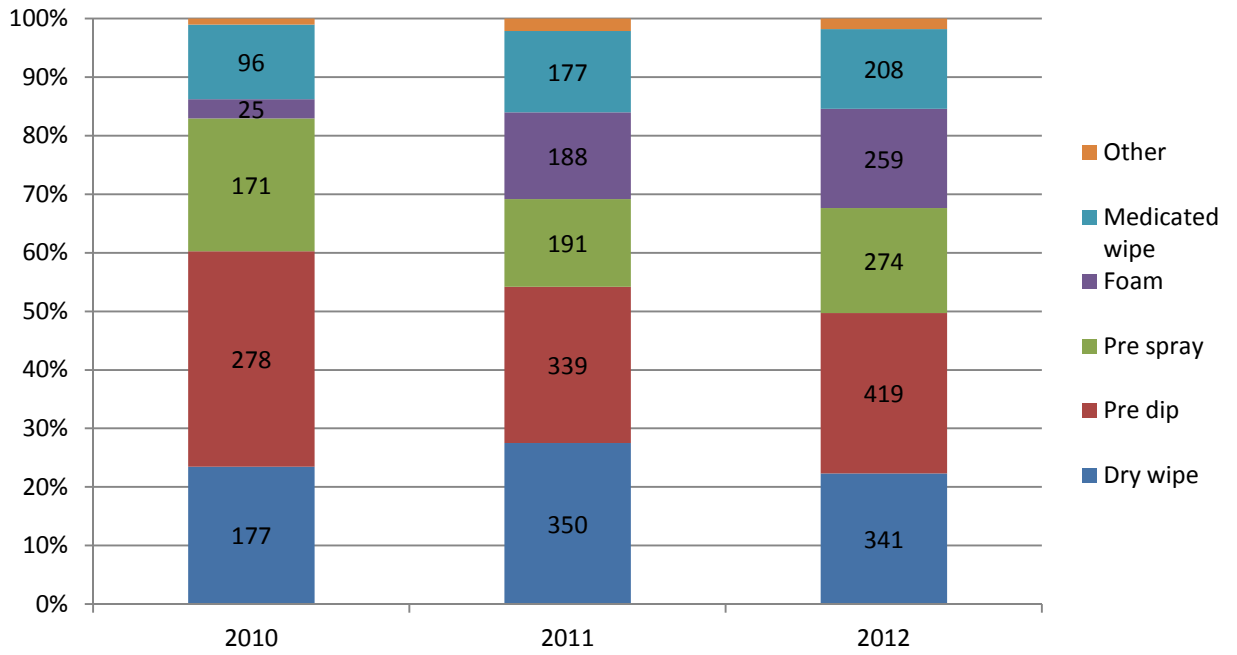
% Milking units banded



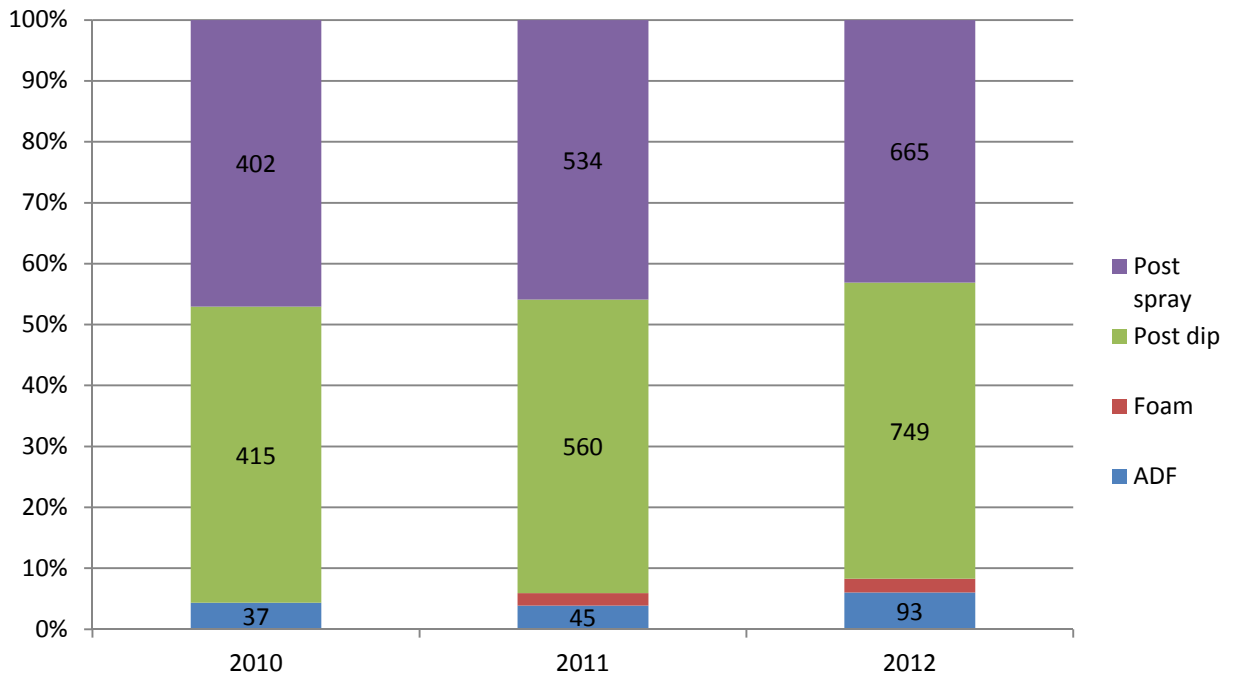
% Foremilking

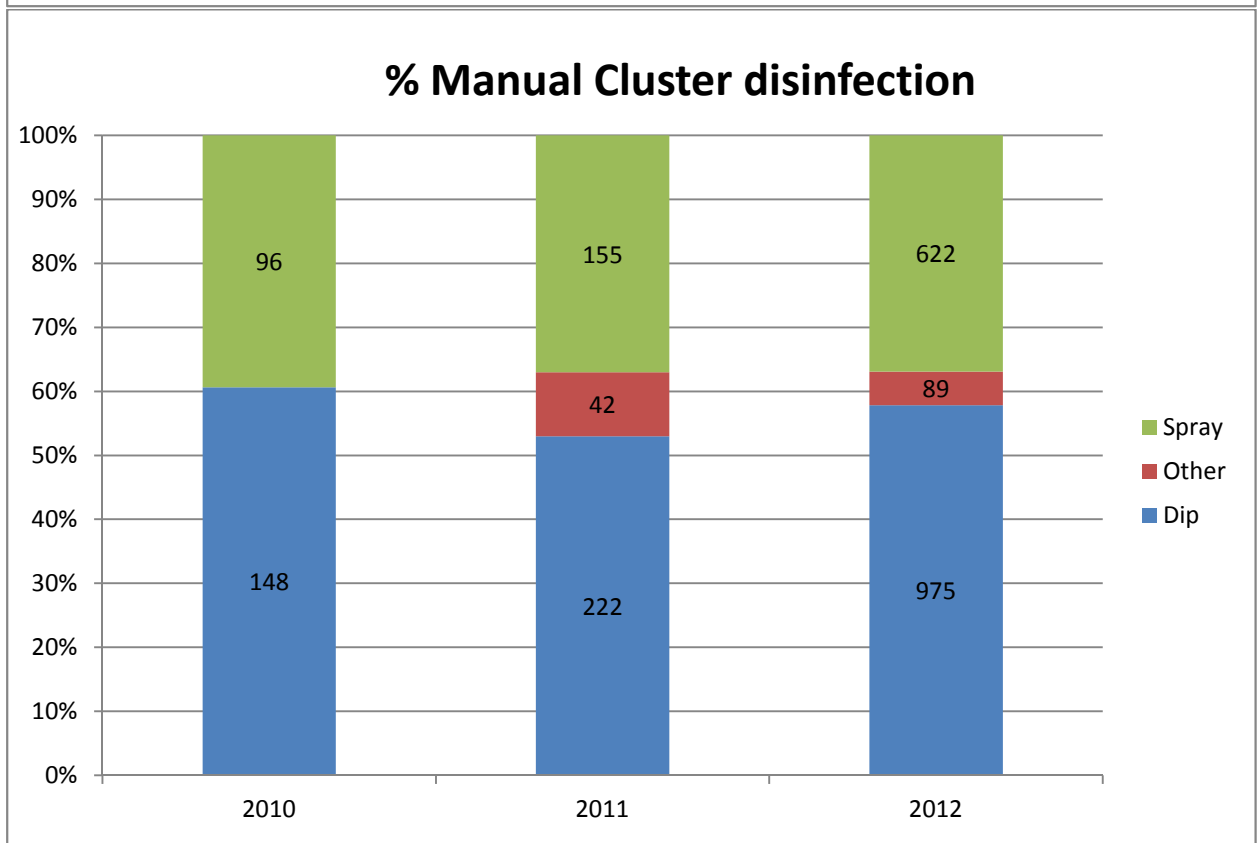
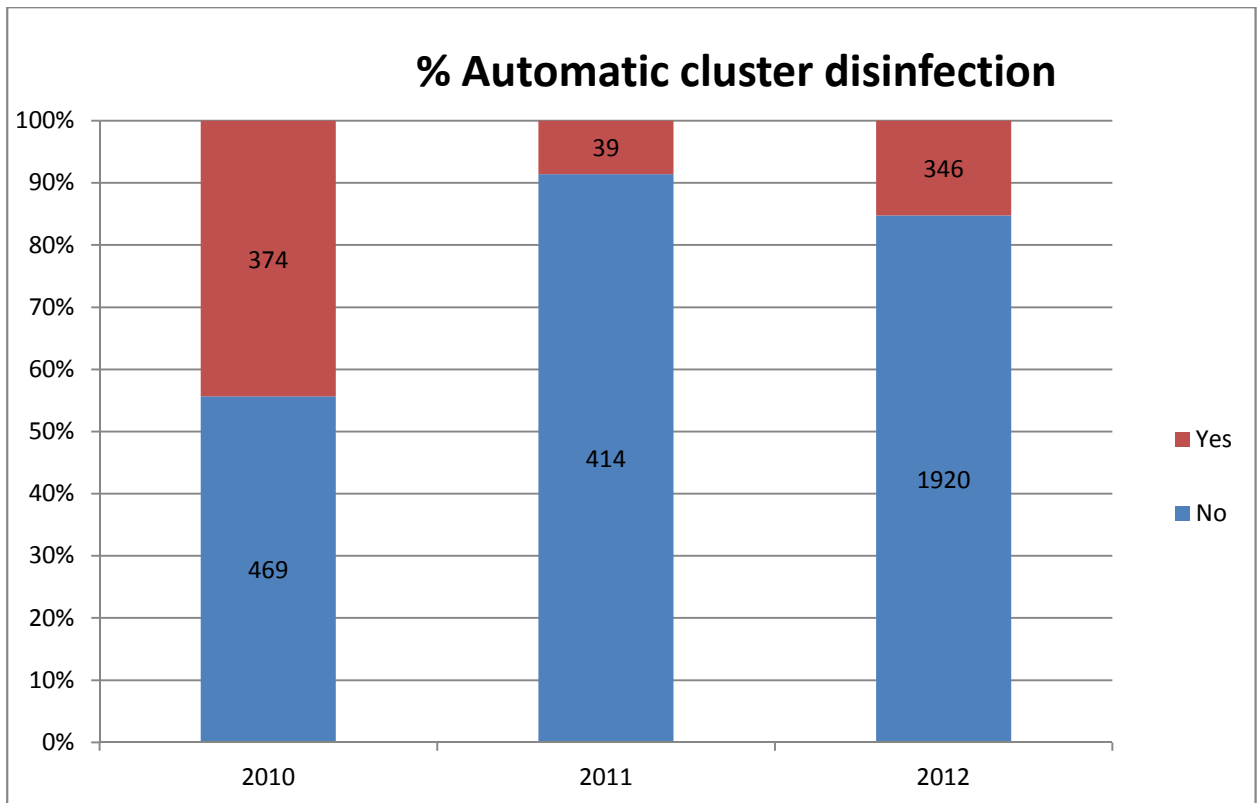


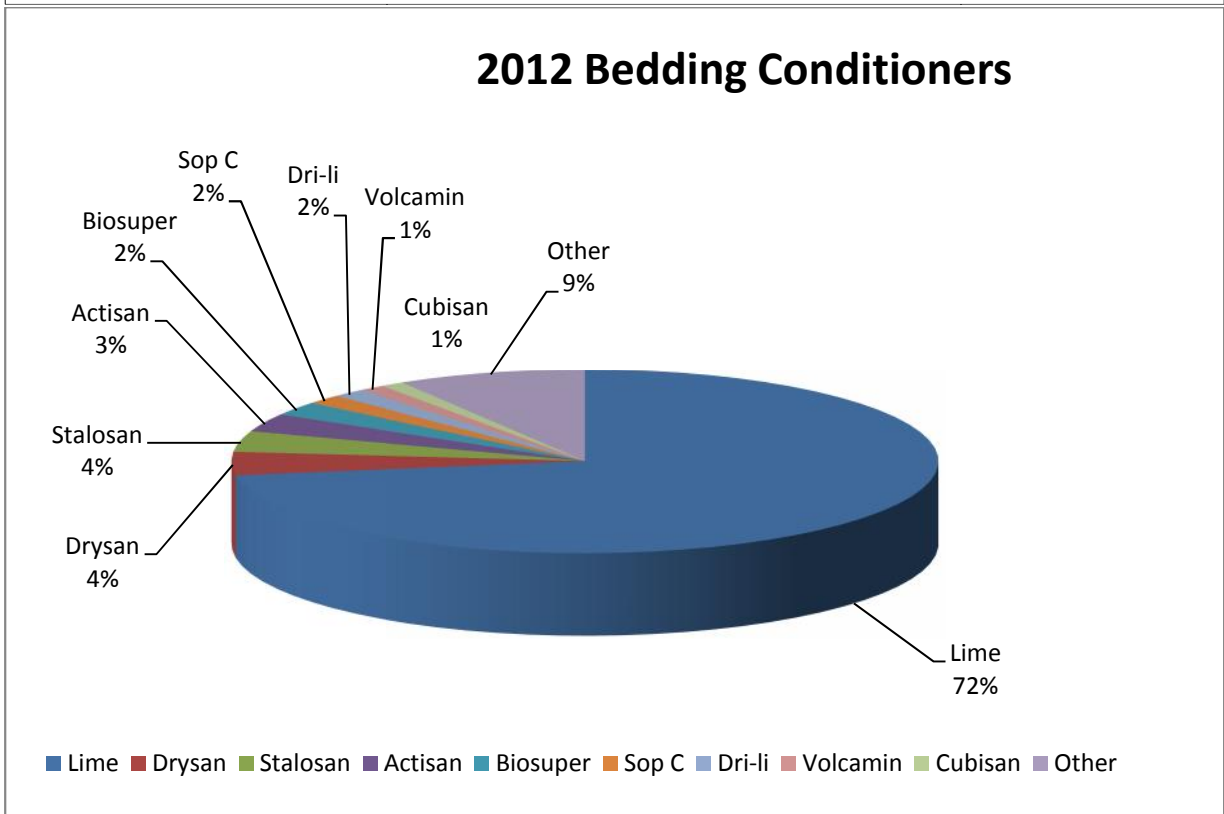
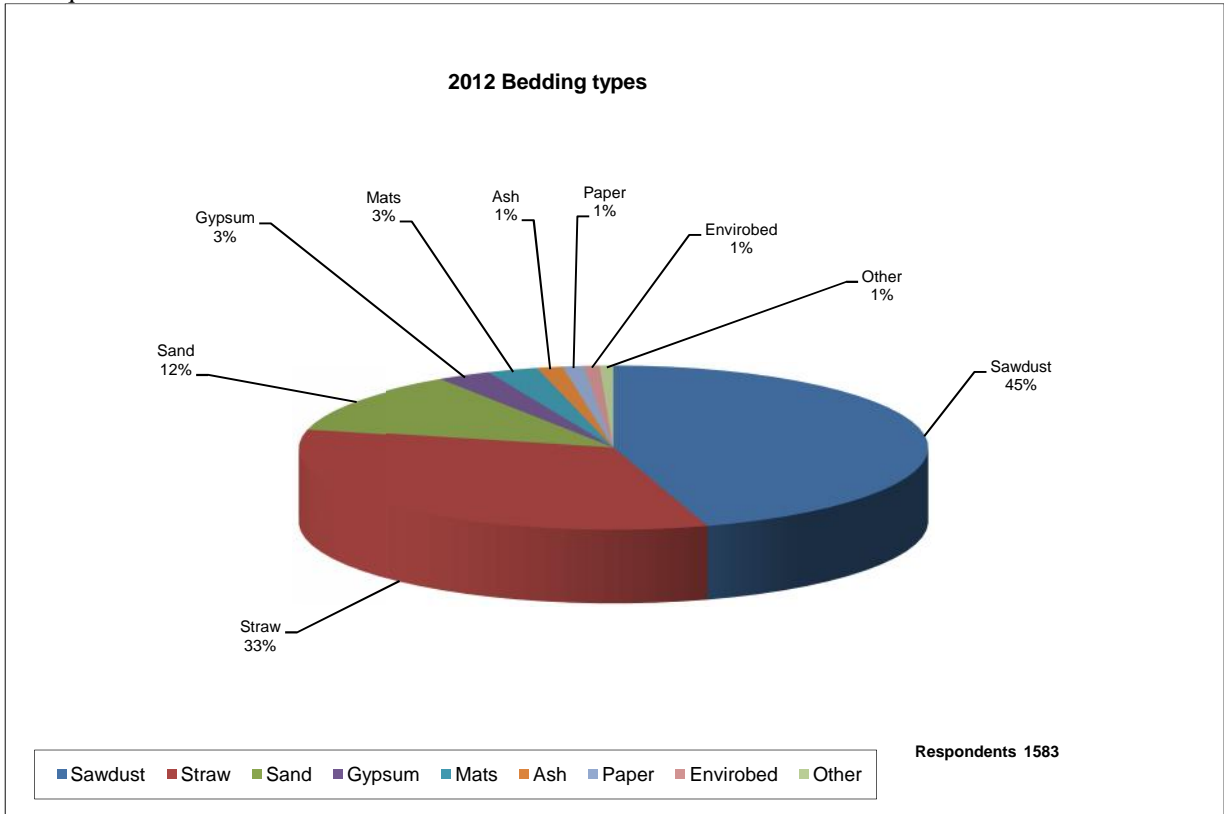
% Pre Milking teat preparation method



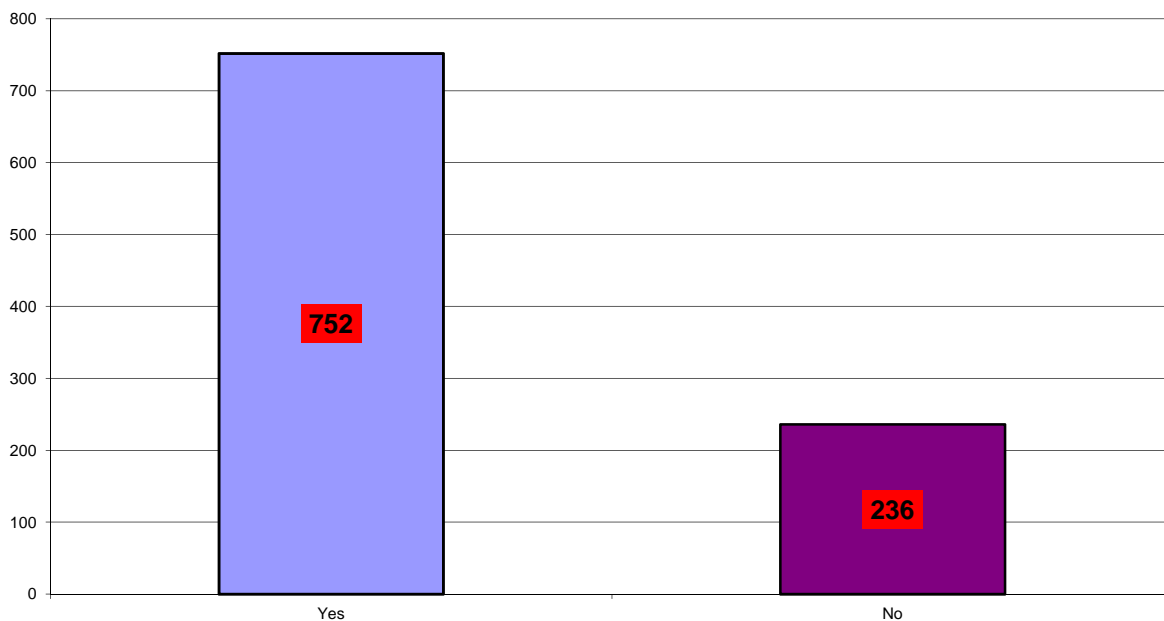
% Post Milking teat preparation method







Bedding Conditioner



2012 Mastitis cases per 100 cows by bedding types

