Preventive Veterinary Medicine 113 (2014) 146–151

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Short communication

Completeness of the dog registry and estimation of the dog population size in a densely populated area of Rome

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ARTICLE INFO

Article history:
Received 20 March 2013
Received in revised form
25 September 2013
Accepted 3 October 2013

Keywords:
Dog registry
Owned dog population

ABSTRACT

In most European countries, registration and identification of dogs is compulsory. In Italy, the national dog registry is composed of regional dog registries. Although dog registries have been established for many years, the issue related to completeness of data has not been addressed so far. The objective of this study was twofold: first to assess the completeness of data of the dog registry through telephone interview of a sample of dog owners drawn from the dog registry, then to estimate the total owned dog population in 4 boroughs of Rome. For the second objective, a capture–recapture method was applied using data from the dog registry and data from a face-to-face questionnaire submitted to people waiting in the sitting room of 5 points of access for booking and payment of primary and specialist care. Different scenarios are proposed to verify the assumptions of the estimation procedure and potential biases are discussed. The completeness of data of the dog registry was 88.9% (95% CI: 85.8–91.9%) and the owned-dog population was estimated at 26,244 dogs (95% CI: 24,110–28,383). The dog registry is an important source of information especially when it is properly updated and completeness of data is known.

1. Introduction

In recent years, many studies have been carried out to investigate the demography of dog populations in a number of social and geographical contexts, such as in urban (Nunes et al., 1997) and rural areas (Childs et al., 1998), and low (López et al., 2009) and high income regions (Asher et al., 2011). As a consequence of the heterogeneity among these settings, the reported human-to-dog ratio varies greatly from 50 to 1 in China, 16 to 1 in Europe, to 10 to 1 in the US (Knobel et al., 2005; Wandeler et al., 1993).

In most European countries, such as Italy and France, compulsory identification of dogs has been introduced and dog owners are obliged to register the dog in the dog registry (FVE, 2011). In Italy, provisions for the registration of dogs lie within the Framework Law 281/1991. According to this law, dogs must be registered and identified by a tattoo and regional governments are responsible for the institution of a regional dog registry. Since 1 January 2005, the application of the tattoo has been replaced by the implantation of a microchip and the microchip has become the only identification method legally recognised for puppies (Decree of the Prime Minister, 28 February 2003).

The Latium Region established the dog registry in the late 1990s (Law 21 October 1997 No. 34). The regional dog registry is currently composed of 12 local dog registries, one for each Local Health Unit (LHU) of the region. The registries are maintained by the LHUs, which are an

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0167-5877/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.prevetmed.2013.10.003

integral part of the Italian Health System and represent the local provider of healthcare and public health services. Since 2007, official veterinarians and veterinary practitioners have been able to register and remove dogs from the dog registry through a secure Internet application. During the registration, the veterinarian enters into the system the owner's personal data, address and telephone number as well as the microchip number, date of birth, sex, breed and name of the dog. In order to maintain updated local dog registries according to the outgoing and incoming dogs, dog owners are legally required to remove and re-register the dog when it is moved to another LHU as well as to communicate the death of the dog or the change of owner, even if the new owner lives within the same LHU.

Over time, many campaigns have been organised by the Latium region to promote the registration of dogs. One of the most successful was the campaign called *Metti al sicuro il tuo cane* (Secure your dog) that was launched in 2009 (Regione Lazio, 2009): during the month of October, dog owners were given the opportunity to register the dog without paying the cost of the microchip while veterinary practitioners offered a discounted fee for the implantation. The campaign was promoted through radio and local newspapers as well as in veterinary practices and clinics. In 2011, after five-year activity of the information system, the present study was carried out to assess the completeness of the dog registry in a high densely populated area of Rome and to estimate the total owned-dog population (registered plus not registered dogs).

2. Materials and methods

2.1. Study area

The urban area of Rome is divided into 20 boroughs – called *Municipio* – sequentially numbered in Roman numerals from I to XX. The study area comprised the boroughs V, VII, VIII, and X (Fig. 1) and corresponds to the LHU Roma B: it covers a surface of 220 km^2 and, at the time of the study, counted approximately 710,000 citizens (ASL Roma B, 2010).

2.2. Completeness of the dog registry

From May to June 2011, a telephone survey was conducted to verify the completeness of the dog registry of the LHU Roma B. First, the list of all living dogs of the study area was extracted from the dog registry. Data were held anonymously by the researchers because only owners' telephone numbers and specific data on dogs (breed, sex, age, and name) were extracted. A random sample of telephone numbers was drawn from the list. The sample size was defined according to the following assumptions: 70% response rate, 90% correctly registered, 5% precision and 95% CL. If multiple telephone numbers were available, mobile numbers were preferred to fixed lines. The same telephone number could have been drawn more than once, because several dogs could have been owned by the same owner. Numbers were called a minimum of three times and, in case of no answer, in different periods of the day (10 am–1 pm or 2–5 pm). At the initial contact, a description of the institution involved in the project was provided as well as the aim of the telephone interview, namely the verification of data in the dog registry. Eventually, the interviewer asked if the respondent was willing to answer a brief questionnaire. The questionnaire comprised seven questions: five closed questions and two open questions. In order to verify that data on the dog were correct, the first question was customised for each respondent according to the sex, name, and age of the dog reported in the dog registry. We give an example of the first question (in italics, data taken from the dog registry): "Are you currently the owner of a *female basset hound* named *Polly* aged *five* years old?" In the case of a positive answer the dog was considered correctly registered. If a negative answer was given, the next question was: "You are not the owner because: you have never been the owner; you were the owner and the dog is dead; you were the owner, but the dog has been moved to another place?" In all of these cases, the dog was considered not correctly registered. In the case of a mismatch between the data reported in the dog registry and those communicated by the dog owner, the interviewer investigated the reason for the mismatch with further questions. For these cases, it was decided whether or not the correctness of the data was satisfactory only in a second phase.

2.3. Estimation of the dog population size living in the study area

For the estimation of the owned-dog population, the traditional two-list capture–recapture approach was applied; the Lincoln–Petersen's formula with Chapman's correction (Chapman, 1951) was chosen. According to this formula, the total population size can be estimated as

$$N = \frac{(M+1)(C+1)}{R+1} - 1 \quad (1)$$

where N is the unknown population size, M is the number of individuals that are captured marked and then released in the first capture session (first list), C is the number of individuals that are captured in a second capture session (second list), and finally R is the number of individuals in C that are considered recaptured because they have the mark applied during the first capture session. For the calculus of variance, Seber's formula (Seber, 1970) was chosen. This estimate is considered to be unbiased only when certain assumptions are met: the population under study can be considered as a closed population; the fact of being detected in a list does not change the probability of being detected in the other (that is, the two lists are independent of each other); the true cases are all identified and there are not false positives (that is, 100% sensitivity and specificity); there are no matching errors of individuals between the two lists (that is, a unique identifier is available to recognise each subject). In the present study, the first list M was the list of dogs in the dog registry of the LHU Roma B. The total number of dogs was adjusted down for the proportion of dogs incorrectly registered ($M_{adjusted}$). This proportion was calculated taking into account the results of the telephone survey. In order to build a second list C being independent of M, a sample of dogs was collected through a face-to-face survey in the study area. The face-to-face