



## Outbreak, Surveillance and Investigation Reports

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### Analysis of Rabies Surveillance Data (2008-2011) in Bali Province, Indonesia

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#### Abstract

Bali Province was historically free from rabies. The first human rabies case in Bali was confirmed in late 2008. By June 2010, rabies had spread to all districts, affecting 30% of villages with 133 human deaths reported. To describe rabies situation in Bali from 2008 to 2011, data on human deaths and animal surveillance were collected from provincial public health and livestock offices of Bali, and Disease Investigation Centre (DIC) in Denpasar City, Bali. A total of 443 dogs were tested for rabies by the DIC Denpasar. Of these, 29% were tested positive by Fluorescent Antibody Test (FAT). The highest proportions of positive sample were from dogs that bit human and dogs with clinical signs of rabies. Male dogs were 1.7 times more likely to have rabies than the female ones and unvaccinated dogs were 2.2 times more likely to be infected with rabies than the vaccinated dogs. To control rabies in Bali, a multi-ministerial coordination mechanisms at national and local levels were established. Prevention and control measures were implemented, including mass dog vaccination, surveillance, stray dogs depopulation and public awareness campaign. Mass dog vaccination and stray dogs depopulation targeting dogs with history of biting humans or clinical symptoms demonstrated success in preventing spread of rabies in Bali.

**Keywords:** rabies, dog, human, surveillance, Bali, Indonesia

#### Introduction

Rabies is a viral zoonosis of the central nervous system which is always fatal.<sup>1</sup> The disease is caused by Lyssavirus genus of the family Rhabdovirus and affects all mammalian species including humans.<sup>2</sup> The disease can be spread by rabid animals and dogs are the principal carriers for maintaining the infectious cycle of rabies. Contact of saliva with mucous membrane or wound can result in transmission of rabies. Similar to bites, scratches can also convey the infection.<sup>3</sup>

Rabies is one of the major public health concerns in many countries of Asia. The disease is endemic in Indonesia with 24 out of 33 provinces affected and approximately 150-300 people died of rabies every year.<sup>4</sup> In West Java, the first rabid case was reported in buffalo during 1884, in dog during 1889 and in human during 1894.<sup>5</sup> Rabies is one of the diseases that became a national priority.

Although Bali was historically free from rabies, the first animal and human rabies cases were confirmed in Badung District in late 2008.<sup>6</sup> Since then, the

disease spread rapidly, reaching its peak and affecting all districts in June 2010. To control rabies in Bali, multi-ministerial coordination mechanisms were established at national and local levels. Prevention and control measures have been implemented, including mass dog vaccination, surveillance, stray dogs depopulation and public awareness. Although rabies was spreading throughout Bali, information related to rabies situation in the province was limited since there was no common disease information platform to capture both animal and human rabies cases. Therefore, aims of this study were to describe rabies situation in Bali using data available from provincial public health and livestock offices of Bali and Disease Investigation Centre of Denpasar, and discuss on the effectiveness of current preventive and control measures.

#### Methods

Bali province has an area of 5,632 km<sup>2</sup> and 592 km coastline. Administratively, the province has nine districts, including Jembrana, Tabanan, Badung, Gianyar, Karangasem, Klungkung, Bangli, Buleleng

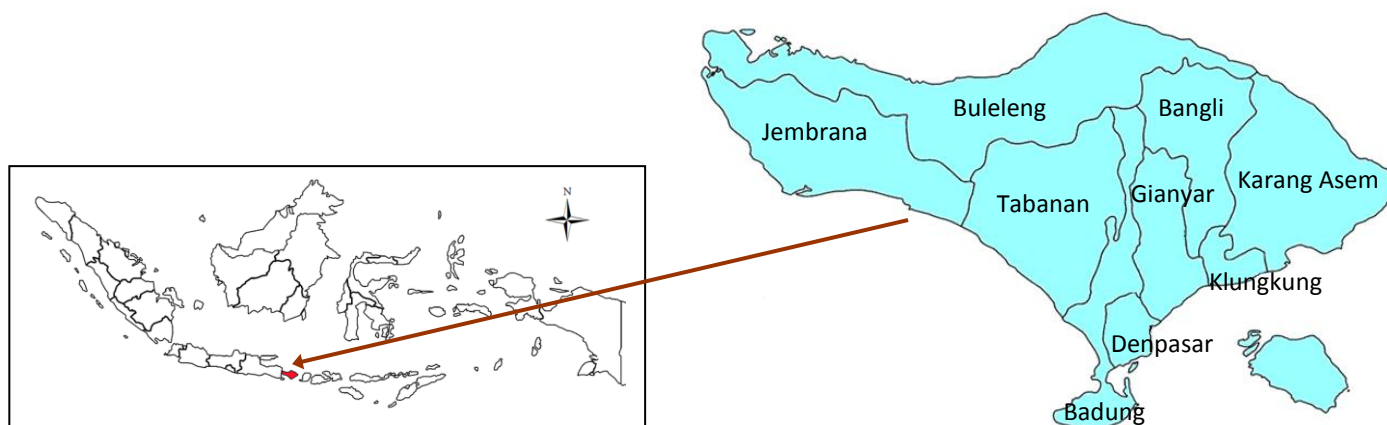


Figure 1. Map of Bali Province with districts, Indonesia

and Denpasar City, the capital city of the province (Figure 1). The human population of Bali Province was 3,891,428<sup>7</sup>, with a population growth rate of 2.5 percent per year.

### Data Collection, Management and Analysis

Table 1. Type of data collected from different sources in Bali Province, Indonesia, 2008-2011

Source	Data	Period
Disease Investigation Center (DIC), Denpasar	Number of affected village Samples from dogs	Nov 2008 to Nov 2011 Sep 2010 to Nov 2011
Provincial Public Health Office	Number of human rabies cases Number of human cases bitten	Nov 2008 to Nov 2011
Provincial Livestock Office	Mass vaccination	May to Nov 2011

Information on human and animal rabies was provided by the Provincial Public Health Office,

Provincial Livestock Office and Disease Investigation Centre (DIC) in Denpasar (Table 1).

Data were entered and managed in spread sheet, and quality and validity were assessed. Data analysis, both descriptive and analytical methods, were conducted using Epi Info 3.5.3<sup>8</sup>. Association between gender and vaccination status was calculated using odd ratios with 95% confidence intervals. Cases were defined as the animal samples tested positive for rabies by Fluorescent Antibody Test (FAT). Geographic information system (GIS) was used to describe spatial patterns and spread of rabies in Bali Province.

### Results

#### Rabies in Animal

Results of laboratory analysis from DIC in Denpasar showed that number of villages affected increased gradually from 1% (5 of 723) in 2008 to 30% (216 of 723) in 2010 before it went down to 9% (62 of 723) in the following year. Locations and proportions of infected villages from November 2008 to November 2011 were illustrated in figure 2.

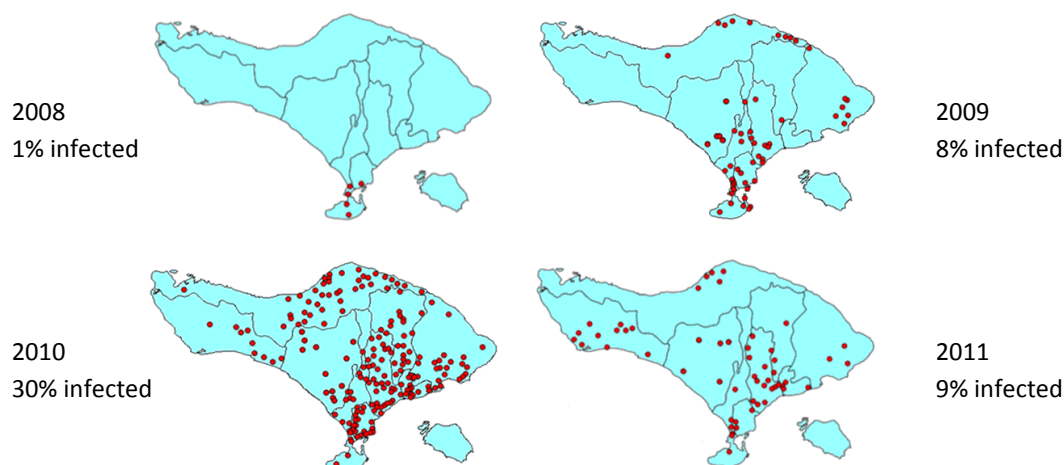
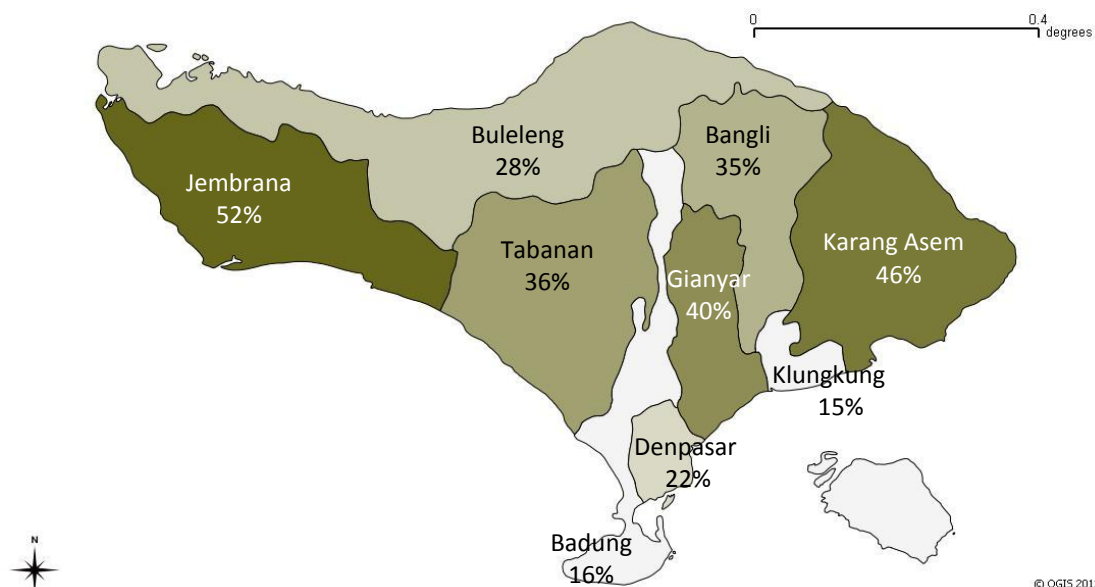


Figure 2. Geographical distribution of rabies infected villages in Bali Province, Indonesia, November 2008 to November 2011



**Figure 3. Spatial distribution of positive samples of dog rabies by district in Bali Province, Indonesia, September 2010 to November 2011**

There were a total of 433 samples submitted and tested by DIC from September 2010 to November 2011. Of these, 128 (29%) samples were tested positive for rabies, with the highest in Jembrana District (52%) and lowest in Klungkung District (15%) (Figure 3). Most of positive samples were from dogs that had history of biting people and dogs with clinical signs of rabies with 47% and 36% respectively. None out of 86 samples submitted during stray dog depopulation from January to November 2011 was tested positive for rabies.

Although there was no statistical significance, male dogs were 1.7 times more likely to be tested positive for rabies than the female ones and unvaccinated dogs were 2.2 times more likely to be positive for rabies than vaccinated dogs (Table 2).

The second dog mass vaccination program since May to November 2011 in Bali Province covered 83% of the total dog population.

#### **Rabies in Human**

Total number of reported human deaths of rabies in Bali Province from 2008 to September 2011 was 133. The highest number of reported human deaths (82) was in 2010, with incidence proportion of 2.1 per 100,000 population. The number of rabid human deaths reduced to 19 in all districts during 2011, except in Klungkung and Bangli Districts where the number of human deaths were not reduced (Table 3).

Although number of reported human rabies deaths reduced over the time, number of human cases bitten by dogs remained unchanged, with over 4,000 reported cases per month (Figure 4).

**Table 2. Positive samples of dog rabies by gender and vaccination status in Disease Investigation Centre (DIC), Bali Province, Indonesia, January to November 2011**

Variable	Category	Sample positive	OR (95% CI)
Gender	Male	30% (53/175)	1.7 (1.0-2.9)
	Female	21% (23/111)	
Vaccination status	Unvaccinated	37% (40/109)	2.2 (0.9-5.0)
	Vaccinated	21% (11/52)	

#### **Discussion**

The results from this study revealed that rabies has spread to all districts in Bali since it was first introduced to the island in late 2008 and reached the highest rate in 2010. Since then, the number of affected villages, human deaths and rabid dogs reduced gradually, reflecting success of dog mass vaccination program conducted in late 2010 and in 2011. Over 70% of dog population in the province were vaccinated after the vaccination programs. The impacts of effective vaccination program rely heavily on well planned vaccination and good communication strategies. However, vaccinated animals may not have long-lasting protection with low quality of vaccine, poor health condition and a single dose of rabies vaccine.<sup>10</sup> This reflects the finding in this study where dogs that had vaccination history against rabies were tested positive for rabies.

Male dogs were more likely to be infected with rabies than the female ones, which might be important for the spread of rabies in Bali. The behavior of males

**Table 3. Temporal distribution of human rabies deaths in districts of Bali Province, Indonesia, 1 Jan 2008 to 22 Sep 2011<sup>9</sup>**

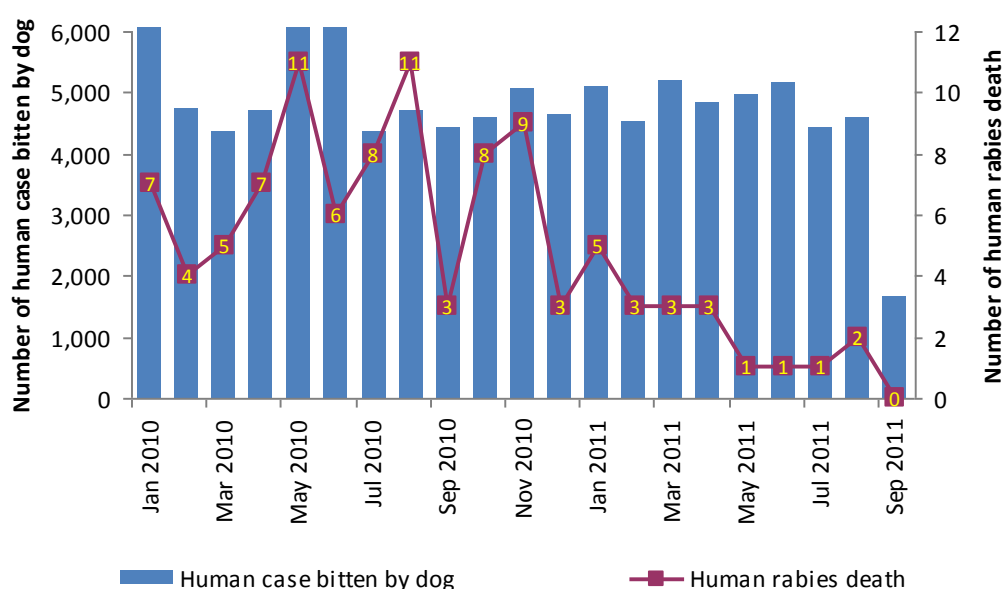
District	Number of human death				Total
	2008	2009	2010	2011	
Buleleng	0	0	21	5	26
Jembrana	0	0	0	0	0
Tabanan	0	13	5	0	18
Badung	4	6	10	1	21
Denpasar	0	3	6	2	11
Gianyar	0	1	5	1	7
Klungkung	0	0	4	4	8
Bangli	0	0	2	4	6
Karangasem	0	5	29	2	36
<b>Total</b>	<b>4</b>	<b>28</b>	<b>82</b>	<b>19</b>	<b>133</b>

that move around greater distance to find females as their mating behavior increase risk for coming into contact with rabid animals than the females. This finding is in agreement with Panichabhongse<sup>11</sup> that two-thirds of the positive cases were male dogs. Wandeler, et al also reported that male dogs left their referral household significantly more often and covered greater distances.<sup>12</sup>

High proportion of positive samples from dogs that bite humans and dogs with clinical signs of rabies can be used to convince communities to report any incident in accordance with this finding to the relevant authorities. Depopulation measure should be

targeted on the dogs which are involved in unprovoked dog bites or dogs showing clinical signs of rabies.

Although number of human deaths from 2010 to 2011 decreased, numbers of reported human cases bitten by dogs remained stable, with over 4,000 cases per month. Therefore, human are still at risk of getting rabies if dogs are infected. Increase public knowledge about rabies, awareness to seek medical treatment and to report after being bitten by animals, and availability of human post-exposure prophylaxis may contribute to reduction of human deaths and bitten cases.

**Figure 4. Temporal distribution of number of human cases bitten by dog and human rabies deaths by month in Bali Province, Indonesia, January 2010 to September 2011**

## Public Health Actions and Recommendations

Collaboration between human health and animal health sectors to improve public knowledge and awareness about rabies through public counseling at sub-village level, high level of commitment to provide human post-exposure prophylaxis and establishment of rabies center to facilitate reporting and disseminating information to the public are key factors to prevent human and dog rabies.

The interpretation of rabies situation in Bali was based on available data, which provided good representation of rabies situation in Bali. Improvement on data recording and continuous analysis of surveillance data both in human and animal sectors are essential to understand the rabies situation and allow meaningful evaluation of the prevention and control program as well. Mass dog vaccination and targeted depopulation of stray dogs with bite history or clinical symptoms demonstrated good way in preventing the spread of rabies.

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