

## Dominant factors influencing leptospira sp infection in rat and suncus

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### Abstrak

**Latar belakang:** Tikus dan cecurut dapat menularkan leptospirosis. Setiap jenis tikus dan cecurut mempunyai habitat masing-masing, antara lain jenis, daerah, dan ketinggian. Tujuan penelitian ini untuk menganalisis pengaruh ketinggian, variasi spesies, jenis tanah, tata guna lahan, dan banjir terhadap infeksi *Leptospira sp* pada tikus dan cecurut.

**Metode:** Penelitian potong lintang dilakukan di beberapa lokasi pada bulan April-November 2011 di Jawa Tengah (kota dan kabupaten Semarang, kabupaten Demak, kabupaten Sleman dan Wonogiri). Tikus dan cecurut yang tertangkap diidentifikasi, dan diambil ginjal untuk diperiksa keberadaan bakteri leptospira dengan Polymerase Chain Reaction (PCR). Untuk mengidentifikasi faktor yang mempengaruhi infeksi leptospira sp pada tikus, analisis data memakai pendekatan risiko relatif.

**Hasil:** Spesies tikus dan cecurut, tingkat elevasi dan jenis tanah berpengaruh terhadap risiko infeksi *Leptospira sp*. Dibandingkan dengan *S. murinus*, *Rattus norvegicus* spesies hampir 78 kali lipat berisiko infeksi *Leptospira sp* (risiko relatif rasio suaian (RRa = 77.87, P = 0,001], dan *R. tanezumi* memiliki risiko yang lebih rendah (RRa = 7,95, P = 0,048). Menurut tingkat elevasi tanah, elevasi yang rendah (0-100 m) dibandingkan dengan yang lebih tinggi (101-600 m) berisiko 2,3 kali lipat terinfeksi *Leptospira sp* (RRa = 2,27, P = 0,132).

**Kesimpulan:** Infeksi leptospirosis pada tikus berkaitan dengan species tikus dan cecurut serta tingkat elevasi serta jenis tanah. (*Health Science Indones 2012;2:xx-xx*)

**Kata kunci:** species tikus dan cecurut, leptospirosis

### Abstract

**Background:** Mice and suncus may transmit leptospirosis. Each type mice and suncus had different habitat, among other, types, regions, and altitude. The purpose of this study to analyze the effect of altitude, variety of species, soil type, land use and flood against *Leptospira sp* infection in mice and suncus.

**Methods:** A cross-sectional study conducted at several locations in April-November 2011 in Central Java (the town and district of Semarang, district of Demak, district of Sleman and Wonogiri). Mice and suncus caught were identified, kidney were taken for the existence of bacteria leptospira by Polymerase Chain Reaction (PCR). To identify factors affecting leptospira sp infection, analysis of data using relative risk approach.

**Results:** Species of rats and suncus, elevation level, soil types and area related to risk *Leptospira sp* infection. Compared with *S. murinus*, *Rattus norvegicus* species had almost 78-fold to be *Leptospira sp* infected (adjusted relative risk ratio (RRa = 77.87; P = 0.001], and *R. tanezumi* had less risk (RRa = 7.95; P = 0.048). In term of elevation level, Lower elevation level (0-100 m) compared with higher level (101-600 m) had 2.3-fold risk to be *Leptospira sp* infection (RRa = 2.27; P = 0.132).

**Conclusion:** Species of rats and suncus, elevation level, soil types and area related to risk *Leptospira sp* infection. (*Health Science Indones 2012;2:xx-xx*)

**Key words:** Species of rats and suncus and leptospirosis

Leptospirosis is one of zoonotic diseases caused by *Leptospira* bacteria. Due to its transmission does not need a vector, leptospirosis is classified as a direct zoonosis disease. It is transmitted from animal infected by leptospira with rat is the major reservoir. *Leptospira* can live in reservoir's kidney and excreted through its urine. This disease actually is not vicious, but if not well medicated, it can cause some complications to the heart, kidney or brain membrane with fatal consequences. Leptospirosis is a neglected and forgotten disease. *Suncus* is also another leptospirosis reservoir.<sup>1,2</sup>

Research in New Zealand at three locations with different land elevation and micro climate showed different species dominated in each location.<sup>3</sup> Research in Halimun Mountain National Park (West Java) found two different species of rat in different land elevation, they were *Maxomys bartelsii* and *Niviventer lepturus*. At the land elevation until 1,560 meters above sea level, *Maxomys bartelsii* was found predominantly than *Niviventer lepturus*, and it was opposite at the land elevation more than 1,560 asl.<sup>4</sup> A previous study in Semarang City (Central Java) indicated the spread of leptospirosis in 2009 was predominantly in low elevation of land area (less than 47 m).<sup>5</sup>

Leptospirosis causes problems and even some outbreaks in several areas. Leptospirosis in Java Island was initially widespread in north coastal area in Central Java such as Semarang City and Demak District. The cases of leptospiraa infection in Demak District tend to increased in last 4 years.

In 2004 until 2008 in several Central Java the number of leptospira cases detected increased.<sup>6</sup> New Leptospirosis cases were recently found in low elevation of land area (0-100 m). Leptospirosis cases were also ever reported sporadically in other districts of low area as well as and high elevation of land area.<sup>7</sup>

The purpose of this study was to identify dominant factors influencing to Leptospirosis infections in rats and *suncus*.

## METHODS

This cross sectional study was done in several locations had leptospirosis problems with different elevation of land area. Population of this study was all species of rat and *suncus* in selected area in Central Java (Semarang district and city, Demak, Sleman and Wonogiri

districts). Samples were all species of rat and *suncus* trapped.

City and districts with different elevation of land as decided before (less than 100 m, 101 – 600 m above sea level). Traps were laid down in each study location for three nights. Rat and *suncus* trapped then to be unconsciousness and identified. The kidneys were removed for leptospirosis examination by Polymerase Chain Reaction (PCR) method.

To identify factors affecting leptospira sp infection, analysis of data using relative risk approach using STATA 9 software.

## RESULTS

A number of 231 rats and *suncus* were available for this analysis. Rats and *suncus* in lower elevation level, coastal, alluvial soil type, and flood area were more likely had positive infection of *Leptospira* sp. (Table 1).

Table 2 (our final model) shows that rat and *suncus* species and elevation level were two dominant factors for increasing the risk of infection of *Leptospira* sp.

Compared with *S. murinus*, *Rattus norvegicus* species had almost 78-fold to be *Leptospira* sp infected (adjusted relative risk ratio (RRa = 77.87; P = 0.001], and *R. tanezumi* had less risk (RRa = 7.95; P = 0.048). In term of elevation level, Lower elevation level (0-100 m) compared with higher level (101-600 m) had 2.3-fold risk to be *Leptospira* sp infection (RRa = 2.27; P = 0.132).

## DISCUSSION

Study location areas have variation of land elevations with leptospirosis history problems represented for settlement located in near coastal area, settlement in near plantation, settlement in rice field area, settlement in near bon irrigated for dry field and rice field. Rat habitat is different for every specific species, although it is possible for some species can live in several different habitat.<sup>8</sup>

Rat is the main source for leptospirosis transmission, while *suncus* is usually trapped when rat trap installed. *Leptospira* bacteria ever found in *suncus*. Samples that examined in Central Veterinary Research in Bogor (West Java) in 2002 until 2004 showed 25.80% of rats infected leptospira bacteria. In 2004, rat samples

Table 1. Relationship between height, species, soil type, type of land use, flood and infection of *Leptospira* sp

	Infection of <i>Leptospira</i> sp				Crude odds ratio	95% Confidence Interval	P
	Negative (n=18)		Positive (n=213)				
	n	%	n	%			
Elevation level							
101-600 m	121	94.5	7	5.5	1.00	Reference	
0-100 m	92	89.3	11	10.7	2.07	0.77-5.54	0.149
Soil type							
Latosol	121	94.5	7	5.5	1.00	Reference	
Aluvial	92	89.3	11	10.7	2.07	0.77-5.54	0.149
Type of land							
Coastal	92	89.3	11	10.7	1.00	Reference	
Rice field	121	94.5	7	5.5	0.48	0.18-1.30	0.149
Area							
Non flood area	55	87.3	8	12.7	1.00	Reference	
Flood area	158	94.0	10	6.0	0.44	0.16-1.16	0.096

Table 2. Relationship between species, height and infection of *Leptospira* sp

	Infection of <i>Leptospira</i> sp				Adjusted Odds Ratio*	95% Confidence Interval	P
	Negative (n=18)		Positive (n=213)				
	n	%	n	%			
Species							
<i>S. murinus</i>	63	98.4	1	1.6	1.00	Reference	
<i>R. norvegicus</i>	2	40.0	3	60.0	77.87	5.29-1145.12	0.001
<i>R. tanezumi</i>	148	91.4	14	8.6	7.95	1.02-61.76	0.048
Elevation level							
101-600 m	121	94.5	7	5.5	1.00	Reference	
0-100 m	92	89.3	11	10.7	2.27	0.78-6.58	0.132

\*Adjusted between variable listed on this table, soil type, type of land, and area

with positive leptospira bacteria increasing to 48%.<sup>9</sup> However in this study, rat and suncus found in rat trap survey with only 12% and 1.6% respectively positive of leptospira sp.

The above analysis shows that *R. tanezumi* and *S. murinus* always found in every level of land elevation. This finding is in line with results of previous studies. *R. tanezumi* as well as *Suncus murinus* could be found in most of human settlement in Java Island from less than 1 meter until 3.000 meters. *Suncus murinus* was already adapted with house's environment; this species was not only feed insect but also garbage from human food.<sup>9,10</sup>

On the other hand, all of *R. norvegicus* in this study found in lower elevation location (less than 100 m), with the highest proportion to be infected by *Leptospira*

sp. This result was similar to the survey in Belen, Peru that showed *R. norvegicus* found more infected with leptospira bacteria compared with *R. rattus* (21.7% vs 4.6%,  $p < 0.001$ ).<sup>11</sup>

The results of this study also supported that rat, specially *R. norvegicus* and *R. rattus* (*R. tanezumi*) had important roles as reservoir for leptospirosis transmission.<sup>12</sup> *Rattus* genus also had more relationship to positive leptospira bacteria than non *Rattus* genus ( $P = 0.01$ ).<sup>12</sup>

This study shows that in Central Java, endemic leptospirosis found predominantly in lowland areas. Although in small portion, leptospirosis was also found in more high area. A prior study in urban and rural area infection of bacteria leptospira was low, except in harbor city, infected leptospira bacteria

in *R. norvegicus* was high, In rice field area, *R. argentiventer* and *R. exulans* had important roles in leptospirosis transmission.<sup>13</sup> Our results differed with Smith's findings.<sup>14</sup> We found that either in settlement or in rice field area, *R. tanezumi* had significant roles in leptospirosis transmission.

In conclusion, species of rats and suncus, elevation level, soil types and area related to risk *Leptospira* sp infection. Compared with *S. murinus*, *Rattus norvegicus* and *R. tanezumi* species had higher risk *Leptospira* sp infected. In term of elevation level, lower elevation level (0-100 m) had higher risk *Leptospira* sp infected.

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