**VetStat – The Danish nation-wide monitoring of veterinary medicine use on herd level**

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**Summary:** The Danish monitoring programme, VetStat, collects detailed data on all veterinary usage of therapeutic drugs and coccidiostats on herd level. The detailed information enables standardization of drug usage and allows comparison between individual herds. The vision is to prevent misuse and optimize the usage of antimicrobial drugs. This is achieved by providing information to farmers, veterinary practitioners, and control authorities about usage patterns and linking with bacterial antimicrobial susceptibility data at farm level, and by aiding the development of prudent guidelines. Data will be used in research and in risk assessment to aid the development of risk based control strategies in the food chain, reducing the spread of resistant bacterial infections from animals to humans. The presentation gives a description of the design of the system, the validation of the data, and the prospects for using the information to protect animal and public health.

**Keywords:** antimicrobial, resistance, surveillance, drug statistics, veterinary.

**Introduction:** In recent years, a global concern of the veterinary antimicrobial use contributing to antimicrobial resistance both in animals and humans has arisen. Detailed information on utilization of antimicrobial drugs in food animals is vital for assessment of the contribution of antimicrobial usage to the emergence and trends in resistance problems and for the evaluation of the effect of the measures taken. Acting on the recommendations from "The Microbial Threat", an invitational EU conference held in Copenhagen in 1998, the Danish government decided to implement herd level monitoring of all prescription medicine usage in production animals. While Denmark had for some time monitored such usage on the basis of information provided from the top of the distribution system (i.e., by the pharmaceutical industry) the new monitoring program, VetStat, collects data close to the end user. Since 2001, VetStat has produced valid data at the national level and monthly usage statistics are published at the Danish Zoonosis Centre homepage (http://vetstat.vetinst.dk).

**Data collection.** In Denmark, virtually all therapeutic medicines are prescription-only and, with few exceptions, available only through pharmacies. Medicines obtained by veterinarians for use in practice or for re-sale to clients must also be purchased through pharmacies. The only exceptions to the pharmacy monopoly are vaccines, and the use of premixes approved for use in medicated feed at licensed feed mills. The medicated feed is obtained by the farmer only on the basis of a veterinary prescription. However, coccidiostats approved in the EU as feed additives are freely available from the feed mills. More than 95% of the antimicrobial drugs used in pig production are sold directly to the farmer from the pharmacy, while about 2% is purchased at the feed mills. The VetStat program collects data from feed mills, production animal practice, and pharmacies on feed additives (coccidiostats and antimicrobial growth promoters) and all prescription medicines, including both veterinary and human medicines used in animals. The data record, describing each prescription item used or sold to the farmer, comprises

- Date (of sales if not of usage by veterinarian)
- Source: Identity of dispensing pharmacy, feed mill, or the veterinarian using the drug.
- Prescriber: Identity code of veterinarian and identity code of the practice.
- Drug information: Quantity dispensed and a numerical code identifying unequivocally the type of medicine, including the formulation, active components, strength and size of pack, administration route and ATC/ATCvet –code (Anonymous,1999).
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• Recipient: Farm identity code (CHR-ID), intended animal species, age group (when appropriate), and disease category. In poultry, the “age-group” represents the animal production classes. For medicines sold at pharmacies for use in practice, similar drug information, the date, and the receiving practice is identified. Data on companion animals and horses are reported with fewer details.

At the pharmacies, the information is extracted automatically during electronic processing of sales, and data are transferred at least once a month to VetStat. Feed mills records on sales are entered directly to the database via the Internet, or transferred once a month. Veterinary practitioners report to all prescription medicines used in practice for treatment of production animals. For data collection, most practices use software that automatically extracts the information required by VetStat during the billing procedure. Veterinarians also have the option of recording usage directly into the VetStat database via the Internet.

**Data validation.** The VetStat information is subject both to logic validation on some data and to validation of the amount of drugs reported. Logic validation is a correctional “filter” where all information has to comply with certain criteria contained in fixed table within the database. Data from pharmacies are subject to logical validation of the Nordic item number at data entry, and subsequent validation of the correspondence between animal code, age group, and CHR number after data entry. The percentage of errors is low and declining (in 2002, 4%-7% erroneous codes) and the sources of errors have currently been addressed. Data from the feed mills are subject to logic validation of the individual codes at data entry over the Internet. The percentage of errors in the data from the veterinarians has been high due to technical difficulties in the complex system with multiple routes for transferring data from the veterinary practitioners. A number of technical errors have been corrected in 2002 and, from the onset of 2003; the data are subject to full logic validation within the database. Data records with non-corresponding data on age group, animal species and disease classes, invalid CHR number, or invalid constellations of drug identity and units are returned the practitioner, who must then correct the data via the Internet. Validation of the amounts of drugs is facilitated by the fact that virtually all therapeutic drugs are prescription-only. The data on amounts of medicines used in veterinary practice may be validated against pharmacy data on sales to the specific practice. Pharmacy and feed mill data on annual usage of antimicrobial drugs have been validated against the wholesalers’ statistics, and the VetStat data on total antimicrobial usage have been found to be reliable (Anonymous, 2002). The pharmacy information on drug identity and amounts has a very high validity due to a strict relation to the electronic registration of any sale conducted at the pharmacies.

**The database.** The VetStat database is a relational database on an Oracle platform and is part of the so-called GLR/CHR register, operated on behalf of the Ministry of Food, Agriculture and Fisheries. This GLR/CHR comprise also the central husbandry register (CHR), containing information on farm level about the animal species the number of animals within different age groups, production type, geographic information among other information.

The detailed information in VetStat enables standardization of drug usage, taking into account the potency of the drugs and the animals in which they are used, providing better measures of antimicrobial usage on a national level, and allowing comparison between individual herds. Standardized animal daily doses (ADD) have been defined for every therapeutic formulation (each Nordic item number) and each species. The general principles for standardization of dosage for animals are parallel to the defined daily dosage (DDD) used for human usage, i.e., the mean daily maintenance dose for therapeutic use for the main indication, required to treat an animal of a certain species. For each species and age group, a standard animal weight has been defined, to enable the calculation of an ADD. By relating with data in the CHR database, the prescription rate (Thrane & Sorensen, 1999) for the target group, i.e., number of animals registered within the age group on herd level, can be calculated. Standardization of usage at farm level relative to number of animals is sensitive to the data quality of the CHR-register. Currently, the Danish authorities are addressing the data quality in the Central Husbandry Register.
Employment of the VetStat data. The information on antimicrobial usage in animals can be employed to support prudent use of antimicrobials on different levels:

- Control and intervention to ensure compliance with developed strategies and regulations on the use of antimicrobials,
- Assisting in the interpretation of resistance surveillance data
- Providing information for research in specific use conditions that govern selection and dissemination of resistant bacteria
- Providing vital information for risk assessment of resistance development at the population level.

Prudent use is further supported by providing direct access for veterinary practitioners and farmers to data concerning their own clients or herds via the Internet. The practitioner and the farmer can compare the standardized usage on the individual farm with the mean usage in similar herds on a regional or national level, thus assisting in pointing out herds with potential management problems. As a tool for optimizing the usage, direct linking with bacterial antimicrobial susceptibility data collected at the Danish Veterinary Institute (isolates from surveillance and clinical specimens) at farm level will be provided.

The authorities are using the data for regulatory control of antimicrobial usage and monitoring of the impact of new legislation. With an unrestricted access to data via the Internet, the authorities may use the system to point out farms with a particular high or low drug, as well as irregularities in regard to the legislation, and identifying the responsible practitioners.

A major objective of the VetStat program is to provide detailed data for research purposes. The veterinary usage of antimicrobial drugs is usually measured in weight of active compound, despite clear limitations as a measure usage and its impact on development on resistance (Chauvin et al., 2001). Taking into account the antibacterial potency, mode of activity, and formulation of the drug provides a more accurate measure of the relative importance of different antimicrobial drugs for generating bacterial resistance. The data enables modeling of associations between usage and resistance, including spatial characteristics and potential seasonal influences and other specific use conditions that may govern selection and dissemination of resistant bacteria.

Since 1996, data on drug usage in Denmark have been used in the interpretation of data from surveillance programs on antimicrobial resistance in the annual DANMAP reports. In the DANMAP 2001 report, Vetstat data were employed for the first time (Anonymous, 2002). The detailed consumption data are expected to give a significant contribution to the interpretation of the data from the surveillance of antimicrobial resistance and in assessing the actual risk to human from the use of antimicrobials in animal production. Linking the usage to susceptibility data may also be performed at herd level to analyze differences between groups of farms e.g. with certain animal husbandry systems, or to support the differentiation between selection of resistance and clonal spread of resistant strains. The VetStat information also enables pharmaco-epidemiologic research programs, analyzing the association between antimicrobial use and morbidity, use of vaccines or other medicines and management factors. Finally, VetStat information might be used in risk based control strategies in the food chain, reducing the spread of resistance genes and resistant bacterial infections from animals to humans.

References: