

The Role of Communication in Improving Udder Health

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KEYWORDS

• Udder health • Communication • Motivation • Mindset

KEY POINTS

- To be effective, a mastitis control program should do more than distributing technical information about best management practices to dairy farmers. Prevention of complex diseases such as mastitis requires customized communication strategies as well as an integrated approach.
- Two factors of farmer mindset are the most important behavioral determinants for mastitis management: believing there is a mastitis problem in the herd and belief in the effectiveness of mastitis management to solve that problem.
- Veterinary practitioners can be important intermediaries in communication about udder health, provided that they are aware of their role as advisor and apply the accompanying communication skills.
- It is important to segment communication strategies. Most farmers are interested in improving udder health if you approach them in the right way and offer the services they want.
- The most important step in creating demand for veterinary services is to offer them.

This article aims to help understanding dairy farmers' behavior and mindset regarding udder health management and to describe the efficacy of various communication strategies. Our findings are based on experience gained during the execution of a national udder health improvement program in the Netherlands. These experiences involve the relation between the farmer and the veterinary practitioner but also imply changes in the way national or regional udder health programs should be executed.

The article starts with describing farmers' mindset toward mastitis and the way it relates to farm management and mastitis incidence. Subsequently, the role of communication as an intervention instrument is evaluated, including the role of veterinary

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practitioners (eg, veterinarians). The article concludes by summarizing the main findings in our national program and the implications for future mastitis control programs.

FARMERS' MINDSET TOWARD MASTITIS

From a historical perspective, agricultural extension specialists, researchers, and veterinarians assumed that agriculture was an activity executed by an individual farmer, based primarily on rational, technical, and economic considerations.^{1,2} Although such rational choices play an important role in farm management, we have learned that farmers' decision making about mastitis management is not always clear and understandable.³ Why some farmers, even though it would benefit their results, do not implement effective mastitis management practices is not always known,⁴ but it is often assumed that, besides these deliberate rational considerations, other farmer mindset factors play a role.^{1,3-14}

The farmer mindset comprises a variety of social psychology constructs such as the farmer's personality, attitudes, beliefs, values, intentions, skills, knowledge, perceived norms, and perceived self efficacy (see, eg, the Theory of Planned Behavior¹⁵⁻¹⁷ and the Health Belief Model,¹⁸⁻²⁰ which are both frequently used to explain people's health behavior²¹⁻²³). All of these factors, and probably more, comprise the "human factor," which, for the sake of convenience, is summarized as "mindset."

In an extensive study on self-reported attitudes, behavior, and mastitis incidence conducted on 336 Dutch dairy farms, it was found that mastitis can be explained to a certain extent by farmer mindset and behavior.²⁴ In this study, elements of farmer mindset explain 17% of the variance in clinical mastitis incidence and 47% of the variance in bulk milk somatic cell count (BMSCC), while farmers' self-reported behavior explains, respectively, 12% and 14% of the variance of these parameters. Our findings are supported by studies by Bigras-Poulin and colleagues²⁵ and Tarabla and Dodd¹⁰ that also showed the effect of farmer mindset on farm performance.

For a mastitis control program, it is important to influence elements of farmer mindset in order to change farmers' management practices to improve udder health. **Fig. 1** is a visual representation of our advancing insight into the relationship between a mastitis control program and the udder health status on a farm, and it explains why only a part of the variance in udder health can be explained by surveys and models.²⁴ The figure shows that a mastitis control program can affect elements of farmer mindset and therefore behavior and udder health. It also shows that institutional factors, such as

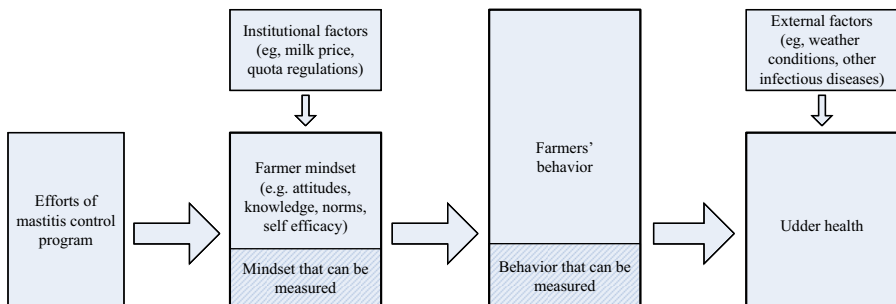


Fig. 1. Advancing insight into the potential efficacy of mastitis control programs to improve udder health and the limitations of evaluative surveys.

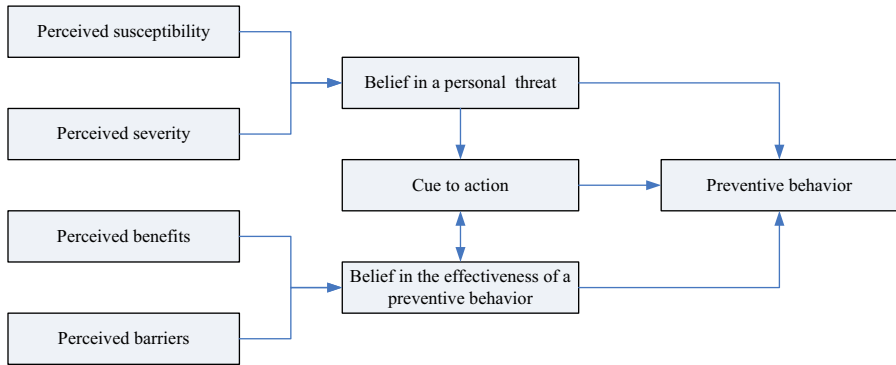


Fig. 2. The Health Belief Model.

quota regulations, influence farmers' decision making. Additionally, external factors, such as hot and humid weather, have a direct effect on udder health. This makes it difficult to explain 100% of the variance in udder health between herds. Although feedback loops are not shown in this figure, it should be taken into account that the past udder health status and external factors also affect farmer mindset and behavior.

Based on the results of our studies,^{24,26–29} 2 factors of farmer mindset seem to be the most important behavioral determinants for mastitis management: belief in a personal health threat (influenced by perceived susceptibility to, and perceived severity of, mastitis problems) and belief in the effectiveness of mastitis management (influenced by perceived benefits from, and perceived barriers to, execution of mastitis management). Interestingly, these factors are also known to be indispensable in motivating people to work on their own health and are included in the so-called Health Belief Model, as presented in **Fig. 2.**^{18–20,30,31}

The mechanisms behind the Health Belief Model correspond to important behavioral determinants such as attitudes, norms, and perceived self-efficacy from the Theory of Planned Behavior^{15–17,19,20} and seem to apply to mastitis management as well. For example, farmers who think that their herd will not have big problems (their herd is “not susceptible”) or who think that mastitis is not a severe animal health or economic problem do not think of mastitis as a “personal threat” and probably are less motivated to change their mastitis management. In addition, if required mastitis management measures are perceived as difficult or as hardly resulting in animal health or economic benefit, farmers may not be motivated to change their mastitis management either.^{32–34}

Perceived threat and perceived effectiveness were found to be important parts of farmer mindset regarding mastitis management. Regarding the perceived threat of mastitis problems, the normative frame of reference (ie, When is mastitis a problem?) varies among farmers, is associated with farmers' interest in working on mastitis, and explains a substantial part of the variance in mastitis incidence.²⁴ Farmers' perception on the effectiveness of management measures is strongly associated with mastitis incidence.²⁴ Additionally, it was shown that farmers' interest in mastitis prevention is associated with the expected efficacy of recommended management tools in improving udder health.²⁶ Jansen and colleagues²⁷ showed that nonmotivated farmers either believe that the mastitis problem is not serious enough or are not convinced of the efficacy of the proposed management measures on their farms.

In 32 extended semistructured interviews, the relevance of the constructs of the Health Belief Model in relation to farmer mindset regarding mastitis management was further explored.²⁸ During the interview, farmers were asked open questions about their perceptions on mastitis and their reasons for working or not working on mastitis management, in order to explore farmers' reasons for improving udder health. The interviews were transcribed in full and were analyzed following the Health Belief Model.¹⁸ The results are presented in **Fig. 3** and show that farmers' perceived threat and perceived efficacy of recommended measures indeed are the main arguments for working or not working on mastitis management. This corresponds with findings on farmers' entrepreneurial behavior change in general³⁵ and with findings on farmers' response to information on economic losses associated with BMSCC levels.³⁶ It is important to note that farmers perceive clinical mastitis and subclinical mastitis as 2 different problems associated with different management measures.²⁴

The results of the 32 interviews presented in **Fig. 3** suggest that farmers have ambivalent perceptions toward their intention to work on udder health and their actual behavior. It seems that some farmers are in a state of cognitive dissonance^{37,38} and use several social-psychological coping strategies to reduce the dissonance between their perceptions and their actual behavior.³⁹ For example, the interviewed farmers proposed many internal barriers (eg, lack of time or disruption of established routines) and external barriers (eg, limitations of the current housing, lack of support) to defend why they are not doing what they ought to do. These proposed barriers match with barriers to the implementation of zoonotic control programs.⁴⁰ Interestingly, when a farmer perceives serious mastitis problems, general measures to improve udder health will be implemented and thus, at the herd level, are used mostly curatively rather than preventively. This implies that when the problem is perceived as important enough, the benefits outweigh the barriers.

Although the interviewed farmers in this study voice a strong demand for simple, short-term, effective solutions, they know that mastitis is a multifactorial and complex disease and that a simple panacea does not exist.⁴¹ This seems to reinforce farmers' beliefs that preventive measures are neither effective nor practical. This perception is one of the main reasons why recommended measures are not always adopted.^{34,42–44}

Message for the veterinary practitioner:

- When farmers do not believe in the solution offered, the problem itself is less relevant.
- When farmers don't think they have a problem, the solution offered is not relevant.

Stop telling farmers they have a problem when they do not believe in the offered solutions or are not able to execute them. Try to focus perceived benefits and remove or reduce barriers. To be able to do that, you need to know what benefits and barriers a farmer perceives. Thus, ask questions like 'What is your goal, when will you be satisfied?', 'What do you like about this measure?', 'What stops you from implementing this?'

COMMUNICATION STRATEGIES AS INTERVENTION INSTRUMENT

The Dutch Udder Health Centre (Uier Gezondheids Centrum Nederland [UGCN]) was established to improve udder health in the Netherlands. In the national mastitis control program, several communication strategies were used to change farmers' behavior. In a study in which we evaluated the effect of the program on farmer mindset,²⁹ we found that elements of farmer mindset did change during the course of the program.

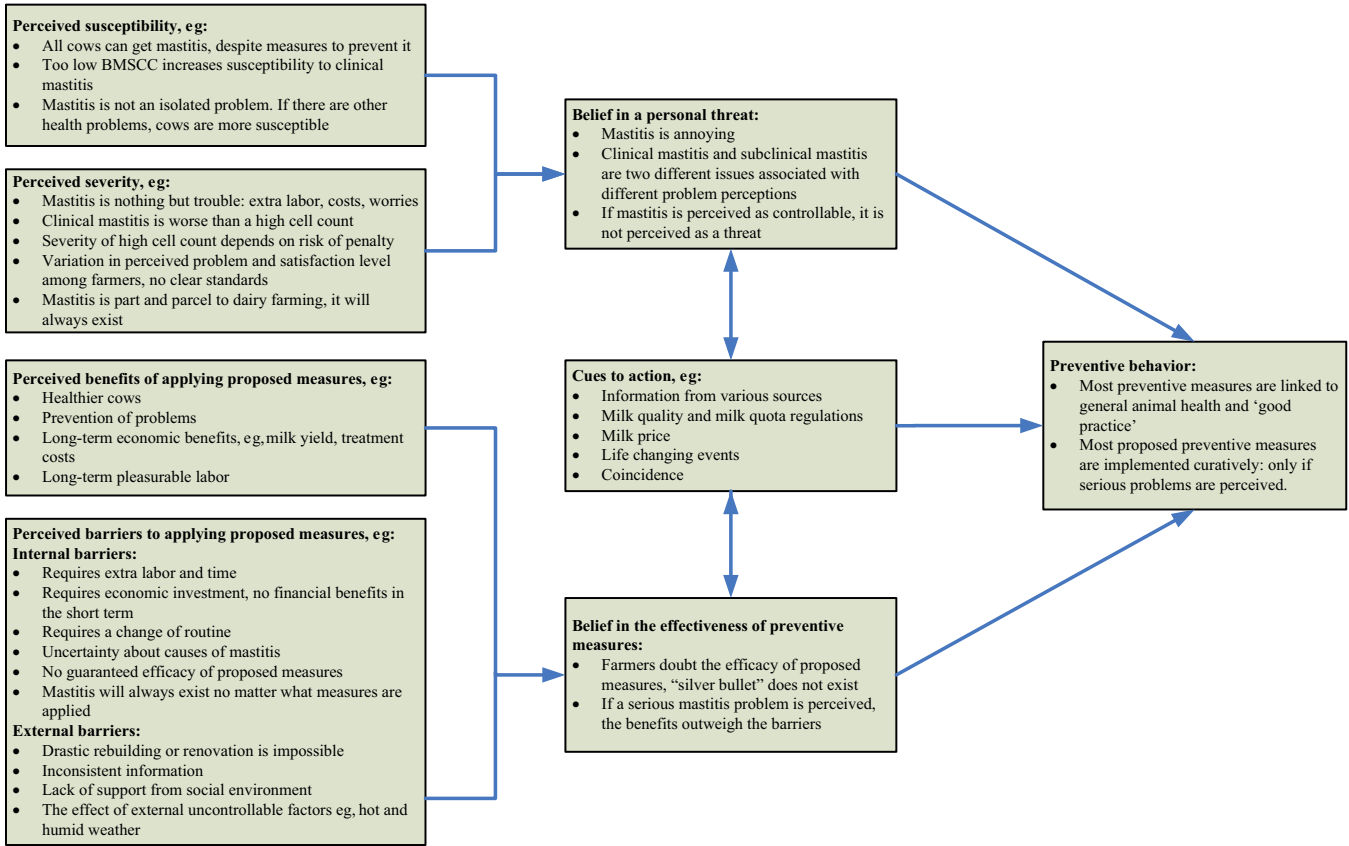


Fig. 3. Dairy farmers' perceptions toward management measures to improve udder health, based on analyses of 32 in-depth interviews by applying constructs of the Health Belief Model.

In particular, it seems that important factors such as perceived threat and perceived efficacy of management measures changed favorably. This is important because, as stated earlier, normative values and self-efficacy are strongly associated with the actual BMSCC²⁴ and influence farms' udder health status in the long term.

In relation to the efficacy of the various communication strategies, our findings suggest that, in order to reach as much farmers as possible, various strategies need to be deployed.^{26,27,45,46} We evaluated 2 strategies²⁶ that are potentially effective in reaching dairy farmers and changing their behavior using the Elaboration Likelihood Model.^{47,48} The effect of the traditional central route, which uses comprehensive, rational, science-based educational tools in, for example, study group settings, is highly dependent on farmers' internal motivation to decrease mastitis.^{47,48} Our findings show that farmers' familiarity with the tools and their interest in using the tools are associated with aspects of farmer mindset, such as the perceived importance of improving udder health and the perceived economic benefits of udder health improvement.²⁶ This suggests that for farmers who are less internally motivated, such communication strategies are less effective and other ways to reach these farmers need to be explored.

Peripheral communication strategies, as used in the milking glove campaign, without using science-based argumentation, were found to be useful.²⁶ For this strategy to be successful, farmers' internal motivation is a less important prerequisite.^{47,48} It was shown that a relatively short peripheral campaign on a single management practice can be quite effective in changing farmers' behavior. The results show that not only the use of milking gloves changed from 21% to 42%, but also the opinion of farmers about the usefulness of wearing milking gloves changed, even though no such arguments were employed in the campaign.²⁶ In contrast to the central route, communication using peripheral change is generally considered to be temporary, susceptible to counter persuasion, and unable to predict future behavior.⁴⁸ Surprisingly, this was not the case for the milking glove campaign. Even though there was a stronger effect on attitudes right after the campaign, the use of milking gloves increased further after the end of the initial campaign. A substantial and increasing number of farmers continued to buy milking gloves, even when extrinsic cues such as free samples were no longer present.²⁶ These findings suggest internalization of new behavior is possible as a profound and sustainable effect of a peripheral communication strategy.

Using peripheral communication strategies,^{47,48} multifaceted goals of decreasing a complex disease like mastitis will not be met in the short term.⁴⁹ However, single management practices (eg, wearing milking gloves during milking) and short-term behavior change can be communicated using a peripheral route, because they are more easily adopted than a combination of multiple actions to achieve a certain goal.⁴⁹ Thus, a step-by-step approach to changing farm management using peripheral communication strategies can be effective. It should be taken into account that ongoing efforts of our national mastitis control program, including central route communication strategies such as the development of educational tools and the implementation of study groups, created a basic awareness among farmers. This may have resulted in an increased efficacy of the peripheral campaigns and suggests that a combination of both peripheral and central communication strategies is most beneficial.

Obviously, not all farmers are reached in udder health programs. We described the results of in-depth interviews with farmers who were considered by their veterinarian to be hard-to-reach.²⁷ Those findings show that although most of them do consider mastitis as a problem and perceive udder health as important, they vary in the way

they use information sources and approach mastitis on their farms. These farmers do not perceive a lack of information on mastitis and they do not have more mastitis problems than other Dutch dairy farmers, which contrasts with veterinarians' perceptions.²⁷ It appears that one specific characterization of a hard-to-reach farmer cannot be made; it was found to be a heterogeneous group. These farmers differ in the way they trust external information and the way they are open toward information from the outside world. Like every farmer, they are part of a social network and receive information from different sources. Thus, it should be possible to reach them through these channels via, for example, local events, coaching by trusted persons, or articles published in farm journals. However, whether they will apply the available information depends on their mindset and the way that their mindset is affected by these strategies.²⁷

The provided information has to be considered as relevant by farmers in order for them to process and apply it.⁵⁰ If farmers have aspirations other than improving udder health, they may not be interested in reading the message in the first place. One should also take into account that changes in farm management entail a long-term process and are much influenced by contextual and institutional factors¹ such as milk price, quota regulations, or other infectious disease outbreaks. Fluctuating milk prices and uncertainty about quota regulations probably influence farmer mindset (see **Fig. 1**) and act as cues for action (see **Fig. 3**). Milk quota utilization, for example, has been described in several countries as an important factor in farmers' decision making regarding the treatment of mastitis.³ If, instead of mastitis, other issues are the focus of an advice, farmers may be more motivated to adopt a certain desired management practice, because the information may relate better to their needs, goals, and demands.⁵¹ Thus, there are several reasons mastitis does not necessarily need to be the point of departure for communication strategies to improve udder health.

Message for the veterinary practitioner:

Can veterinarians develop communication strategies within their own practice?
Yes, they can!

First find a common mission and vision as a practice. The goals of the individual vets have to be taken into account, find the common denominator. For a communication strategy to be successful, you all have to send the same message.

Do you actually want this?

If so: subsequently: set a goal for the practice and make a plan to reach that goal. There is much information on how to make a communication and a marketing plan. The most important questions to be answered are: why? what? who? when? where? how? Some other issues to consider:

- Consider stakeholders to cooperate with
- Involve some of your best clients in the plan, if they think your plan is good, they can become your ambassadors
- Segment communication strategies
- Make sure the timing fits with other issues

CREATING DEMAND AND SUPPLY FOR ADVICE

If communication strategies are implemented to change mastitis management, farmers' demand for advice and the supply of that advice need to be taken into account. Working with the right intermediaries is important,^{52–54} because dealing with the complexities of cause and effect in farming systems, and learning to apply

practices to a whole farming system, requires strong interaction between advisor and farmer.^{55,56} Regular veterinarian–farmer contacts are a potentially powerful way to achieve this because of (1) the high frequency of service contacts, (2) familiarity with each others' context, personal characteristics, preferences, beliefs, aspirations, and competencies that builds up over the years, and (3) the relationship of trust that develops.^{1,57} This interaction can be shaped in several ways, depending on the positions farmer and veterinarian take in the process of knowledge construction.⁵⁸ In our studies, farmers perceive the veterinarian as an appreciated, important, and frequently contacted information source concerning mastitis.^{24,59,60} In addition, study groups on udder health for farmers organized by their veterinarian have been successful in decreasing mastitis.^{45,46,61} Although veterinarians' regular advisory contacts play an important role in optimizing farm management, there are also several constraints.^{54,56,58,62} These constraints relate to advisory competencies and to the room for addressing mastitis management in a commercial, demand-driven, farmer–veterinarian relationship.^{54,56,58,62}

In view of these constraints, a number of measures can be proposed to improve the interaction between the demand and supply side of the market for advisory services.^{51,54,63} Important measures are to (1) improve social skills; best practice exchange about how to convey mastitis management messages in an interactive facilitative way; and (2) raise farmer awareness about the importance of mastitis management in order to stimulate demand for services that address the issue.

On a larger scale, improving linkages between research and practice, and in general a more coordinated research and extension system in support of mastitis management advice, is advisable.^{54,56,62} These local and regional measures can be applied to strategies to be used in mastitis programs. As a guideline, **Table 1** displays the different components of the measures adopted in the Netherlands to promote the provision of mastitis management advice.⁶⁴ With respect to the first measure to support advisors, the Dutch mastitis program developed free-of-charge educational materials for veterinarians to use during study group meetings and when giving individual advice, and veterinarians had the opportunity to attend study group facilitation workshops. Despite the intention to empower veterinarians in individual advisory encounters, most of the educational materials were mainly used in contacts with internally motivated farmers.²⁶ Veterinarians seem to be less successful in reaching farmers that they presume to be nonmotivated to work on mastitis. Veterinarians were found to have difficulties in being proactive advisors and applying essential communication skills.⁶⁵ Our findings suggest that veterinarians seem to be persistent in their curatively oriented, prescriptive, and reactive expert role that prevails in veterinarian–farmer contacts. Instead of being mere technical experts, veterinarians should take on the role of coach, sparring partner, and facilitator from a reflexive and adaptive position.^{1,62,66–68} This indicates that opportunities exist to improve the professional education of veterinarians on communication skills.^{62,67,69}

With respect to the second measure, to increase farmer awareness to stimulate demand for advice, our results^{24,29} show that farmers' awareness about mastitis hardly changed during the course of the Dutch program; most farmers disliked mastitis in 2009 as they did in 2004. The longitudinal study, however, did show an increase in farmers' feeling of control, suggesting that awareness of the efficacy of preventive measures had improved. Thus, in order to stimulate application of mastitis management measures, one should focus on the awareness of the effectiveness and feasibility of practical measures rather than addressing the importance of the problem.

Table 1	
A selection of measures applied by UGCN to promote the provision of udder health advice	
Factors to Support Demand and Supply of Advice	
Supporting advisors in providing udder health advice	<ul style="list-style-type: none"> • Lectures for veterinarians and other advisors • Providing supporting materials for successful organization of study groups • Free-of-charge distribution of educational materials to veterinary practices and other advisors • Regular contact with veterinarians and farmers on UGCN advisory panels
Raising farmer awareness of the importance of mastitis	<ul style="list-style-type: none"> • Study groups facilitated by veterinarians • UGCN as information source with database on udder health management and prevention of mastitis • Articles in farming magazines, newsletters, calendars, posters • Mass media campaigns on, eg, the use of milking gloves and the use of a standardized treatment plan • Udder health workshops, open farm days, symposia
Financial incentive to create demand	<ul style="list-style-type: none"> • Indirect incentive: decrease mastitis and therefore fewer costs and higher milk production • Indirect incentive: helping to comply with somatic cell count norms, thus preventing fines
Optimizing knowledge system linkages between extension and research	<ul style="list-style-type: none"> • (Coordinated) exchange between research projects, associated veterinary practices, and professional education for veterinarians and farmers • Central advisory service, including technical information and practical tools on website • Research results are used to optimize communication strategies

The third measure to create demand for advice is to use financial incentives. In our mastitis control program, as is the case for veterinary practitioners, direct financial incentives could not be applied as a policy measure. Therefore we tried to use indirect incentives. The most important indirect financial incentive for farmers was the decrease in mastitis incidence, as clinical mastitis costs on average \$276 per case.⁷⁰ The baseline survey in 2004 showed that 95% of farmers perceived mastitis as a costly disease and that 69% of farmers worried about the cost of mastitis.⁵⁹ However, when farmers were asked about the most annoying aspects of mastitis, the economic cost was mentioned in third place (20%), after the additional required labor to treat the animal (24%) and the uncertainty about a cow's recovery after treatment (31%).⁵⁹ Thus, although economic cost of mastitis is important, there are also other factors that are important for the adoption of mastitis management measures.³⁶

Another important financial measure is the penalty level for BMSCC. We found that, if the existing level would hypothetically be decreased from 400,000 cells/mL to 350,000 cells/mL, 65% of farmers said they would try to improve udder health, and 67% said they would treat cows with mastitis sooner. The perception on the importance of penalties was found to be associated with the herds' udder health status. Our findings are supported by other research, showing that penalties in relation to milk quality seem to have more impact on behavior than bonuses.³³ Further lowering the penalty level in the Netherlands is difficult due to the lack of support within the dairy sector and the perceived need for compatibility with European threshold levels.

The fourth measure includes the optimization of the connection between research and extension activities. The findings in research projects were implemented as much as possible in communication strategies in order to optimize the program. Furthermore, national campaigns to influence farmers' behavior in relation to mastitis management measures (eg, wearing milking gloves and developing mastitis treatment protocols) were developed in cooperation with important stakeholders such as suppliers of, for example, pharmaceuticals, feed, and farm management systems. The network of stakeholders coordinated by the UGCN supported the distribution of knowledge from science to practice. Our findings show that although several measures were included in our mastitis control program, mastitis is such a complex disease that it is difficult to optimize the intervention by using only one communication strategy. A mastitis control program needs to be supported by a full mix of policy instruments including regulations, subsidies, and penalties to optimize the efficacy of changing farmer mindset and behavior,^{63,71} provided that such policy measures are clear, integrated, and stable.^{1,72}

Message for the veterinary practitioner:

The most important step in creating demand for veterinary services is to offer them! Offering these services should be part of the communication strategy. Again: it is important segment communication strategies. Most farmers are interested in improving udder health if you approach them in the right way and offer the services they want. To be able to reach that, it is crucial to ask questions. Ask what they want, what their goals are and how you can help them achieve it. Do not think for them, if they think your proposal is too expensive, they are very well able to tell that. Some farmers will not be interested, but be sure of that before you delete an opportunity to sell your services.

IMPLICATIONS FOR MASTITIS CONTROL PROGRAMS

In the design of effective mastitis control programs, essential communication principles to change people's behavior, as described in **Table 2**, need to be implemented.^{50,73–76} First, it should be taken into account that a farmer is not a passive absorber of knowledge. Originally, agricultural extension had a strong supply-driven character employing a downstream transfer-of-technology (TOT) approach, in which farmers were seen as passive recipients of information that they should uniformly adopt and apply.¹ As the presented material shows, communication strategies need to take into account the complexity of farmer mindset and decision making in order to understand underlying motivations for behavior and to find opportunities for communication strategies. To motivate farmers to improve udder health, one should acknowledge that farmers are part of a wide social context. Attention should be given to cues for action, such as life-changing events,⁷⁷ and perceived barriers should be taken into account. Arguments on the efficacy of measures, using economic arguments and arguments on practical feasibility, should be used consistently by all stakeholders to stress the profitability and benefits of preventive measures.

A second important principle is the segmentation of target audiences, which is needed to customize communication strategies to farmer mindset.^{43,50,76,78,79} Our findings show that different types of farmers, such as information seekers, do-it-yourselfers, wait-and-see-ers, and reclusive traditionalists, have different ways of using information sources.²⁷ Thus, they should be approached differently and with different strategies; for example, the central and peripheral routes of the Elaboration

Table 2	
Seven principles for designing an effective mastitis control program	
1	<i>The receiver is an active processor of information</i> A message will be received differently by different people; the individual mindset affects the way a person attends to, interprets, and accepts a message. Campaigns should include not only a downstream transfer-of-technology approach, but also an upstream approach, taking into account social determinants of people's mindset and behavior.
2	<i>Different target audiences may respond to different messages differently</i> Target audiences must be segmented into meaningful subgroups based on important characteristics such as demographic and mindset variables, before the development of targeted messages.
3	<i>Formative research, including message pretesting and process evaluation is essential</i> Research (focus groups/interviews) is needed to understand the target audience. The target audience needs to pretest the messages to ensure that they are both appropriate and effective. Continuous monitoring and evaluation of outcomes is necessary to study the efficacy of the chosen strategies.
4	<i>A theoretical framework increases likelihood of success</i> Campaigns using theoretical frameworks such as the Health Belief Model, the Theory of Planned Behavior, or the Elaboration Likelihood Model are more likely to be successful than those that do not. Theories suggest important determinants around which to develop messages and help ensure that the chosen strategy supports the processes of behavioral change.
5	<i>Comprehensive, coordinated interventions are most successful</i> Successful campaigns are comprehensive and coordinated together with other stakeholders, including a variety of strategies and policy measures to support the communication campaign.
6	<i>Multiple delivery channels and multiple sources increase likelihood of success</i> Communication campaigns involving a number of message delivery channels and more than one source appear to be more successful than those that do not.
7	<i>Campaigns must be sustained over time</i> Communication campaigns need time to achieve and maintain sustainable success. The end of the campaign needs to be flexible depending on monitoring and evaluation of outcomes and should not have a predetermined deadline.

Likelihood Model^{47,48} should be used to reach farmers with different levels of internal motivation.

A third important principle of effective large-scale strategies is to include formative research as a fundamental theme within the program design. As the Dutch program shows, cooperation between scientists from different disciplines can lead to new insights. This can lead to a new normative frame of reference on mastitis and to the development of mastitis management measures that are perceived as effective in improving udder health. Additionally, it is important to monitor and evaluate the progress being made.⁵⁰

The fourth principle of effective mastitis control programs is the use of theories such as models from social psychology. These theories provide insight into important behavioral determinants^{21–23}; see, for example, the Theory of Planned Behavior,^{15–17} the Health Belief Model,^{18–20} and the Elaboration Likelihood Model.^{47,48} Our findings show that such theories can have added value in understanding farmer mindset and can therefore contribute to the development of effective communication strategies.

The fifth and sixth principles of effective mastitis control programs are the development of comprehensive interventions, preferably with multiple channels and

multiple approaches. Currently, most animal health programs still focus on influencing farmers' behavior according to the traditional TOT approach. This approach, however, has become increasingly criticized because it ignores the highly interactive and locally specific nature of knowledge construction. Nowadays, it is recognized that to achieve more sustainable agricultural practice, advisors and farmers, as well as other stakeholders, need to engage in a process of joint experiential learning to which all parties equally contribute knowledge.^{1,80,81} Our findings show that when a complex disease such as mastitis is being addressed, an approach integrating different disciplines as well as provisions and policy instruments is needed. This also has consequences for the way a mastitis control program is designed. By addressing different stakeholders as equal partners instead of informative consultants, communication strategies can be designed that are more effective in changing farmers' behavior than traditional TOT strategies that reach only the internally motivated farmers. This implicates that veterinarians should not be the only intermediary in disease control programs. Cooperation with other advisors may be the cue to make steps forward. Efforts should be made to build networks among stakeholders to tailor and to customize communication strategies to farmer mindset.^{43,50,76,78,79}

A last principle for designing effective mastitis control programs is the need for sustainment over time. Sustainable behavioral change needs a long-term approach and therefore complex interventions should not aim to finish within a certain limited time frame. Consistent rehearsal of the same message and follow-up on previous activities is needed over longer periods, sometimes even generations, including continuous monitoring and evaluation of the progress being made.⁵⁰ A sudden end of disease control programs would suggest that the disease is no longer considered to be an important issue. It can also result in a lack of trust among stakeholders about cooperating with new initiatives in the future, because of uncertainty about the longevity of these initiatives and supporting policies.^{1,72} This implicates that mastitis control programs need to be institutionalized to be most effective in improving udder health in the long run.

Message for the veterinary practitioner:

For veterinary practices to develop and implement a mastitis control program it is important to:

- Have a plan on practice level
- Take communication serious
- Make sure everyone communicates the same message
- Cooperate with other stakeholders
- Use and harmonize all communication channels to reach the farmer

SUMMARY

Our findings provide insight into Dutch dairy farmers' behavior and mindset toward mastitis management, and into the way these can be affected by communication strategies. They may differ from those of North American dairy farmers, but probably many findings are comparable. Elements of farmer mindset are important determining factors in mastitis control, including the perceived threat (ie, "Do I have a problem?") and the perceived efficacy of mastitis management measures (ie, "Can I solve the problem easily?"). These issues need to be addressed in communication strategies. Veterinarians can be important intermediaries in communication about udder health,

provided that they are aware of their role as proactive advisor and apply the accompanying communication skills.

To be effective, a mastitis control program should do more than distributing technical information about best management practices to dairy farmers. Prevention of complex diseases such as mastitis requires customized communication strategies as well as an integrated approach between various stakeholders and different scientific disciplines. Because farmers are part of, and are influenced by a wide institutional context, such programs need to be supported by a combination of several policy measures to change farm management in the long run.

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