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PARTICIPATORY POLICY MAKING BY DAIRY PRODUCERS TO REDUCE ANTIMICROBIAL USE ON FARMS

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Impacts

- Antimicrobials are widely used in food-producing animals, posing a potential risk of spread of antimicrobial resistant bacteria from animals to humans. Frequent use of certain antimicrobials in food animals may reduce their effectiveness as treatments for both animals and humans.
- Intensive collaboration and dialogue between dairy producers, veterinarians, industry partners and researchers led to the development of an antimicrobial stewardship policy including practical measures designed to deliver real, on-farm changes in antimicrobial use, while maintaining or improving dairy herd health and welfare.
- Although many producers were already stringent in their antimicrobial use (many were organic dairy farmers), almost 60% envisaged making changes to their use of antimicrobial medicines on farm as a result of their participation in the policy development process.

Summary

Pressures for more responsible use of antimicrobial (AM) medicines in food animals are likely to increase from policy makers and the food industry, including retailers. To address this challenge, participatory approaches to welfare interventions and disease prevention may also be necessary alongside more conventional regulatory measures.

This paper describes the process of enabling groups of dairy producers to use a participatory policy-making (PPM) approach to develop an AM stewardship policy. The policy includes measures agreed to

by all producers for more responsible use of AMs, while maintaining or improving dairy herd health and welfare.

This process provided a unique opportunity for collaboration and dialogue between producers, veterinarians, industry and researchers. Its participatory nature encouraged comprehensive learning for all involved. This integration of science with producers' knowledge and experience led to credible and practical recommendations designed to deliver real and lasting change in AM use.

The multidisciplinary nature of this research marks a significant contribution to embedding social science skills and approaches into the veterinary sphere. As an initial step in creating better understanding of how participatory approaches with farmers can be applied in a UK context and more widely, this work serves as a pilot for promoting more responsible use of veterinary medicines in other livestock species.

Key words

Antimicrobial resistance; public health; participation; antimicrobial stewardship policy; dairy production; veterinary medicine use.

Introduction

The increase of antimicrobial resistance (**AMR**) is a growing problem for human health and an increasing economic burden for society (Laxminarayan *et al.*, 2013). Antimicrobials (**AM**s) are widely used in food-producing animals (O'Neill, 2015) and this has led to growing concern. There is a risk of spread of AMR bacteria from animals to humans, and the frequent use of certain AMs in food animals may reduce their effectiveness for treatment in humans (EFSA, 2015). Increasing resistance also has an adverse effect on the livestock sector, leading to more recalcitrant bacterial infections in food-producing animals, increased costs of treatment, productivity losses and animal welfare concerns (McEwen & Fedorka-Cray, 2002).

High use of AMs in food-producing animals is often associated with intensive pig and poultry production, and use of AMs in dairy cattle may not be seen as an immediate concern (Raymond *et al.*, 2006; Brunton *et al.*, 2012). However, the use of AMs, including those of major importance to treat

serious infections in humans (fluoroquinolones, 3rd and 4th generation cephalosporins and long-acting macrolides; WHO, 2012), are commonplace in dairy systems (Raymond *et al.*, 2006; Brunton *et al.*, 2012). The majority of AMs in dairy cattle are administered for the treatment of mastitis during lactation and at cessation of lactation, dry cow therapy (Swinkels *et al.*, 2015). A survey of AM usage on dairy farms in the United Kingdom (**UK**) revealed that antibiotic tubes used for treating mastitis frequently contain 4th generation cephalosporins, and that a large number of dairy producers fed their calves waste milk from cows with mastitis that were potentially undergoing treatment with these AM families (Brunton *et al.*, 2012).

The UK currently has no governmental regulations to reduce veterinary AM use similar to those introduced in Netherlands in 2010, which required farms to reduce veterinary antibiotic use by 50% by 2013 and 70% by 2015 (as compared with the amounts that had been used in 2009; Speksnijder *et al.*, 2015b). The only UK regulatory measures are voluntary measures to ensure best practice and responsible use through farm assurance schemes and compliance to retailer standards for meat and animal products, as described in the UK Five Year AM Strategy 2013 to 2018 (Davies & Gibbens, 2013). Several major retailers and milk buyers in the UK have or are in the process of setting their own guidelines regarding the use of AMs. For example, one milk buyer recently introduced a requirement for their suppliers to use selective rather than universal dry cow therapy, and some retailers are already monitoring the use of 3rd and 4th generation cephalosporins and fluoroquinolones (Alderton, 2015). Recently, the Responsible Use of Medicines in Agriculture (**RUMA**) Alliance - consisting of 24 organizations along the value chain, including farmer representative organizations, retailers, veterinary practices, farm assurance organizations and animal welfare organizations - published guidelines for more responsible use of AMs by cattle farmers (RUMA, 2015).

Pressures to reduce AM use and to use AM medicines more responsibly in food-producing animals are likely to increase from policy makers and the food industry, including retailers. To address this challenge, participatory approaches to welfare interventions and disease prevention may also be necessary to achieve sustainable farm practice change in addition to more conventional regulatory

methods (Buller *et al.*, 2015). Participatory approaches - in particular participatory policy-making (**PPM**) - offers innovative solutions to the AMR challenge and fills the void in public policy making regarding this challenge. These approaches shift the view of farmers as merely policy implementers to viewing farmers as active partners in collaborative decision making and joint learning processes with other stakeholders to identify and develop solutions together (Schut *et al.*, 2014; Sutton, 1999). Karl (2002) states "*PPM implies empowerment of stakeholders to take part in the whole cycle of the policy process: formulation, implementation, monitoring and evaluation of policy*". Solutions developed by farmers through these approaches often lead to on-farm practice change as they are more practical and implementable than solutions developed by outsiders (Pretty, 1995; Chambers *et al.*, 1989). Moreover, they allow farmers to maintain control and a sense of ownership over the solutions (Escobar & Buller, 2014). Evidence of successful PPM can be found in a number of areas, from citizen participation in local governance to environment management (Van den Hove, 2000).

This paper describes a policy development process in which two groups of dairy producers and their veterinarians were actively encouraged and enabled to work together to develop their own AM stewardship policy leading to changes in farming practice and reduced AM use.

Materials and methods

The policy development process was initiated by two dairy producer groups, a group of 25 organic producers and a group of 48 conventional producers. These two groups exclusively supply one major retailer in the UK. From the outset, the process was a focused initiative driven by producers as a collective, and all producers in the two groups participated in the policy development process to ensure ownership of the policy. The producer groups aimed to develop an enactable on-farm AM stewardship policy that showed their commitment and responsibility to the milk buyer and retailer to reduce and rationalise AM use without compromising animal health and welfare.

The leaders of the producer groups and their lead veterinary advisor initiated the formation of a project team which also included a representative from the retailer and milk buyer and researchers. A facilitator was contracted to guide the policy development process (Figure 1). A series of meetings and workshops were held over the period May to August, 2015 to conceive and develop the policy. The first team meeting was held in May, 2015 to identify policy objectives and policy areas, to clarify specific terms (e.g. What do we mean by responsible use?) and to reach agreement on how to engage all producers in the policy making process (Figure 1, Step 3). Taking workshop costs, group size as well as travel time for producers to the workshop into consideration, it was agreed to organize four regional workshop, with each workshop comprising 20 to 25 producers and their veterinarians. The project team developed an outline for the regional workshops and structured the main discussions around on-farm measures for more responsible use of AMs within four categories (policy principles), based on a conceptual model derived from Speksnijder and colleagues (2015a): 1. disease management strategies, 2. ensuring correct use of medicines, 3. avoiding prophylactic use and 4. ensuring quality data recording and use. These categories provided an initial framework for policy development.

The regional workshops (Figure 1, Step 4) were key in the development of the policy, and were held in June, 2015. Each regional workshop began with a presentation by the lead veterinary advisors to provide insights into AMR and why it mattered to farmers, the dairy industry and the world. As part of this presentation, a survey was conducted amongst producers and veterinarians using an interactive audience response system (Turning Point 5, Turning Technologies, Belfast, UK) to pose multiple-choice questions to which the attendees could respond. The answers to these questions were amalgamated in order to better understand the perception of producers and their veterinarians on the use of AMs and AMR as well as to raise their awareness on the issue and compare and contrast the different levels of awareness represented. These question sessions were followed by short focus group discussions to create a better understanding of the benefits and challenges of current AM use on farms.

The main part of the workshop consisted of group discussions to identify practical measures that could ensure responsible (and often reduced) use of AMs on farm in each category. Workshop participants were divided into smaller groups, with producers and veterinarians kept in separate groups to ensure

producers felt comfortable to actively participate in the discussion (Morgan, 1996) as well as to manage veterinary-client communication dynamics (Shaw, 2004) and thus reduce bias in responses. Participants were requested to discuss and write down practical measures on sticky note paper (one strategy per sticky note). After exhaustion of new ideas, each group was asked to rank the measures they had identified according to ease of implementation on farms. Each group presented their measures in the four categories, and all sticky notes (per category) were then combined. General plenary discussion followed with both producers and veterinarians in order to further develop and agree on the measures presented. The facilitator consolidated the outcomes of the four workshops, and the project team met in July, 2015 to draft an initial policy document. Further feedback on this initial document was achieved through a follow-up meeting at the beginning of August, 2015 with a representation of producers from each region to refine the policy (Figure 1, Steps 5 and 6).

Figure 1. Outline of the process followed to develop an antimicrobial stewardship policy with dairy farmers in the UK

After final review by the lead veterinarian and producer group leaders at the end of August, 2015 (Figure 1, Step 7), the policy was communicated by email to all producers in the two producer groups (Figure 1, Step 8), and policy implementation tools were developed (Figure 1, Step 9). The two groups then began the policy implementation (Figure 1, Step 10).

Results

The turnout at all regional workshops was high: 97 participants (70 producers out of a total of 73 in the two producers groups) and 27 veterinarians, from all practices servicing the farms participated.

Perception of producers and their veterinarians on the use of AMs and AMR

Producers and their veterinarian were responsive and aware of the problem of AMR. When asked whether they agreed or disagreed with the statement that "*AMR is just a fashionable topic and a passing fad*", 80% (76/95) disagreed with this statement.

In terms of antibiotic use, 79% (75/95) agreed with the statement that antibiotic use in the UK livestock sector is too high. Asking specifically about whether they perceived that there were AMR bacteria on dairy farms, 46% (44/97) of the respondents estimated the percentage of UK dairy farms with AMR bacteria as 25 % or less (Figure 2), whilst 23% (22/97) of the respondents estimated the percentage of UK farms with AMR bacteria as 100%. Narrowing down whether producers thought there was AMR on their own farm, 41% (36/87) of the producers and their veterinarians thought there was mild AMR on their farms, and 36% (31/87) thought there was moderate AMR on their farms (none 1%, very limited 18%, and severe 3%).

Figure 2. Participants' response to the question to estimate the presence of AMR bacteria on UK dairy farms

In the fight against AMR, producers and veterinarians indicated that they see the role of veterinarians as being somewhat more important than the role of producers (Figure 3). In response to a question about the importance of the role of the producer in the fight against AMR, 70% (68/97) of respondents indicated that the role of farmer was very important. This is compared with the response to a similar question about the importance of the role of the veterinarian in the fight against AMR, where 87% (84/97) of the respondents indicated the role of the veterinarian was very important

Figure 3. Participants' response to the question about the importance of the role of the producer and the veterinarian in the fight against antimicrobial resistance

An important question for the future success of the policy development process was whether the producers felt able to reduce the amount of AMs they used on their farm whilst also maintaining the

same production levels and health of their herds. 73% (71/97) of respondents indicated they felt they were able to reduce the amount of AMs on their farms.

In the third and fourth regional workshops, a specific question was added. Producers and the veterinarians were asked whether or not they felt they could specifically reduce the use of AMs of major importance to treat serious infections in humans; 53% (27/51) indicated they could.

Antimicrobial Stewardship Policy

A conceptual model originally developed by Speksnijder and colleagues (2015a) was adapted by the project team to provide a structure (core principles) around which the final stewardship policy was developed:

Principle 1: Disease reduction strategies

Principle 2: Ensuring correct use of medicines

Principle 3: Avoiding prophylactic use

Principle 4: Encouraging quality data recording and use

Based on the strategies discussed during the workshops, policy-specific and practical measures were developed (Table 1). Practical measures were organised under the following policy statements, which were developed during subsequent meetings with the producer representatives after the regional workshops. These policy measures adhered to the above-mentioned principles, and were stated in active forms.

- All producers use animal production practices that reduce, and, where possible, eliminate the need for AM therapies.
- All producers work with their veterinarians to assess and address disease risk regularly.
- On all farms, all staff engaged in using antibiotics use them responsibly or are adequately supervised by staff who are able to do so.
- On all farms, the use of antibiotics to prevent disease is minimalised.
- On all farms, unified data is collected and used to benchmark and compare medicine use within and between farms in order to work towards further reductions in AM use.

The term ‘responsible use’ was clarified to reflect an individual as being able to identify the correct animal to treat (only treating infections), as well as identifying the correct product to use at the correct dose (amount) and correct duration (including initiating treatment at the right time).

Table 1. Policy measures - Antimicrobial Stewardship Policy, Year 1

Whilst developing the policy, it became clear that, within the producer groups there was only limited information available as to the levels of AM use on farms. Hence, some of the policy measures could only be defined if more detailed information on current use was available. Thus it was decided that the measures agreed on would initially only apply to the first year of implementation, and that the policy would be updated and reviewed on a yearly basis as the understanding of use on farms develops and scientific evidence on the subject grows.

Participation in the policy development process

Evaluations at the end of the workshops indicated a consistently positive response from participants (Figure 4). Comments provided on the *benefits* of participating in the workshop included:

“*made me think about antibiotic use more”*

“*knowing the opinions of my fellow producers*”

“*ideas for moving our practice forward, using drug usage as part of the Herd Health Plan*”

“*helped develop policies to advantage all parties*”

“*helped make policy that works for the farmer*”

Figure 4. Participant’s response to regional workshop evaluation questions

(note: Question 4 was left blank by some respondents as this question was not relevant for veterinarians.)

Although generally very positive about the workshops, participants also felt that the development of such a policy was difficult and mentally taxing. Scoring their experience from 1 (not at all challenging)

to 10 (very challenging), over 42% (33/78) of participants gave a score of 8 and higher as to whether they felt participation in this process was challenging. More than half of producers (58%; 45/78) gave a score of 8 or more as to whether they envisaged making any changes to their use of AM medicines on farm as a result of their participation in the workshops. Changes mentioned by producers and veterinarians included:

"*more targeted approaches*"

"*further reduction in use of cephalosporin, more selective dry cow therapy*"

"selective dry cow therapy, bacteria testing on farm"

"*better storage and disposal of partly used AMs*"

*"reduce use of Naxcel (*ceftiofur, a 3rd generation cephalosporin*)*

"*more prevention*"

"*stop using Marbocyl (*marbofloxacin, a fluoroquinolone*) and Cobactan (*cefquinome, a 4th generation cephalosporin*) injectables"*

"*changing dry cow therapy, reducing 3rd and 4th generation AMs* "

Discussion

This is the first known application of PPM to livestock health policy. The policy development process provided a unique opportunity for intensive collaboration and dialogue between producers, veterinarians, industry partners and researchers. The participatory process provided comprehensive learning for all involved, and allowed for the integration of science and the producers' own knowledge and experience. The process led to the development of credible and practical recommendations designed to deliver real on-farm changes in antibiotic use. Achieving genuine and effective change in AM use depends upon the collaborative engagement of farmers, veterinarians, and other actors along the value chain, including milk buyers and retailers (Buller et al., 2015).

Although evidence of substantive increases in AMR bacteria in the dairy sector is currently limited (EFSA, 2015; Landers *et al.*, 2012), three quarters of producers (and their veterinarians) in this survey

thought that they had mild to moderate levels of AMR on their farm. This result brings up a number of other questions: On what evidence is this claim being made? Are farmers and veterinarians experiencing reduced effectiveness of AMs on their farms, or is their perception of this issue driven by media or by the concern of the retailer they supply?

In developing the practical policy, there was a tension between the producers' commitment to set common and consistent measures as a group and their individual desire to retain personal autonomy of action. Producers were willing to commit to the policy measures; however, how each measure was to be implemented and achieved on farm needed to be farm-specific and in the hands of the individual producer. As a result of this tension, the measures adopted were less prescriptive in nature than, for example, the RUMA guidelines. Being less prescriptive should not necessarily mean less effective, however, as Biggs and colleagues (2016) have shown less prescriptive and more bespoke criteria to select cows for dry cow therapy on dairy farms can lead to better results in terms of reduced AM use. Comparing the adopted policy measures in the current study with the RUMA guidelines revealed that most aspects indicated in the guidelines had been included. Those specific issues which were not included were nevertheless discussed within the workshops. For example, keeping closed herds (where no introductions of new animals are made in order to ensure biosecurity) was tabled, but was not considered possible for all producers, particularly those with organic herds.

Discussions over what measures to include and how best to achieve these measures was challenging at times. One particular area of difficulty for farmers was maintaining a coherent and correct policy of medicine use when staffing was often inconsistent and changing (particularly with the use of relief milkers or casual workers). Contrary to human health where those who administer medicines need to have a licence or specific training, in the farming sectors of the UK, AMs prescribed by the veterinarian are largely administered by producers and farm staff. Producers indicated they were able to ensure their permanent staff had the appropriate qualification and training relevant to administering AMs, however this was seen as much more of a challenge when using temporary relief workers. Thus, making certain that the correct animal is treated, with the right dose, at the right time and right duration becomes more

difficult. The producers agreed to overcome this by defining clear responsibilities regarding AM use and having clear AM decision trees with protocols for applicable diseases in the relevant languages for the nationalities of the relief workers.

Although recording AM use on farms is required by law (DEFRA, 2012), producers in the UK have few methods to aggregate these records, therefore little comprehensive data is available which relates to AM use on individual or group levels. For this reason, there is at present no clear understanding of AM use per individual animal on UK farms. Medicine data recording is a mandatory requirement in the Royal Society for the Prevention of Cruelty to Animals and Soil Association standards as part of farm assurance in the Herd Health Plan (Hemsworth *et al.*, 2009). However, differences in recording practice, little agreement on choosing specific numerators or denominators, and the absence of a single universal recording system used by all group members was a limitation. During the policy development process, producers realised that to be able to set realistic reduction targets (Key Performance Indicators) and to benchmark AM use well, they would have to gain a better understanding of how medicines were being used on both individual and group levels. Also, currently in the UK, there are few methods of systematically integrating farm management and veterinary data. The producer groups therefore agreed that in the first year of policy implementation, the focus would first be to collate and use all on-farm data for analysis.

Through the four regional workshops, all producers in the two groups participated in the process. It is anticipated, however, that engaging all producers of a particular group in the PPM process might not always be practical. Initial discussions have now been held with sheep and beef producer groups supplying the same retailer to implement a similar policy development process. Working with these groups will bring a new set of challenges, as the number of producers are much larger and more geographically diverse. Other challenges in terms of transferability of the PPM approach relate to the efficacy of producers. The belief of producers in their own ability to make a change is essential for the success of this process. The participating dairy producers felt they had the power and autonomy to make changes on their farms; this, however, might not be the case in all livestock sectors nor in all countries.

Particularly in the poultry and pig sectors, producers are less autonomous and might not feel empowered enough to make this process a success. Further work using the PPM approach in different contexts and settings is necessary to explore transferability of the approach.

Concluding Remarks

This research provides insight on how to enable groups of dairy producers to conceive, design and implement AM stewardship policies to address the challenge of more responsible use of medicines on farms, while maintaining or improving dairy herd health and welfare. As an initial step in creating better understanding of how participatory approaches with producers can be applied in a UK context and more widely, this work serves as a pilot for promoting more responsible use of AMs in other livestock species.

Acknowledgements

We would like to thank all producers who are members of WD Farmers and producers in the Coombe Farm organic milk producer groups, along with their veterinarians, who so actively participated in the policy workshops. We also would like to thank Paula Baker, Gwen Rees and Esther Jones for their assistance with the workshops.

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