



# A mixed methods approach to assess animal vaccination programmes: The case of rabies control in Bamako, Mali



Laura Mosimann<sup>a</sup>, Abdallah Traoré<sup>d</sup>, Stephanie Mauti<sup>b,c</sup>, Monique Léchenne<sup>b,c</sup>, Brigit Obrist<sup>b,c</sup>, René Véron<sup>a</sup>, Jan Hattendorf<sup>b,c</sup>, Jakob Zinsstag<sup>b,c,\*</sup>

<sup>a</sup> Institute of Geography and Sustainability, University of Lausanne, Géopolis, 1015 Lausanne, Switzerland

<sup>b</sup> Swiss Tropical and Public Health Institute, P.O. Box, 4002 Basel, Switzerland

<sup>c</sup> University of Basel, Petersplatz 1, 4003 Basel, Switzerland

<sup>d</sup> Laboratoire Central Vétérinaire (LCV), Km 8, Route de Koulikoro, Bamako, Mali

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## ABSTRACT

In the framework of the research network on integrated control of zoonoses in Africa (ICONZ) a dog rabies mass vaccination campaign was carried out in two communes of Bamako (Mali) in September 2014. A mixed method approach, combining quantitative and qualitative tools, was developed to evaluate the effectiveness of the intervention towards optimization for future scale-up. Actions to control rabies occur on one level in households when individuals take the decision to vaccinate their dogs. However, control also depends on provision of vaccination services and community participation at the intermediate level of social resilience. Mixed methods seem necessary as the problem-driven transdisciplinary project includes epidemiological components in addition to social dynamics and cultural, political and institutional issues. Adapting earlier effectiveness models for health intervention to rabies control, we propose a mixed method assessment of individual effectiveness parameters like availability, affordability, accessibility, adequacy or acceptability. Triangulation of quantitative methods (household survey, empirical coverage estimation and spatial analysis) with qualitative findings (participant observation, focus group discussions) facilitate a better understanding of the weight of each effectiveness determinant, and the underlying reasons embedded in the local understandings, cultural practices, and social and political realities of the setting. Using this method, a final effectiveness of 33% for commune Five and 28% for commune Six was estimated, with vaccination coverage of 27% and 20%, respectively. Availability was identified as the most sensitive effectiveness parameter, attributed to lack of information about the campaign.

We propose a mixed methods approach to optimize intervention design, using an “intervention effectiveness optimization cycle” with the aim of maximizing effectiveness. Empirical vaccination coverage estimation is compared to the effectiveness model with its determinants. In addition, qualitative data provide an explanatory framework for deeper insight, validation and interpretation of results which should improve the intervention design while involving all stakeholders and increasing community participation. This work contributes vital information for the optimization and scale-up of future vaccination campaigns in Bamako, Mali. The proposed mixed method, although incompletely applied in this case study, should be applicable to similar rabies interventions targeting elimination in other settings.

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## 1. Introduction

With an estimated 60,000 human deaths caused annually, rabies constitutes an important public health problem, especially in Asia and Africa (Hampson et al., 2015). The virus is transmit-

ted by animal bites, mostly from dogs, causing infection of the nervous system that is inevitably fatal after symptoms appear (Jackson, 2013). The high cost of post-exposure prophylaxis (PEP) in addition to delivery and availability problems with vaccines and immunoglobulins intensify the burden of the disease in resource-poor countries (Shim et al., 2009; Shantavasinkul and Wilde, 2011). In Africa and Asia, human rabies is nearly always due to dog bites, and children are disproportionately exposed (Kayali et al., 2003a; Sambo et al., 2013).

\* Corresponding author at: Swiss Tropical and Public Health Institute, P.O.Box, 4002 Basel, Switzerland.

E-mail address: [jakob.zinsstag@unibas.ch](mailto:jakob.zinsstag@unibas.ch) (J. Zinsstag).

Dog mass vaccination campaigns are the most effective intervention strategy for rabies control in settings where the disease is endemic (Cleaveland et al., 2006; Lembo et al., 2010; WHO, 2005). To interrupt transmission and eliminate the disease, a vaccination coverage of 70% or higher is recommended (Coleman and Dye, 1996).

In N'Djamena, Chad, a mass vaccination campaign for domestic dogs took place in 2012 and was repeated in 2013. Dog owners were encouraged to bring their animals to fixed vaccination points, set up in all urban districts, where dogs received free rabies vaccination. Vaccination coverage of 71% was achieved in both years (Lechenne et al., 2016). However, significant variability of the coverage and participation was observed between vaccination zones.

Canine rabies is an important public health issue in Mali. The incidence of human rabies in the capital city of Bamako was 0.37 cases per 100,000 persons per year (Kone, 2013). Due to insufficient disease surveillance throughout Mali, we assume there is a substantial underestimation of the human incidence. Cleaveland et al. (2002) evaluated disease underreporting of ten- to one hundredfold in Tanzania. On the basis of a Knowledge, Attitudes and Practices (KAP) study of people in Bamako about rabies and its control (Mauti et al., 2015), the first pilot mass vaccination campaign took place in 2013 in one of the six communes of Bamako. Although the intervention strategy and the setting were comparable to those in N'Djamena, the estimated vaccination coverage in Mali was only 18% (Muthiani et al., 2015). In order to evaluate more precisely the reasons for such low participation of dog owners, a second pilot mass vaccination campaign was conducted in 2014 in Communes Five and Six of Bamako.

Rabies vaccination campaigns are problem-driven and transdisciplinary by nature, being at the interface of society, science and politics. Several cross-cutting issues interfere, such as participation, values and uncertainties, which can be both epidemiological and sociocultural (Hirsch Hadorn et al., 2008). While their effectiveness has been mostly evaluated using quantitative data (see Section 2), a recent anthropological study was conducted in Southern Tanzania to explore community perceptions and responses to a dog rabies vaccination program in the region, showing the importance of social and cultural determinants of the effectiveness of interventions (Bardosh et al., 2014). For example, such determinants might be local understandings of the disease and experiences of rabies cases, ideas of social responsibilities, or livelihood patterns and the linked cultural practices, including religion.

Access is a key issue for the success of any health intervention which depends on a series of factors. Obrist et al. (2007) developed an analytical, action-oriented framework to evaluate health care access in poor countries. This framework, developed specifically for Africa, “combines health service and health-seeking approaches and situates access to health care in a broader context of livelihood insecurity” (Obrist et al., 2007; p. 1584). The five dimensions of access identified are availability, accessibility, affordability, adequacy and acceptability. Based on this framework, an “effectiveness model for health interventions” has been developed by Zinsstag et al. (2011b), integrating the five factors of access and adding the efficacy of the vaccine, diagnostic accuracy, provider compliance and consumer adherence. Effectiveness is then calculated as the product of the efficacy of the vaccine and the coverage, the latter being reduced by the determinants of access named above. It is important to understand as many elements as possible influencing a given health and social systems context to identify where and why an intervention loses effectiveness. This model corresponds precisely to the case of rabies control programs, which are strongly embedded in a larger socio-cultural, political and institutional context and depend on the participation of the community and all involved stakeholders.

To understand the meaning and importance of the different effectiveness parameters, a deeper qualitative assessment is required to account for the cultural, social, political and institutional context as well as the social dynamics of the setting. Since interventions like rabies mass vaccination campaigns exceed the individual participation of dog owners, it is important to consider the concept of social resilience. “Resilience refers to an ability, capability or capacity of individuals, social groups and even social-ecological systems to live with disturbances, adversities or disasters” (Obrist et al., 2010; p. 286). While rabies control programs intervene at the household level, where individuals take the decision to vaccinate their dog or not, their success depends on a higher level of social resilience to deal with the threat of rabies. Effective cooperation and collaboration of and between all stakeholders, institutions, political authorities, social groups and communities are necessary on the intermediate (community) level to build social resilience.

To monitor the recent campaign in Bamako, we used a mixed methods approach. We applied the effectiveness model of health interventions (Zinsstag et al., 2011a), adapted to the context of rabies control (Muthiani et al., 2015), and we used a triangulation method for each effectiveness parameter. We further applied an integrated mixed methodology for the intervention level allowing for consideration of cultural, social, political and institutional aspects. The pilot dog rabies mass vaccination campaign in two of Bamako's communes served as a case study where the methodology was partially applied to evaluate strengths and weaknesses and potential replicability in other settings. Along with the effectiveness analysis, a coverage estimation based on a Bayesian model was done, and the two results compared in order to validate the analysis.

The aim of this study was to elaborate a mixed methods approach providing key epidemiological and sociocultural data in order to improve and optimize future intervention designs through better evaluation of the key effectiveness determinants in rabies control and better integration of local understandings and enhanced community participation. This article presents the methodology and its application to the small scale vaccination campaign in Bamako in September 2014, subsequent to the first pilot mass vaccination campaign conducted one year earlier (Muthiani et al., 2015). The Ministry of Livestock and Fisheries (Ministère de l'Élevage et de la Pêche, Mali) approved the study which was conducted by the Central Veterinary Laboratory of Bamako (Laboratoire Central Vétérinaire, LCV) and the governmental veterinary services, in collaboration with the Swiss Tropical and Public Health Institute (Swiss TPH). The campaign was funded by the Swiss Agency for Development and Cooperation (SDC) in Mali and the EU FP7 project ICONZ supported the operational research.

## 2. Materials and methods

### 2.1. Effectiveness evaluation of a rabies vaccination campaign

A mixed methods approach was developed to determine a) the effectiveness of a free-central-point rabies vaccination campaign and b) its optimization at an intermediate (community) level. The effectiveness of an intervention has both quantitative and qualitative components requiring a mixed methods approach within or between phases of the research process (Creswell and Clark, 2007). In the case of rabies control and its multidimensionality, a mixed methods approach appears particularly adequate, as emphasized also by Bardosh et al. (2014). Rabies control has an important quantitative component consisting of the epidemiological characteristics, the vaccination coverage estimation and the participation rate in the intervention. At the same time, it has also a qualita-

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