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The use of antibiotics on small dairy farms in rural Peru

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ABSTRACT

Very little is known about the use of antibiotics on small dairy farms in lower/middle-income countries. The use of these drugs can have profound impacts on animal health, farmer income and public health. A survey of 156 farmers was conducted in Cajamarca, a major dairy-producing center in the highlands of Peru characterized by small farms (<15 cows) to assess patterns and determinants of antibiotic use and farmers' knowledge of antibiotics. The reported incidence of disease on these farms was relatively low (0.571 episodes of disease per cow-year), but more than 83% of the reported episodes were treated with antibiotics. The most commonly used antibiotics were oxytetracycline, penicillin and trimethoprim-sulfamethoxazole drugs; antiparasitic drugs were also used to treat what were likely bacterial infections. An increased incidence of treated disease was significantly associated with smaller farm size, lower farmer income, the previous use of the Californian Mastitis test on the farm and antibiotic knowledge. Farmers' knowledge of antibiotics was assessed with a series of questions on antibiotics, resulting in a "knowledge score". Increased knowledge was significantly associated with the use of antibiotics for preventative reasons, the purchase of antibiotics from feed-stores, the experience of complications in animals after having administered antibiotics, the number of workers on the farm and the educational level of the farmer. Overall, antibiotics appeared to be used infrequently, most likely because therapeutic interventions were sought only when the animal had reached an advanced stage of clinical disease. Few farmers were able to define an antibiotic, but many farmers understood that the use of antibiotics carried inherent risks to their animals and potentially to the consumers of dairy products from treated animals. The results of this study are useful for understanding the patterns of antibiotic use and associated management, demographic and knowledge factors of farmers on small dairy farms in rural Peru.

1. Introduction

Small farms constitute the majority of farms in the developing world (FAO, 2010), and in many low/middle income (LMI) countries, they are still predominate suppliers of animal products to their domestic markets. Dairy production is a rapidly expanding sector of animal agriculture in the developing world because of population growth, increases in per capita income, urbanization and the westernization of diets (Cox and Zhu, 2005; Knips, 2005). However, few countries where dairy production is growing have adequate systems to ensure food animal product safety and quality. One of the areas where this is most evident is the use of antibiotics in animal agriculture. Very little is known about antibiotic use on small farms in LMI countries.

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In the dairy industry, antibiotics are primarily used for therapeutic and prophylactic purposes (Oliver et al., 2011). These uses have demonstrated benefits, including improved animal health, higher production levels and the reduction of foodborne pathogens (Mathew et al., 2007); however, they can also result in a number of problems, including the emergence of antibiotic-resistant bacteria, human and animal illness, economic loss for farmers and dairy processors and environmental contamination (Barton, 2000; Gilchrist et al., 2007; Gustafson and Bowen, 1997). The inappropriate use of antibiotics, defined by the World Health Organization as overprescription, underprescription, inappropriate dosing, an incorrect duration of treatment or the incorrect choice of drug for the relevant organism, can exacerbate these problems.

Knowledge of patterns of antibiotic use is fundamental to understanding farming practices and animal health on small farms; furthermore, a basic knowledge of how drugs are used can provide some measures of drug misuse, the magnitude of the risk of disease and an the need to introduce other disease control methods. This knowledge is also necessary for designing, implementing and evaluating regional and local interventions directed at optimizing the use of veterinary drugs and improving farming practices.

Very few attempts have been made to document antibiotic usage on smallholder dairy farms in either the developed or the developing worlds. The studies that have evaluated antibiotic use on farms have either only examined a small number of farms (Luna-Tortos et al., 2006; Roderick et al., 2000) or enrolled farms through mailed questionnaires, resulting in low response rates and potential selection bias (Dunlop et al., 1998; Sawant et al., 2005; Zwald et al., 2004). The aim of this study was therefore to comprehensively assess patterns of antibiotic use on small dairy farms in Cajamarca, a major dairy-producing center in the northern highlands of Peru. Cajamarca is characterized mostly by small peri-urban and rural farms (<15 cows/farm) with 30,000 registered milk producers (Garcia and Gomez, 2006) producing an estimated 307,187 kg of milk per day (Gerz and Boucher, 2006). The farms encountered in Cajamarca are typical of small dairy farms in many other LMI countries, especially in Latin America.

2. Materials and methods

2.1. Participants

This cross-sectional study was conducted in the countryside surrounding the city of Cajamarca, the capital of the region of Cajamarca. A list of randomly selected farmers was generated from among the farmers who work with the non-profit organization Foncreagro using simple random sampling. Foncreagro is a non-profit organization that works with small farms to develop agricultural projects related to improved farming practices and sustainable development. Foncreagro works with approximately 6000 farmers in two provinces and five districts of the region of Cajamarca. All farmers who agreed to participate provided verbal consent, and approval for this study was granted by the Institutional Review Boards of the University of Pennsylvania and the Universidad Peruana Cayetano-Heredia in Lima.

2.2. Questionnaire

The questionnaire developed for this study was adapted from questionnaires used by Zwald et al. (2004), Sawant et al. (2005), Raymond et al. (2006) and Jimenez-Velasco (2002). The questionnaire was divided into four sections: (1) information on the farms and animals, (2) disease incidence, antibiotic use and knowledge of antibiotics, (3) farm management and (4) demographic and economic information pertaining to the farmer. A copy of the questionnaire is included in the appendix with indicators of the test–retest reliability of the survey in the sampled population for a subset of questions. Questionnaires were piloted on a convenience sample of ten dairy farms in two villages outside of Cajamarca and optimized before they were administered to the full sample of farms. All questionnaires were administered in Spanish by a Peruvian veterinary student and a veterinary student from the United States. After the questionnaire was administered, the California mastitis test (CMT) was performed on all lactating cows on the farm and an average CMT score was generated for each farm. The California mastitis test (CMT) measures the somatic cell count in milk, which reflects the degree of inflammation present in the udder. Ali and Shook (1980) showed that a log transformation of SCC to a somatic cell score of the type used in the CMT achieves nearly normal distribution, and a CMT score of zero (corresponding to 200,000 cells/mL) is a generally accepted cut off with high sensitivity and specificity for intra-mammary infection (Doohoo and Leslie, 1991).

2.3. Disease incidence and drugs used

Farmers were asked about disease incidence and drug use on their farm in various ways. First, they were asked if they had used antibiotics to treat any diseases in the past year, and if so, to name the drugs used. Next, they were shown pictures of antibiotics available on the local market and asked if they had used any of those drugs in the past year. Finally, they were asked about specific categories of disease (mastitis, peri-parturient infections, respiratory infections, diarrhea, skin/foot infections and others (mostly non-specific symptoms such as febrile or off-feed)) in the past year. Farmers who reported that their cows experienced one or more episodes of disease were asked how many episodes they had observed, if they had treated any of the episodes, and, if so, with which antibiotic (using the illustrations to guide their choices).

2.4. Knowledge score

A knowledge score was generated to assess farmers' understanding of what antibiotics are and the risks associated with their use. First, farmers were asked if they knew what an antibiotic was and to define the term in their own words. Farmers were also asked if they knew what drug withdrawal times were and to define them in their own words. For each of these questions, zero points were