



Short communication

Pet population management and public health: A web service based tool for the improvement of dog traceability

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ABSTRACT

The risks associated with zoonotic infections transmitted by companion animals are a serious public health concern: the control of zoonoses incidence in domestic dogs, both owned and stray, is hence important to protect human health. Integrated dog population management (DPM) programs, based on the availability of information systems providing reliable data on the structure and composition of the existing dog population in a given area, are fundamental for making realistic plans for any disease surveillance and action system. Traceability systems, based on the compulsory electronic identification of dogs and their registration in a computerised database, are one of the most effective ways to ensure the usefulness of DPM programs. Even if this approach provides many advantages, several areas of improvement have emerged in countries where it has been applied. In Italy, every region hosts its own dog register but these are not compatible with one another. This paper shows the advantages of a web-based-application to improve data management of dog regional registers. The approach used for building this system was inspired by farm animal traceability schemes and it relies on a network of services that allows multi-channel access by different devices and data exchange via the web with other existing applications, without changing the pre-existing platforms. Today the system manages a database for over 300,000 dogs registered in three different Italian regions. By integrating multiple Web Services, this approach could be the solution to gather data at national and international levels at reasonable cost and creating a traceability system on a large scale and across borders that can be used for disease surveillance and development of population management plans.

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1. Introduction

The relevance of free roaming dogs (FRD) to public health is well known. The control of these populations is a key issue for the management of some zoonoses (Vučinić et al., 2011; Voslárva and Passantino, 2012). The FRD population is closely linked to the owned pet population (e.g. the uncontrolled reproduction of pets is stated to be an

important cause of dog overpopulation, and pet abandonment also results in an augmentation of the FRD population) (Fielding, 2010). Therefore, to gain insight into FRD related problems, a thorough understanding of the owned population dynamics is required. The possibility to collect, analyse and manage specific information about sources, reproductive rate, and management of pets will provide a baseline for designing and implementing both dog population management (DPM) and disease control programs (Slater et al., 2008; OIE, 2011b). Dog traceability is a key building block for such information basis. Further, a recent survey among 172 OIE member countries reported dog traceability to be the most used DPM tool in developed countries (Dalla Villa et al., 2010).

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It is stated that animal traceability plays a key role in improving the management of disease outbreaks, vaccination programs, early response and notification systems, animal movement controls, inspection, and certification for many species (OIE, 2011a). Animal traceability implies the identification of each animal by assigning a unique code number, the registration of this information in a database, and the record of the animal movements from birth to death (Trautman et al., 2008). Hence, an up-to-date database would allow competent authorities and other stakeholders to access accurate information about population size, structure and composition in a given area. A recent emergency event in Italy (the earthquake that hit the Abruzzo region in 2009) highlighted the importance of a comprehensive database system in which information about the number of animals present on the area and their premises could be retrieved, allowing efficient veterinary intervention plans to provide feed, shelter and health care to both companion animals and livestock (Dalla Villa, 2011).

Despite the importance of traceability, there is no European Union (EU) legislation providing for the compulsory identification and registration of dogs. Results from a survey (www.carodog.eu) carried out in 13 EU countries show that 61.5% had national laws providing for dog identification and registration. However, even among those countries, issues concerning the efficiency of dog traceability emerged, primarily due to the presence of multiple databases with no connectivity (e.g. Portugal and Spain). In Italy, the legislative framework foresees a dog national database (DNDB), managed by the Ministry of Health, and several dog regional databases (DRDBs) held by municipalities, feeding the national one by sending periodic batch files. This communication procedure does not allow a real time up-date of information and can lead to a mismatch between local and national data (as reported by Stifter et al., 2011). A broad harmonised and effective communication system based on a real-time interoperability between databases, could avoid these incongruities that can impair the whole traceability system. To address this issue, and following the successful approach developed for the National Bovine Register Database (Caporale et al., 2001; Di Pasquale et al., 2007), a new Web based application for the management of DRDBs was developed.

This paper shows the structure, functionalities and advantages of this Web-based Service applied to the DRDB, reports some data from the regions that have acquired the software, and finally proposes future development and applicability for public health purposes.

2. Methods

2.1. Software architecture

The software architecture is based on Web Service technology (Mockford, 2004). Web services are software systems designed to support interoperable machine-to-machine interaction over a network (World Wide Web Consortium, 2012). This interactive applicative service can be accessed by several peripherals, each with its own

specific graphical user interface, sharing the same data back-end (Possenti et al., 2006).

The structure is partitioned in three layers (presentation tier, business/logic tier and data tier). The *presentation tier* is the user interface, its main function is to translate tasks and results to something the user can understand; the *business logic tier* is essential to coordinate the application, make logical decisions and evaluations, perform calculations, move and process data between the two surrounding layers; finally, the *data tier* is where the information is stored and retrieved from a database, passed to the business logic tier for processing and eventually made accessible to the user. The presentation level includes the front page, open to the public (<https://anagrafecanina.izs.it/>), which allows retrieval of a dog's file card (after the insertion of a microchip code) and to access the private area after user authentication. The private area can be accessed only by veterinarians that have been authorised by the Local Health Units (LHU). Veterinarians are responsible for the creation of a new record, as well as for the registration of an animal's death; they are also allowed to retrieve or insert data into the dog file cards. The user interface is divided in major sections allowing the insertion of all compulsory information (e.g. owner data, animal data, and transponder data), as well as other useful events information (e.g. dog death circumstances, owner's change of address, bite or aggression episodes, spay/neutering, prophylaxis interventions). The components of each layer can be replaced without any relevant impact on the other ones.

Thanks to the Web Services technology, the system can easily establish a connection with different devices providing a multi-channel access. Indeed, the described software has been upgraded recently with a service for mobile phones enabling, after sending a dog microchip code, immediate retrieval of dog information via SMS. Another additional function, currently under development, is an application for smartphones and tablets that will allow the recovery, via the connection with the transponder-reader, of the dog file card during veterinary monitoring and control activities in the field.

2.2. Software acquisition

The software was developed following the need of the Molise region to implement the legislation on dog population management and to improve the local traceability system (Italian Law, 2005). The software has been active in Molise since June 2011. In July 2011 and in April 2012 two other Italian regions (Sicily and Calabria respectively) also acquired the system.

The adoption of this software allows regional and local Veterinary Services to develop their own applications, without changing the pre-existing platform or user interface, using the Web Services proposed system as a back-end layer.

3. Results and discussion

The central databank system, operating through a Web Service application, was managing data for 333,538 dogs at the last access (11th of July 2012). From the date of software

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