



Rabies awareness and dog ownership among rural northern and southern Chadian communities—Analysis of a community-based, cross-sectional household survey



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ABSTRACT

Canine rabies represents a major – but preventable – public health threat in Chad. In preparation for a nation-wide canine parenteral mass vaccination campaign we conducted a community-based, cross-sectional multi-stage cluster survey in 40 villages in two southern and two northern regions of Chad. Our objective was to investigate rabies awareness and dog-ownership among the rural population.

Almost half of the households (45%) owned dogs, with an overall dog:human ratio of 1:7.8. Southern households owned almost two thirds (701/918) of all dogs and the number of dogs per household was twice as high compared to the north (2.7 vs. 1.3, respectively). This translates into a dog:human ratio of 1:5.2 in the south and 1:16.4 in the north. Only 76% of the respondents had heard of rabies. Respondents who (1) were male, (2) > 19 years, (3) had primary education or higher and (4) were of Muslim faith were more likely to have heard of rabies ($p < 0.01$). High level of rabies knowledge was positively associated with (1) southern residence, (2) any kind of education and (3) Christian or “other” religions. In contrast to rabies awareness, high level of knowledge was negatively associated with increasing age.

11% of respondents reported that at least one family member had been bitten by a dog in the past year and half of these bite victims were children. 31% of respondents knew someone who had died of rabies and twice as many (58%) reported having encountered a rabid animal. Most of the respondents could identify classical rabies symptoms (58–94%), however they lacked knowledge about rabies prevention and appropriate wound management. Only 2 out of 963 (0.5%) reported to have vaccinated their dog.

A major proportion of our study population is at great risk of rabies (likely higher than 7 rabies death per million per year) due to lack of awareness of the disease, inappropriate post-bite treatment and insufficient knowledge about preventive measures. This reflects the urgent need for advocacy programs to raise rabies awareness among the community. Close intersectoral collaboration between the public health and veterinary sector and integration of local authorities, is a key element in the fight against rabies

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1. Introduction

Although canine rabies has been eliminated in vast parts of the western world, it remains endemic and neglected in resource-limited countries. An estimated 59'000 people die of rabies every

year with the majority of victims occurring in Asia (59.6%) and Africa (36.4%) (Hampson et al., 2015). Rabies in humans (Cleaveland et al., 2002) and dogs (Kitala et al., 2000) is greatly under-reported in Africa. In a study conducted by Cleaveland et al. (2002) in Tanzania, the true number of human rabies cases was 10–100 times greater than officially reported.

To date, no effective therapy to cure patients who have developed clinical symptoms has been established (Jackson, 2013a) and recovery after treatment of clinical rabies occurs only in very rare cases, usually with permanent severe neurological dam-

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age (Madhusudana et al., 2002; Willoughby et al., 2005). The administration of immediate post-exposure prophylaxis (PEP) – consisting of bite wound cleansing and injection of rabies vaccine and immunoglobulins – after exposure to rabies can prevent the onset of the disease (WHO, 2013). More than 15 million people require PEP annually (WHO, 2013). However, in many African countries the availability of PEP is limited and often not affordable for a large part of the population (Dodet et al., 2008). Moreover, administration of PEP alone is insufficient to interrupt the transmission cycle between animals and humans. Only interventions targeted at the host species will eliminate rabies in the dog population and eventually stop transmission to humans. Zinsstag et al. (2009) concluded that the most cost-effective intervention strategy to eradicate rabies is the combination of parenteral dog mass vaccination campaigns and PEP. The authors have used a dog-human mathematical transmission model to show that after 5 years a break-even in costs could be achieved compared with costs of PEP alone.

In Chad, rabies is an endemic disease and, thus represents a major – but preventable – public health threat. The human rabies mortality is estimated to be 7 per million per year in N'Djamena, the capital of Chad, alone (Frey et al., 2013). A partnership between the Chadian authorities and the Swiss Tropical and Public Health Institute (Swiss TPH) established in the year 2000 is working towards the goal of canine rabies control in N'Djamena. Over the ten years of rabies research, incidence in dogs was reported to be stable (1.4–1.7/1000 dogs) (Kayali et al., 2003; Dürr et al., 2008) with a reproductive number R_0 of just above 1 (Zinsstag et al., 2009). One rabid dog is exposing on average 2.3 humans (Kayali et al., 2003).

In 2012 a parenteral dog mass vaccination campaign covering the whole town of N'Djamena was conducted and repeated in 2013. Both interventions reached a coverage of over >70% (Léchenne et al., 2016), exceeding the WHO-recommended required immunization coverage to interrupt the transmission cycle of the rabies virus (Coleman and Dye, 1996). The interventions led to a reduction of dog rabies cases of over 90% (from 19 cases in 2012 to 2 cases in 2013) and are proof of the feasibility of dog vaccination in the region.

The long-term target in the fight against rabies in Chad is a nation-wide canine parenteral mass vaccination campaign. To plan the campaign Chad's cultural diversity needs to be taken into account. The most widely practiced religions in Chad are Islam and Christianity (INSEED, 2009). Muslims predominantly inhabit northern Chad, whereas Christians primarily live in southern regions. A previous study conducted by Mindekem et al. (2005) in N'Djamena showed that Muslims tend to keep fewer dogs than Christians and during the vaccination campaigns in N'Djamena it was observed that accessibility of dogs was lower in districts inhabited by a Muslim majority (Léchenne et al., 2016). Dog:human ratios and the local community's rabies awareness are not only expected to vary within these different contexts but also at the national level and geographic region.

Surveys focusing on knowledge, attitude and practices (KAP) are widely used to plan efficient veterinary public health interventions, to take an in-depth look at local health behaviour and to identify knowledge gaps that might affect appropriate practices (WHO, 2008). Additional information, such as socio-demographic characteristics, is usually collected during KAP surveys. Rabies-related studies conducted so far in Chad were limited to the urban settings of N'Djamena (Kayali et al., 2003; Mindekem et al., 2005; Dürr et al., 2008; Zinsstag et al., 2009).

Between February and March 2014 we conducted a community-based, cross-sectional multi stage cluster survey in 40 villages in rural Chad. The aim of this study was (1) to assess differences in rabies awareness, knowledge, prevention and health-seeking behaviour in northern and southern Chad, (2) to estimate the dog

rabies vaccination coverage, (3) to estimate the dog:human ratio and the dog-population density, (4) to collect and compare data on socio-demographic characteristics between northern and southern households

2. Material and methods

2.1. Study area

Chad is a landlocked country located in Central Africa spreading over 1.284 million km². Geographically, Chad is divided into three distinct regions; the Sahara Desert in the north bordering Libya and the Sudanese savannah in the south bordering Central African Republic. The Sahelian belt lies in the centre of Chad bordering Niger, Nigeria and Cameroon in the west and Sudan in the east. As diverse as the geographical setting is Chad's cultural background with over 200 distinct ethnic groups. Vast parts of the northern regions are part of the Sahara desert with only a few mobile pastoralist communities inhabiting the area. A hotspot of mobile pastoralist and sedentary agricultural communities can be found around Lake Chad, the most important water body of the Sahel. The more densely populated southern regions of Chad are primarily inhabited by sedentary farmers. According to the last official population census conducted in 2009 the country counts about 11'176'000 inhabitants of which 78% live in rural and 22% in urban areas (INSEED, 2009).

Administratively, Chad is divided into 23 regions and each region is headed by a governor. Regions are divided into 61 departments each lead by a prefect. The departments are again divided into sub-prefectures (200 in total) comprising each a number of different cantons (over 400 in total) led by a chief of canton. The smallest administrative entity in a rural setting is the village with its village chief.

58% of Chadians are Muslim (with the vast majority being Sunni) predominantly inhabiting northern Chad. Christians (19% Catholics, 16% Protestants), Animists (4%) and others (3%) primarily live in southern regions (INSEED, 2009).

2.2. Sampling procedure

We divided Chad into north and south on regions level and employed stratified multi level sampling. Two northern regions and two southern regions (4 regions in total) were randomly selected, with selection probability proportional to the size of the population. In each region, one department was selected proportional to population size (4 departments in total) and in each department we randomly selected 10 villages (40 villages in total). As data on the population on village level was not available this sampling was done by simple random sampling. The departments sampled were Kouh Ouest in the region of Logone Oriental, Grand Sido in Moyen Chari, Dar Tam in the region Wadi Fira and Guera in the region Guera (Fig. 1). Some key characteristics of the regions sampled, based on the 2009 national census, are presented in Table 1.

2.3. Ethics

This study was approved by the ethical review board of the cantons of Basel, Switzerland (Ethik Kommission beider Basel, EKBB ref. 168/13, 29 July 2013) and authorized by the Chadian public health authorities. Consent to be interviewed was verbal.

2.4. Data collection

A structured questionnaire in French was developed by the authors to gather information on (i) the characteristics of the person interviewed, (ii) household demographics and (iii) dog owner's

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