SOCIETY DEBATE AND MEDICINE USE – AS CASE DAIRY HUSBANDRY IN THE NETHERLANDS

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Abstract

Medicine use in animals and in particular antibiotic use is under criticism of the society. Therefore, antibiotic use in dairy herds in The Netherlands in the period 2005-2012 was studied. The number of daily dosages per cow per year was applied as the indicator for antibiotic use. A large variation in use at herd level was found, which decreased over time. The effect of public pressure on the reduction in antibiotic use is explained by examining the differences in trends between three groups of farmers. One group was guided in their antibiotic use, one group was very diverse, and one group consisted of participants of a long term nutrient management project. The adaptation process was compared with the diffusion of innovation theory of Rogers.

1. Introduction

Increasing resistance of bacteria to antibiotics has been observed in hospitals, which has led to concerns in human medicine practice. Application of antibiotics in animals to prevent and treat animal health problems is blamed for contributing to the growing bacterial resistance in humans. Grave et al. (2010) compared sales of veterinary antimicrobial agents for the year 2007 across 10 European countries, based on the total amount of active substances used in all animal sectors. Use in The Netherlands was reported to be relatively high. The European Food Safety Authority panel on Biological Hazards (EFSA, 2011) concluded that a highly effective control option would be to stop all uses of modern antibiotics (called 3rd class antibiotics) or to restrict their use; it was also considered of high priority to decrease total antimicrobial use in animal production in the EU.

In The Netherlands, societal and political debate regarding antibiotic use intensified since 2008. A consumer survey which showed that information on food safety (e.g. contaminants and medicines), ranked highest amongst consumer wishes contributed to this (Verhees et al. 2008). Also the discovery of livestock associated MRSA (*staphylococcus aureus*) in hospitalised Dutch patients (Van der Zee et al., 2013) and the detection of the same strains of ESBLs (*extended spectrum beta-lactamases*) in the livestock chain and humans (Leverstein-Van Hall et al., 2011) caused serious concerns. This led to the situation that patients from animal husbandry background do undergo a specific procedure when entering a hospital, especially in the animal intensive areas in the South of the country. They are checked for presence of antibiotic resistant bacteria.

In the period 2007 to 2013, The Ministry of Agriculture, Nature and Fisheries (now the Ministry of Economic Affairs) in cooperation with the Ministry of Public Health, sent 21 official letters to the Netherlands' Parliament, explaining the problems and proposing solutions. A Memorandum of Understanding was signed in December 2008 between the Ministry of Agriculture, Nature and Fisheries, the Ministry of Public Health, the animal sector representatives and the Veterinary Association to monitor antibiotic use in the cattle, pig and poultry sectors and develop actions to reduce it. In December 2010, targets of a 20% overall reduction in 2011 and a 50% reduction in 2013, taking 2009 as base year, were added to the

memorandum. From 2011 onwards, efforts focusing on awareness raising have been undertaken by farmers' organizations, the Veterinary Association and Practices, and Dairy Processing Cooperatives and Companies. The preventive use of antibiotics including dry-cow therapy came into then discussion. Since January 2012 the use of modern drugs are prohibited, unless the veterinarian substantiates on the basis of a herd examination, that no alternative drug is available for treatment of the particular health problem.

Studies on antibiotic use at herd level are very limited, illustrating that antibiotic use is an emerging topic. About the effect of policies and public opinion on changes in antibiotic use in dairy herds has not been reported. The aim of this study was to examine the effects of farm and farmer and society on the trends in use.

2. Data, farmer groups and methods

In the period 2004-2005, dairy stakeholders in The Netherlands discussed that it was desirable to try to realise a more useful use of veterinary medicine data (Kuipers et al., 2005). A pilot study was performed to examine the collection of such data and to find useful tools to deal with such data. During the following years, data on medicine use were collected from three groups of farms comprising a total of 94 dairy herds. These data covering the period 2005-2012 together with experiences over that period provided the source material for the present study.

Medicine data from each participating herd were collected from the invoices of veterinary practices. Three groups of farmers were involved in this study: 1. A guided group of 41 farmers; 2. An incidental group of 40 farmers; 3. An environmental group of 13 farmers. This last group of farmers consisted of the participants in a long term sustainability project on nutrient management on the farm.

In this study, the number of Animal Defined Daily Dosages was used as indicator for antibiotic use. When applied to cows, the number of daily dosages indicates how many days per year an average cow in the herd is under treatment with antibiotics. There were 3 treatment categories assigned, i.e. injectors for dry-cow therapy (used at the moment of drying off), drugs for udder health (mastitis) and all other drugs. The "other" drugs were used for claw and leg problems and for health reasons related to the intestine and respiratory tract of the animal. In veterinary practice in The Netherlands, drugs are specified as 1st choice drugs which are advised, 2nd choice drugs which are permitted, and 3rd choice drugs (modern antibiotics), which are restricted in application and can be applied only by veterinarians since year 2012. These last drugs are essential for treating human patients who do not react to the traditional antibiotics and have serious health problems. Human medicine authorities and doctors focus their critics mainly at use of those drugs for animal application.

The analysis was done by calculation of the average number of daily dosages per cow per herd during the period 2005 till 2012. The number of daily dosage is calculated on a yearly basis. Most herds were served by different veterinarians. The trends in use were explained applying the "diffusion of innovations theory" of Rogers (1995)

3. Results

The total group of 94 dairy farms was spread over the country and was linked to 32 veterinary practices out of a total of about 300 practices partly active in farm animals. This sector comprises 18,682 herds with an average herd size of 79 cows in 2012. The guided, incidental and environmental farmer groups had average herd sizes of, respectively, 110, 107 and 130 cows.

Variation

The overall mean for the years 2005 to 2012 and standard deviation of the number of daily dosages were 5.86 and 2.14 per year, respectively. The lowest number of daily dosages was 0.4 and highest was 16.5. The distribution of the number of daily dosages was somewhat skewed towards higher values.

Trends

The trends in ADDD over years for the 3 farmer groups are illustrated in Figure 1. The results are presented for three phases. In the first phase 2005 to 2007, farmers were still increasing antibiotic use. The second phase 2008 to 2010 was a period of growing societal awareness and the start of a reduction in antibiotic use by some farmers.

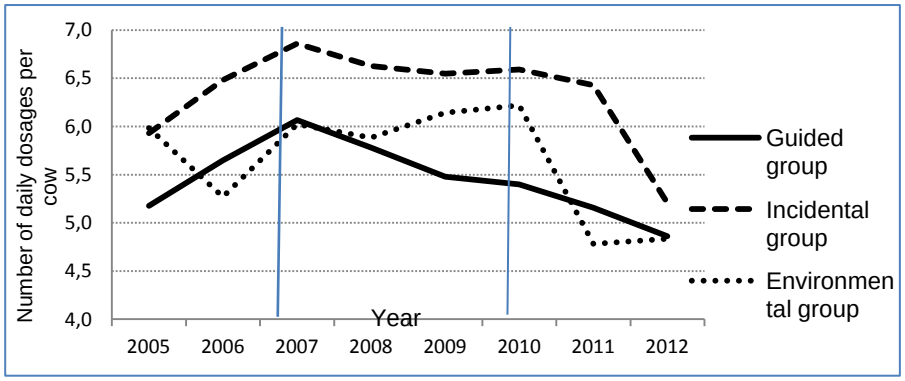

Figure 1. Trend in number of daily dosages for 3 farmer groups split into 3 time phases

The group of farmers which was guided since 2008 did achieve a significant drop in use in the second phase (see Figure 1). The environmental group of farmers were participants in a sustainability program, but were not acquainted with the antibiotic issue until 2012. Nevertheless, this group reacted to the public debate by reducing antibiotic use very significantly in 2011, the reduction phase of the process (2011-2012). The incidental farmers group reacted in 2012 to society pressure and the regulations, which were introduced in 2012 onwards. This regulation restricted the 3th class antibiotics.

Rogers' theory of innovation

The trends in use for the groups of farmers were also described by applying the diffusion of innovations theory of Rogers (1995). Diffusion relates to the process in which an innovation is communicated through certain channels over time among members of a social system. In our case we applied it to a farmers' community. Newness of an innovation may be expressed in terms of knowledge, persuasion or a decision to adopt. In this study it applies to the notion of a responsible antibiotic use. He described how populations react on the introduction of innovations. Usually there is an upward trend of adaptation. However, when we applied it to antibiotic use in this study, a downward trend was expected to occur. If public pressure increases to reduce antibiotic application, first a small group will react, resulting in a small overall reduction in use. When this is seen to be feasible, more farmers will follow resulting in a larger overall reduction in use. Finally, the remaining conservative farmers will adopt the practice. Rogers indicated five categories of system innovativeness: Innovators, Early adapters, Early majority, Late majority, and Laggards.

The adaptation process in this study did follow the principle of Rogers' theory. The trend in antibiotic use from 2007 on shows a downward trend. The guided group can be seen as the Early adapters (or innovators). The environmental group of farmers were Innovators in that particular field for several years, but were not

active with the antibiotic issue, as was experienced by us. However, they reacted quite actively to the public debate by reducing antibiotic use in 2011. They may be characterised as the Early majority category. The incidental farmers group behaved like the Late majority category by reacting in 2012 to the societal pressure and to the regulations concerning 3rd choice drugs.

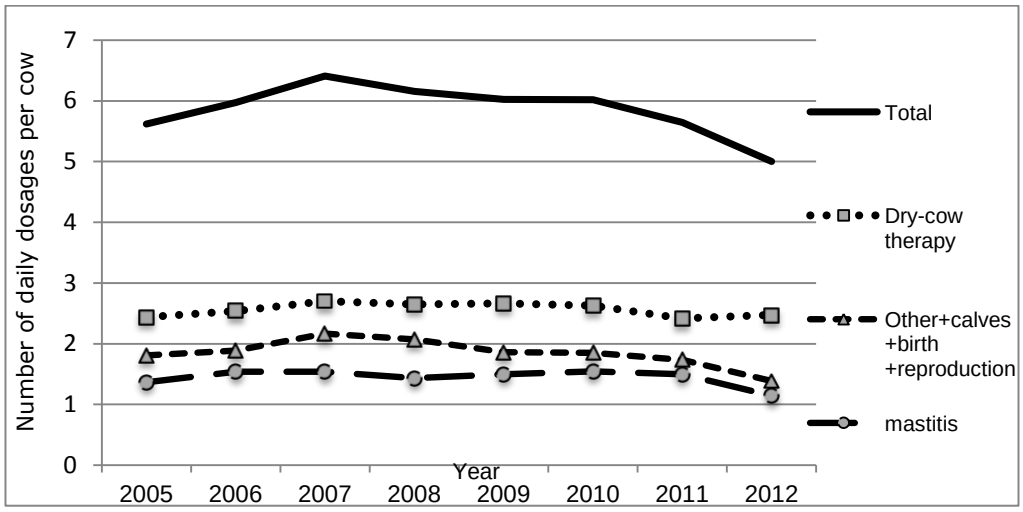

Figure 2. Number of daily dosages per cow per year distributed among 3 treatment categories and total usage over period 2005-2012

Treatment category

The drugs were designated to some treatments categories. The main treatment groups were dry-cow therapy and mastitis, both related to udder health. These accounted for 68% of the number of daily dosages in the period 2005-2012. The overall trend in use started to reduce since 2007 (Figure 2). The trend in use was mostly influenced by a lower use of "other" drugs in as well the second phase (2008-2010) as third phase (2011-2012), and by fewer drugs for mastitis in the third phase. Use of 3rd choice drugs was, on average, 18% of total usage in the period 2005-2010. This was reduced to 14.5% in 2011 and became about 1% in 2012. Veterinary costs per cow per year including medicine costs plus costs of labour of the veterinarian for farm visits and guidance increased until 2007 and then declined.

Management factors

Improvement in responsible medicine use can be achieved by applying good cow management practices and improved herd conditions. Farm factors affecting use are illustrated in Figure 3. The farmers who were considered more "successful" tended to have a higher level of antibiotics use (Kuipers et al., 2013). More successful is defined as having a higher health herd status, a lower average cell count of the herd (indicator for mastitis) and a higher milk return per cow. This also tended to coincide with somewhat younger farmers and a higher education. Clearly the environment the farmers lived in stimulated a higher use of antibiotics to keep the herd healthy. However, in a follow up study was shown that these farmers were also able to change their attitude towards the application of antibiotics the most fast. After three years of public attention for antibiotic use in animal husbandry, they decreased their level of use substantially.

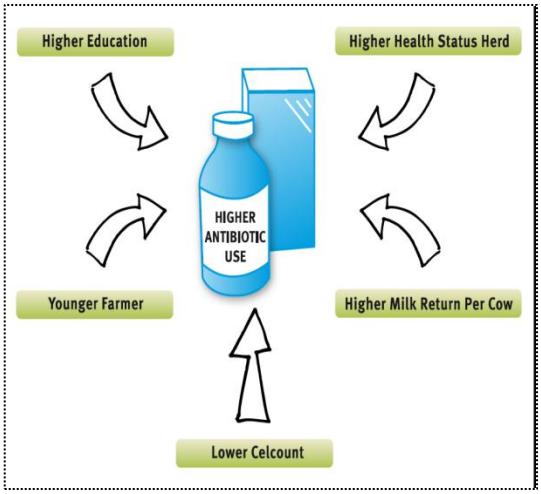

Figure 3. Farm and farmer factors influencing antibiotic use

4. Discussion and conclusions

A large variation in antibiotic use among herds was found. Udder health appeared to be the main cause for the application of antibiotics in the herd. Changes in management practices will enhance this effect. Those farmers who achieve high production standards were the most sensitive to take measures to lower the antibiotic use in their herds. They were more interested to work on this medicine topic when medicine use was linked to specific animal health categories. Trying to lower the health incidence of the herd is often a higher priority than lowering the antibiotic use. Both should preferably be approached in combination with each other.

The trend in antibiotic use by the one farmer group that was guided and the two non-guided groups could be described by Rogers Diffusion of Innovation theory. Restrictions on the use of 3rd choice drugs were successful in minimizing use. Veterinary cost per cow decreased in recent years linked to the downward trend in use.

It appeared from the present study that adaptation was easier for clinical mastitis and the "other" drugs than for dry-cow therapy injectors. However, there is considerable variation in practices within and between dairy producing countries that can provide useful information. Especially in Denmark and New Zealand other approached to medicine usage exist. For instance, the dry-cow therapy is less strictly applied than in other intensive milk producing countries. Also, antibiotic level targets may be sharpened by governments in years to come depending on the development of antibiotic resistant bacteria and societal involvement. This will affect the approach on farm level directly.

Effective communication about animal health issues was studied by Jansen et al. (2010). They worked with hard-to-reach-farmers. In this study, awareness raising proved to be helpful in the reduction of the antibiotic level and also in the variation in use. However, a combination of awareness raising and restrictive measures appeared to be really effective in reducing antibiotic use, although specific goals for the dairy sector have not yet been reached. The national reduction in antibiotic sales in the study period was much higher than in the dairy sector. This was due to the the large reductions in use in the pig and poulty sectors. Those sectors more than halved the total number of daily dosages applied together (thus more than 50% reduction was achieved). However, this trend in application is not extended to years 2013 and 2014. In other words, the reduction in use is levelling of. A responsible minimum level of use has to be sought, both satisfying animal welfare and human medicine interests. This is the big challenge to deal with in coming years. In this context, research focussed on this topic can be useful as well as experiences from health management in ecological farming.

The involvement and commitment to policy goals of the veterinary profession is very important in achieving a change in the behaviour of farmers. In The Netherlands, the main tools of communication between a veterinarian and a farmer are the animal health plan and the treatment plan. The animal health plan contains a series of management and housing factors that may influence dairy cow health and therefore medicine use. It is a herd evaluation sheet and tool, which is discussed each year with the farmer. The treatment plan presents the most suitable drug per treatment category. This plan requires to be regularly updated by the veterinarian to make it applicable to the specific health situation in the herd. Moreover, a suitable presentation of data to farmers and veterinarians supports the awareness raising process. From 2012 on, farmers are informed about their number of daily dosages on herd basis on a quarterly basis by the Netherlands Veterinary Medicines Authority. This Authority is responsible for the execution of the national targets. A website application is available for communication and reporting purposes. The reported number of daily dosages for each herd is accumulated over time as a rolling average. A warning value is presented each year by the Medicines Authority for each animal species. When a dairy farm is exceeding this value for cows, the farmer is contacted by the dairy company and requested to take action. The dairy industry is very involved in this topic of antibiotic application. One of their actions is to integrate antibiotic use indicators into their quality assurance schemes (Kuipers and Verhees, 2011).

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