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Comparison of two methods for collecting antibiotic use data on small dairy farms

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ABSTRACT

Antibiotics are commonly used in animal agriculture; they can improve animal health and productivity, but their use may also represent a public health threat. Very little is known about antibiotic use on small farms in lower/middle income countries. To understand antibiotic use on these farms and promote the judicious use of these drugs, pharmacoepidemiologic data are necessary. However, acquiring such data can be difficult, as farmers are often illiterate (and therefore cannot participate in written surveys or keep treatment records), antibiotics can be obtained over-the-counter (in which case no prescriptions are generated) and monitoring and surveillance systems for drug use are often non-existent. The goal of this study was to compare two methods of acquiring pharmacoepidemiologic data pertaining to antibiotics that are well-adapted to farms in lower-middle income countries: self-report and the collection of discarded drug packaging. A convenience sample of 20 farmers in Cajamarca, Peru, participated in the study. Farmers placed discarded antibiotic packaging in bins for six months. At the end of the six-month period, farmers were interviewed and asked to recall the antibiotic usage that occurred on their farm over the past month and past six months; these self-reported data were quantitatively and qualitatively compared to the bin contents collected in the last month and previous six months. We found that the agreement between the bins and self-report was relatively poor for both the quantity and types of antibiotics used. The bins appeared to perform better than self-report when bottles and mLs of antibiotics were measured, while self-report appeared to perform better for intra-mammary infusions. The bins also appeared to perform better when data pertaining to an extended time period (six months) were collected. The results of this study will provide guidance to investigators seeking to collect pharmacoepidemiologic data in similar environments.

1. Introduction

Antibiotics are commonly used in animal agriculture for growth promotion, the treatment of sick animals and the prophylactic and/or metaphylactic treatment of healthy animals during periods of increased risk of infection. These uses can improve animal health and productivity (Mathew et al., 2007), but they may also promote antibiotic resistance among bacteria isolated from animals and humans, which can lead to infections with limited treatment options, greater mortality, and increased healthcare costs (Walsh and Fanning, 2008). The US Centers for Disease

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Table 1
Examples of methods used to acquire pharmacoepidemiological data in human and veterinary medicine and selected references of studies using the relevant methods.

Human medicine		Veterinary medicine	
Method	Reference	Method	Reference
In-person interviews of patients	Glintborg et al., 2007; West et al., 2013	Mailed/online questionnaires	McEwen et al., 1991; Dewey et al., 1999; Zwald et al., 2004; Sawant et al., 2005; Jordan et al., 2009
State or national-level health care databases	Hennessy, 2006; Hennessy et al., 2007	State or national-level surveillance systems	Dewey et al., 1999; Ruegg and Tabone, 2000; Merle et al., 2012; Stege et al., 2003; Bos et al., 2013
Drug sales records	Wirtz et al., 2010	Drug sales records	Grave et al., 1999; Chauvin et al., 2005; Kools et al., 2008; Mitema, 2009; Bondt et al., 2013
Medical records	Strom et al., 2011	In-person interviews of farmers	Luna-Tortos et al., 2006; Timmerman et al., 2006; Hill et al., 2009; Callens et al., 2012; Persoons et al., 2012
Pharmacy records	Stewart and Lynch, 2011	On-farm treatment records	Meek et al., 1986; Carson et al., 2008; Pardon et al., 2012; van der Fels-Klerx et al., 2012
Patient diaries	Parker et al., 2007	Tissue drug levels	Jones and Seymour, 1988
MEMS cap measurements	Parker et al., 2007	Collection of drug packaging	Dunlop et al., 1998; Carson et al., 2008; Saini et al., 2012
Drug levels in the body	Bisson et al., 2008		

Control and Prevention (CDC) reported that the widespread use of antibiotics in agriculture has resulted in increased resistance in infections in humans (CDC, 2013), and the propagation of resistant bacteria in animals and animal food products can increase the likelihood of the transmission of these bacteria to humans via food, the environment or direct contact with animals (Turnidge, 2004).

The misuse of antibiotics in human medicine in lower/middle income (LMI) countries has been extensively documented (Radyowijati and Haak, 2003; Kristiansson et al., 2009; WHO, 2009; Haak and Radyowijati, 2010; Okeke, 2010). It is highly likely that antibiotics are also used inappropriately in animal agriculture in LMI countries.

To understand the public health risk associated with antibiotic use in animal agriculture, pharmacoepidemiologic data on antibiotic use in livestock are necessary. Despite recommendations from the World Health Organization (WHO, 2003) to implement national surveillance programs for assessing antimicrobial usage in food animals, very little is known about the use of antibiotics in food animals in LMI countries. Furthermore, in LMI countries where sales records and on-farm treatment records are rarely kept, it can be difficult to collect accurate data of this type.

In general, data on antibiotic use in livestock have been collected at the national, regional, local and farm level from a variety of sources, including pharmaceutical companies, distributors, feed stores, pharmacies, over-the-counter retailers, veterinary clinics or farmers (Singer et al., 2006). Examples of the different methods/sources used to collect information on drug use in both human medicine and veterinary medicine in previous studies are shown in Table 1.

Each source of data can be more or less accessible, especially in LMI countries where record-keeping and regulatory oversight may be limited. Data collected from the final user of the drug (or from the guardian or owner of the user – i.e., in this case, the farmer) are ideally suited for investigations on patterns of drug use (Singer et al., 2006). However, the ascertainment of drug use data from the users of the drug is subject to misclassification of drug exposure due to recall bias, reporting bias or social desirability bias (West et al., 2013). Using data from prescriptions or sales records can also be unreliable, as such data do not take into account the adherence of the patient (or, in the case of a farm, the adherence of the farmer purchasing the drug) or the possibility of obtaining drugs from other sources (over-the-counter drugs, drugs sold on the black market, etc.) (West et al., 2013). Enhancing the validity of pharmacoepidemiologic data obtained at the farm level is vital for using antibiotic-use data to make inferences or design interventions aimed at promoting the judicious use of these drugs.

Few of the methods used in veterinary medicine can be applied in LMI countries where farmers are often illiterate, few (if any) treatment records or sales receipts are kept and national monitoring programs are nonexistent; as a result, the two methods most suited to small farms in LMI countries are in-person interviews with farmers and the collection of discarded drug packaging. The goal of this study was to compare the results obtained with these two methods on a sample of farms in a rural area of Cajamarca, a major dairy-producing region of Peru characterized 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. Farms

The field research team (first and second author) approached a convenience sample of owners of mid-sized farms in and around the city of Cajamarca to participate in the study. The purpose of the study was explained to the