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Antibiotic use in dairy herds in the Netherlands from 2005 to 2012

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ABSTRACT

The aim of this study was to examine the variation in antibiotic use and the effects of external factors on trends in antibiotic use at the herd level by using the number of daily dosages as an indicator for antibiotic use. For this purpose, antibiotic use was analyzed in 94 dairy herds in the Netherlands from 2005 to 2012. The herds were divided into 3 groups of farmers: one group was guided in their antibiotic use from 2008 to 2010 as part of the project, whereas the other 2 groups were not actively guided. The farms were located in 10 of the 12 provinces and were clients of 32 of the 300 veterinary practices that treat cattle. Sales invoices from the veterinary practices provided the antibiotic and cost data for the participating farmers. The number of animal-defined daily dosages (ADDD) indicates the number of days per year that the average cow in a herd is given antibiotic treatment. The average ADDD for all farms from 2005 to 2012 was 5.86 (standard deviation = 2.14); 68% of ADDD were used for udder health, 24% for clinical mastitis and 44% for dry-cow therapy. Variation in ADDD among herds decreased during the study period. The trend in ADDD can be described as having 3 phases: (1) a period of increasing use coinciding with little public concern about antibiotic use (2005–2007), (2) a period of growing awareness and stabilization of use (2007–2010), and (3) a period of decreasing use coinciding with increasing societal concerns (2010–2012). The greatest reduction in use was for drugs other than those used to treat the udder. Drug use for mastitis treatment fell considerably in the final year of the study period, whereas farmers were reluctant to reduce use for dry-cow therapy. Almost 40% of the herds were given less than 2.5 ADDD for dry-cow therapy, which is equivalent to 2.5 tubes per average cow in the herd, and 20% used more than 3 tubes per cow. Use of third- and fourth-generation cephalosporins and fluoroquinolones dropped from 18% of ADDD during 2005 to 2010 to 1% in 2012, with a shift toward penicillins and broad spectrum drugs. The ADDD was 22% lower in 2012 than 2007, the year of the highest usage. The decrease in ADDD over time varied between the 3 groups of farmers. During the second phase of the study, the guided group began to display a reduction in use, whereas the other groups only displayed a significant reduction in the third phase. The reduction in antibiotic use has resulted in lower veterinary costs per cow in recent years.
Key words: antibiotic use, variation and trend, dairy farmer group, treatment category

INTRODUCTION

An increase in the resistance of bacteria to antibiotics, as observed in hospitals, is causing concern among medical practitioners (Schwarz et al., 2001; EFSA, 2009, 2011). The use of antibiotics in animal production is blamed for contributing to the increasing bacterial resistance to antibiotics in humans (Wise et al., 1998; Refsdal, 2000; Oliver et al., 2011). Leverstein-van Hall et al. (2011) have shown that bacteria in human patients, retail chicken meat, and live poultry share the same extended spectrum β-lactamases (**ESBL**) genes and plasmids. Likewise, Reist et al. (2013) and Timofte et al. (2014) reported the presence of ESBL in bacteria found in slaughtered cattle and milk from cows with mastitis. The European Food Safety Authority (EFSA, 2009) has reported on the presence of methicillin-resistant *Staphylococcus aureus* (MRSA) in livestock. Brunton et al. (2012) linked the high prevalence of cefotaximase-producing *Escherichia coli* in dairy calves to the selective pressure induced by the high level of antimicrobial residues in the waste milk fed to calves.

Grave et al. (2010) compared the sales of veterinary antimicrobial agents across 10 European countries in

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2007 based on the total amount of active substances used in all animal sectors. Use of these agents 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 cephalosporins, systemically active third- and fourth-generation cephalosporins, or to restrict their use; as co-resistance is an important issue, it is also of high priority to decrease total antimicrobial use in animal production in the European Union."

In the Netherlands, societal and political debate on antibiotic use has intensified since 2008, following a consumer survey showing that information on food safety (e.g., contaminants and medicines) ranked highest among consumer demands (Verhees et al. 2008). The discovery of livestock-associated MRSA in hospitalized Dutch patients (van der Zee et al., 2013) and the detection of the same strains of ESBL in the livestock chain and humans (Leverstein-van Hall et al., 2011; Dierikx et al., 2013) have also fueled public debate.

A Memorandum of Understanding was signed in December 2008 between the Netherlands Ministry of Agriculture, Nature and Fisheries, the Ministry of Public Health, animal sector representatives and the Veterinary Association to monitor antibiotic use in the cattle, pig, and poultry sectors and develop use-reduction strategies. The targets, which included a 20% overall reduction by 2011, increasing to a 50% reduction by 2013 with 2009 as a base year, were added to the Memorandum in 2010. Since 2011, actions to raise awareness of antibiotic use have been undertaken by farmers' organizations, the Veterinary Association and Veterinary Practices, and the Dairy Processing Cooperatives and Companies. The preventive use of antibiotics, including dry-cow therapy, has come under scrutiny. In January 2012, the use of third- and fourth-generation cephalosporins and fluoroquinolones was prohibited unless, following a herd examination, a veterinarian substantiates that no alternative drug is available for the treatment of the particular health problem.

Several studies have discussed antibiotic use in traditional and organic dairy farms (Zwald et al., 2004; Sato et al., 2005; Bennedsgaard, et al., 2010); a literature overview on antibiotic use was reported by Van Werven et al. (2012). Overviews of the use of active substances and treatments in 1,013 herds in major US dairy states were presented by Hill et al. (2009). Pol and Ruegg (2007) developed a method of quantifying drug usage and treatment practices, using the number of defined daily dosages per adult cow per year, providing insight into antibiotic use on 20 traditional and 20 organic farms in Wisconsin. The same indicator was used by Saini et al. (2012), who estimated drug use in 89 Canadian herds.

However, studies on antibiotic use at the herd level are rather limited, illustrating that antibiotic use is an emerging topic. Insight into the methods of antibiotic use and use-reduction strategies would be useful in guiding such a trajectory. Until now, knowledge of the effects of policy initiatives and public opinion on changes in antibiotic use in dairy herds has been scarce. In the studies that have been published, an examination of trends over time was not feasible due to the short duration of the studies.

Discussions in 2004 and 2005 among dairy stakeholders in the Netherlands recognized the necessity of improving the use of veterinary medicine data (Kuipers et al., 2005a). A pilot study was undertaken to examine the data collection and identify useful indicators for monitoring medicine use in dairy herds. Subsequently, data on antibiotic use were collected from a group of dairy farms over an 8-yr period. Against this background, the objectives of our study were to examine the variation in antibiotic use over time with the effects of selected external factors on the trends in antibiotic use at the herd level.

MATERIALS AND METHODS

Source of Data

Data on drug use were collected in a group of 94 dairy farms in the Netherlands from 2005 to 2012 as part of two consecutive projects on medicine use. These data, together with experiences recorded during the same period, provided the source material for the present study.

Sales of drugs to farmers are facilitated by veterinary practices and recorded in their management administration system. Additionally, drugs used by veterinarians during farm visits and the number of hours the veterinarian spent on the farm are also recorded daily in the management administration system. Each month, invoices are prepared and sent to the farmers based on the recorded data. The farmers participating in the study signed an agreement permitting the project team to collect detailed drug usage data from these invoices from the veterinary practices. Initially, some farmers also purchased small quantities of drugs through online veterinary services. Where this occurred, the invoices were copied from the farm records, but this practice ceased during the course of the project. The invoices list the brand names, quantities, and costs of the drugs and other materials alongside costs (professional fees)