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The application of medical informatics to the veterinary management programs at companion animal practices in Alberta, Canada: A case study

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ABSTRACT

Companion animals closely share their domestic environment with people and have the potential to, act as sources of zoonotic diseases. They also have the potential to be sentinels of infectious and noninfectious, diseases. With the exception of rabies, there has been minimal ongoing surveillance of, companion animals in Canada. We developed customized data extraction software, the University of, Calgary Data Extraction Program (UCDEP), to automatically extract and warehouse the electronic, medical records (EMR) from participating private veterinary practices to make them available for, disease surveillance and knowledge creation for evidence-based practice. It was not possible to build, generic data extraction software; the UCDEP required customization to meet the specific software, capabilities of the veterinary practices. The UCDEP, tailored to the participating veterinary practices', management software, was capable of extracting data from the EMR with greater than 99%, completeness and accuracy. The experiences of the people developing and using the UCDEP and the, quality of the extracted data were evaluated. The electronic medical record data stored in the data, warehouse may be a valuable resource for surveillance and evidence-based medical research.

1. Introduction

New surveillance strategies are required for the early detection and rapid response to emerging global health issues that arise at the human-animal-environment interface. Pets have been nominated to act as sentinels for changing human disease risks; a recommendation that has been supported by numerous case reports and surveys (Scotch et al., 2009). There are also calls to increase the data available to inform evidence-based practice in veterinary medicine (Smith-Akin et al., 2007; Johnson et al., 2011; Santamaria and Zimmerman, 2011). Both surveillance and evidence-based practice require access to data on clinical actions and patient outcomes. There is limited surveillance of pets in Canada but there are opportunities to access more frequent and detailed medical information from this population.

There are pets in approximately 60% of Canadian homes (Perrin, 2009). A 2008 online Ipsos-Reid™ survey targeting

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urban pet owners, determined that 78% of dogs and 50% of cats had been examined by a veterinarian in the previous 12 months (Perrin, 2009). Under the regulations of the Alberta Veterinary Medical Association (Alberta Veterinary Medical Association, 2003) the findings from these examinations must be documented in the examining veterinarian's medical records making them a rich source of clinical data that have the potential to be used for surveillance or research.

Animal health records are not abstracted at general veterinary practices and the manual review of large numbers of paper-based records is difficult. However, the adoption of electronic medical records (EMR) by veterinary practices has made access to a huge volume of veterinary clinical data more feasible. There are challenges to accessing and extracting the data from EMR's. First, under Alberta provincial legislation, the Personal Information Protection Act, veterinarians have a legal duty to their clients to ensure the privacy of their patients' medical records (Government of Alberta, 2012). Second, the purpose of the EMR is to document and support patient care, assure continuity of care and assist with the financial management of the practice. These databases are not intended to be used for outcome analysis or to support population level studies (Bhattacharyya, 2004; Lyman et al., 2008; Johnson et al., 2011; Santamaria and Zimmerman, 2011). In order to use the EMR for surveillance, the data must be moved out of the veterinary practice management system and transformed into a format that supports subsequent analysis.

Informatics provides tools and methods for data collection, management and analysis (Savel and Foldy, 2012). Public health informatics is defined as "the systematic application of information and computer science and technology to public health practice, research and learning" (Friede et al., 1995). It is an interdisciplinary field with its core in systems design engineering. With the use of informatics it is possible to *extract* data from EMR's at practices, *transform* it into a functional format and *load* it for export to an external data warehouse. Extract, transform and load (ETL) computer technologies enable the integration of data from multiple veterinary practices into a single external data warehouse where subsequent analyses looking for patterns and trends can occur (Lyman et al., 2008; Government of Canada, 2010). A clinical data warehouse can function as the hub of a network of private practices where data is centrally located and analyzed for disease surveillance (Birtwhistle et al., 2009), for performing any number of population-based studies (Detmer, 2000; Lyman et al., 2008), or to evaluate medical and surgical interventions to inform evidenced-based practice (Santamaria and Zimmerman, 2011).

The overall objective of this project was to describe the development and assessment of a companion animal surveillance system using the electronic medical record, informatics and a syndromic disease definition. The purpose of this study was to pilot and evaluate medical informatics methods for retrieving (extracting) and storing complete companion animal health records from veterinary practice EMR's in a form suitable for epidemiological analyses (transforming and loading). The objectives were to: (i) develop and deploy a data extraction program that was acceptable to the practices and would accurately and completely extract, transform and load the retrospective and prospective clinical data for data warehousing; (ii) evaluate the users' experiences; (iii) evaluate quality of the data extraction process; and (iv) demonstrate that the warehoused electronic medical records provided valid, complete and representative data.

2. Methods

2.1. Recruitment of veterinary practices

Recruitment was conducted by a veterinarian who had been in practice in the study area. In August 2009 the owner/manager of each companion animal and mixed food animal/companion animal veterinary practices located in the city of Calgary, Alberta and the surrounding communities of Cochrane, Airdrie, Chestermere, Strathmore and Okotoks (Fig. 1) was contacted by telephone. The objectives and methods of the study were described. If the practice had completely computerized medical records and the owner/manager expressed a willingness to participate, the project proposal was presented in a face to face meeting. Prior to access to the practices' computer systems, a mutually acceptable data sharing agreement was signed by each of the practice's managing owners and the author (Anholt).

2.2. Development of the data extraction tool

The first five practices that agreed to participate in this study were recruited to develop and pilot a customized data extraction program called the University of Calgary Data Extraction Program (UCDEP). Development of the UCDEP at each of the 5 pilot practices continued until it was performing as expected. It was then installed at the other participating practices.

The UCDEP used queries written against the structured query language (SQL) server on each veterinary practice management system (VPMS) database as the data extraction method. A computer software developer with extensive experience in veterinary database development (K. MacLean) was contracted to create the data extraction software. The desired data from the VPMS database included the date the animal was seen at the practice, the patient identification number used by the practice, the first three digits of the owner's home postal code also known as the forward sortation area (FSA), the animals' species, breed, sex, date of birth, and the medical records. The practices used similar numerical patient codes, so to further distinguish the records a unique numerical code was assigned to each practice (the practice identification number) and to the records that originated from that practice. To preserve the confidentiality of the medical record, none of the fields that recorded financial information or information that could identify the owner or pet were extracted.

Data was extracted retrospectively from January 1, 2007 to the day prior to installation of the UCDEP software on the practice computer. Prior to 2007, the VPMS at the participating practices was an older technology and data extraction was more difficult. Following retrospective data collection, the UCDEP was configured so that on each day