Surveillance and research for vectorborne diseases in Finland

Climate change and health impacts of infectious diseases in the north, Copenhagen September 19, 2011

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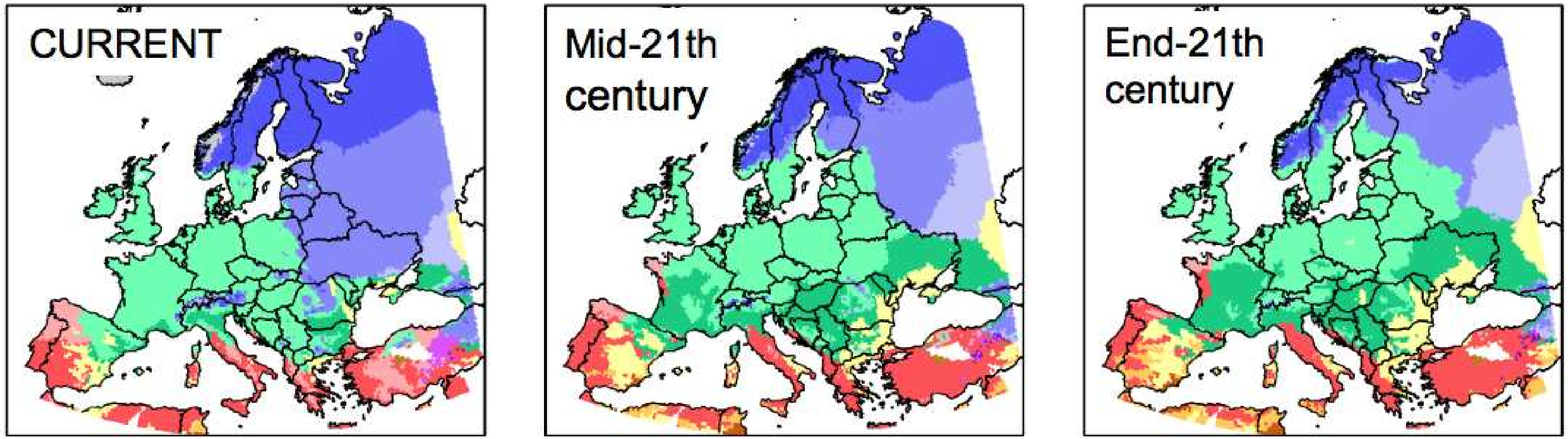
Change in climate zones in Europe according to moderate A1B scenario [Jylhä et al., 2009]

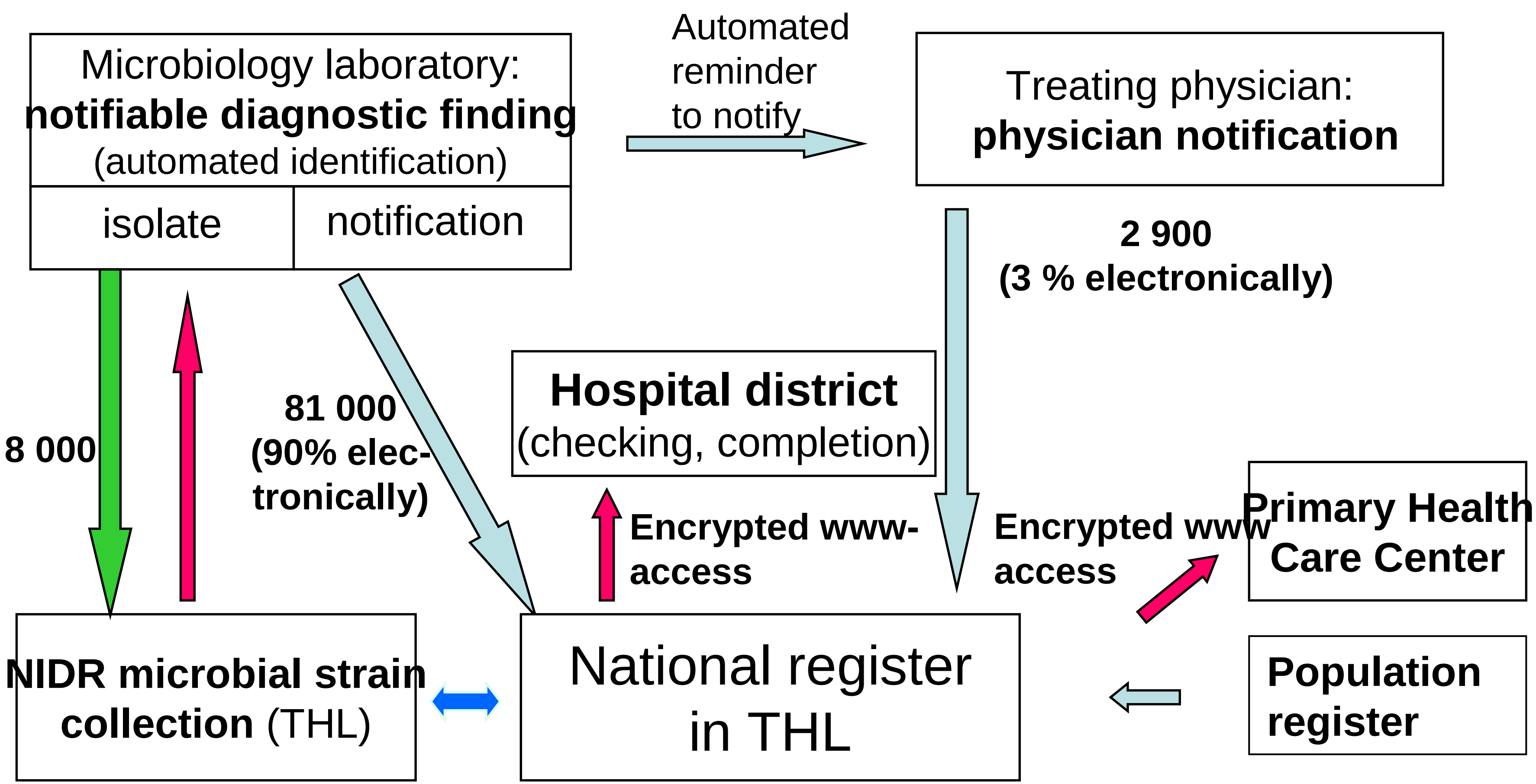


- The annual mean temperature in Finland is projected to increase by 2-6°C by 2070-2099, compared with the mean of 1971-2000
- Warming is stronger in winter (3-9°C) than in summ er (1-5°C).
- Simultaneously, precipitation is projected to increase by 10-40% in winter and 0-20% in summer.

National infectious disease register (NIDR)

- Individual cases with microbiological diagnosis (only)
  - **Rapid component directly from the laboratories** (mandatory)
    - commercial laboratory software
    - from lab mainframe to NIDR mainframe computer (web, encrypted)
  - Microbial strains (specimens in some diseases) of defined species to THL for further characterization (mandatory)
  - Complementary notification from physicians (mandatory)
- Laboratory reminder to the attending physician with laboratory report on the test result
- National (unique) person identifier
  - Reliable linkage of data from several sources

Flow of data and information in NIDR 1.1.2009 -



Data for 2009

Notifiable diseases and microbes

- Physician and laboratory notifiable
  - 32 diseases (P) and causative microbes (L)
  - Physician notification content complementary to laboratory notification
- Laboratory notifiable only
  - 40 microbes or microbe groups
  - All microbes in blood or cerebrospinal fluid
- Can be revised rapidly (e.g. novel influenza A(H1N1))

National infectious disease register

- Links notifications as cases with the national person identifier
- Requests missing information
  - Automated ’tasks’ to the hospital district Infectious Disease Register ’responsible person’ for completion or revision
  - Selected diseases: completion/revision centrally
- Retrieves additional data from population register (place of residence, date of death, country of birth, most recent nationality)
- Links data from THL reference laboratories (identification, typing and susceptibility data) to notifications

Puumala in Finland

- Puumala = rural district in East Finland
- Finnish name: myyräkuume (vole fever)
- Incidence particularly high in Finland
- Notifiable disease
- Geographic variations
- Epidemics in every 3-4 year
- Infections due to occupational and recreational activities

Puumala virus epidemiology

- During 1995-2009, nearly 25,000 notified cases of epidemic nephropathy due to Puumala virus.
  - During 2005-2009, 1,927 to 3,259 annual cases
  - 61% were male, 79% were 25–64 years old.
- Incidence
  - Overall 27.1/100,000 population
  - Rate 25–44-yo men twice as high as among women
  - No sex difference among those >65 years

Puumala virus incidence by HCD, Finland 2010

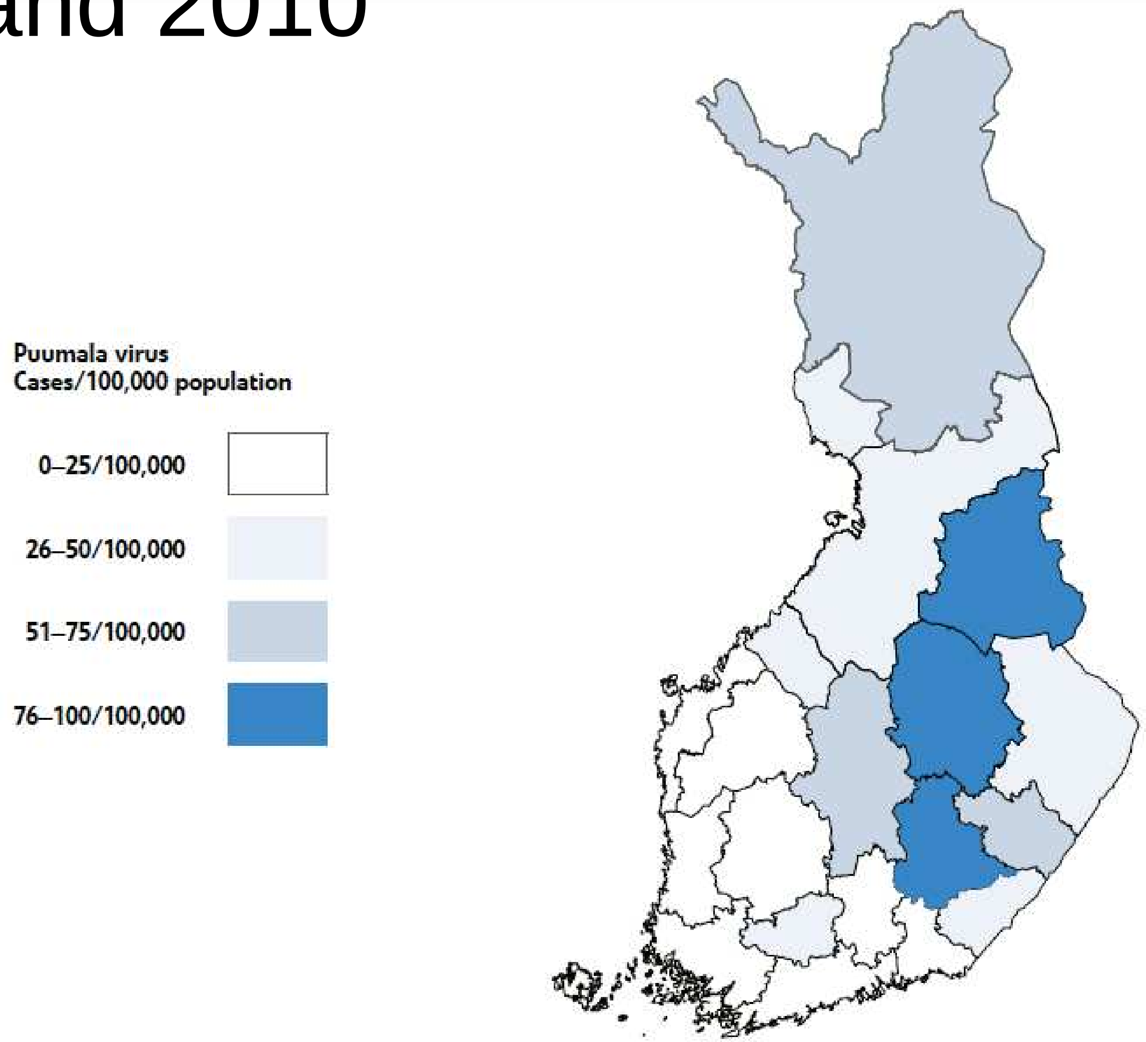


Figure 16. Cases of Puumala virus by hospital district, 2010 (no. of cases per 100,000 population).

Puumala virus cases by month, Finland1995-2009

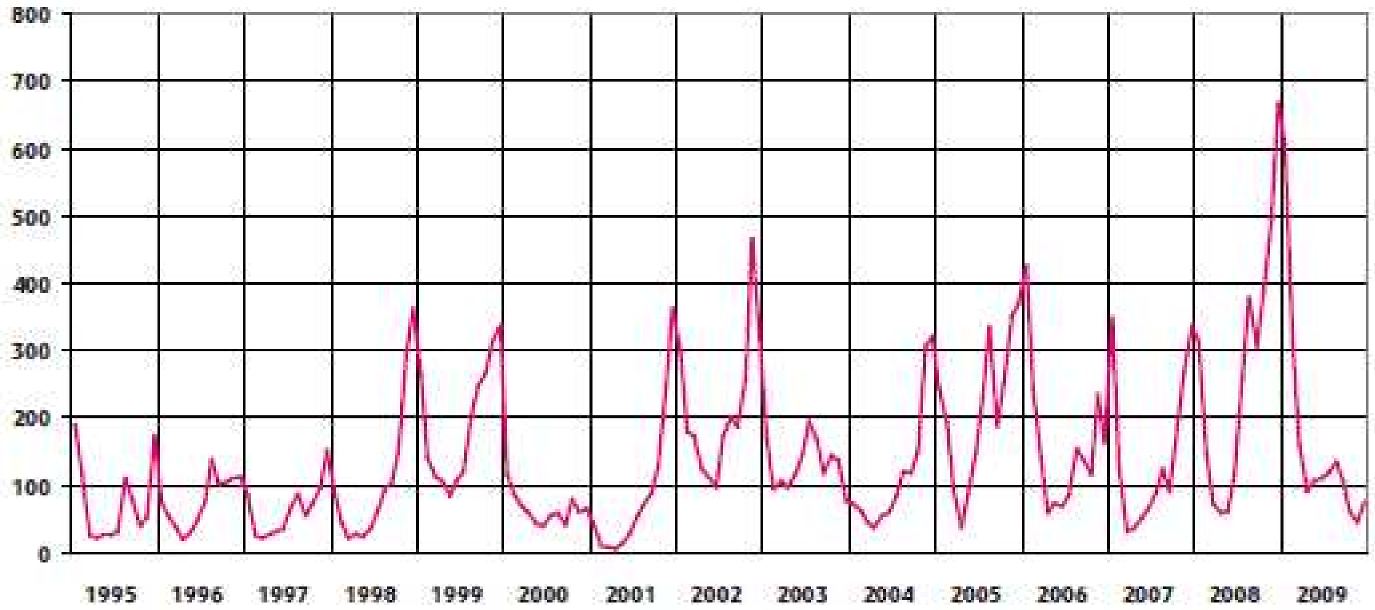
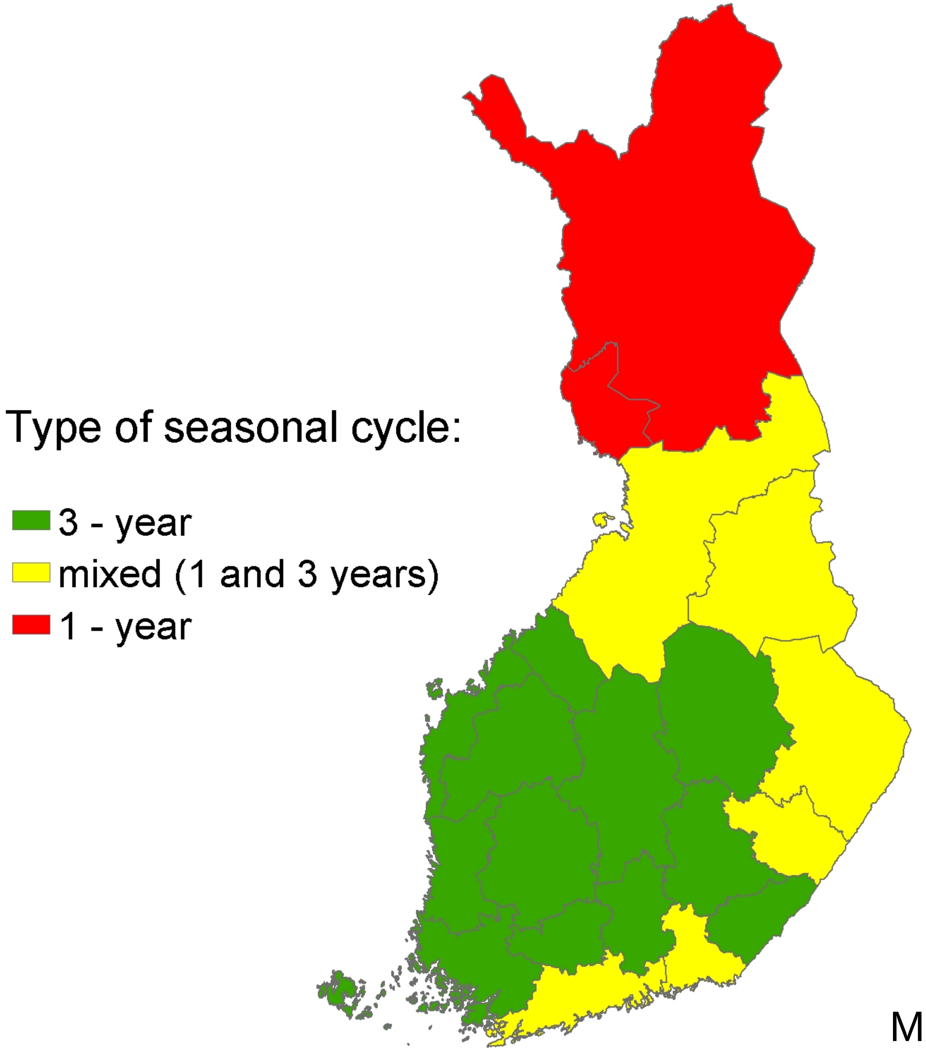


Figure 30. Puumala virus cases by month 1995–2009, number.

Seasonal and geographic variation

- Seasonal variation - peak incidence in December (August-December)
- Annual and seasonal variation has been associated with the 3-year cycles of the bank vole population density
- Regions with higher rates may vary from year to year depending on bank vole population density.
- Seasonal patterns don’t appear to be related to rates of disease, age or gender

Seasonal cycles of Puumala cases by HCD, Finland, 1995 - 2005



Makary P et al. 2007

Disease burden of Puumala virus infections, 1995–2008

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(*Accepted 23 December 2009*)

SUMMARY

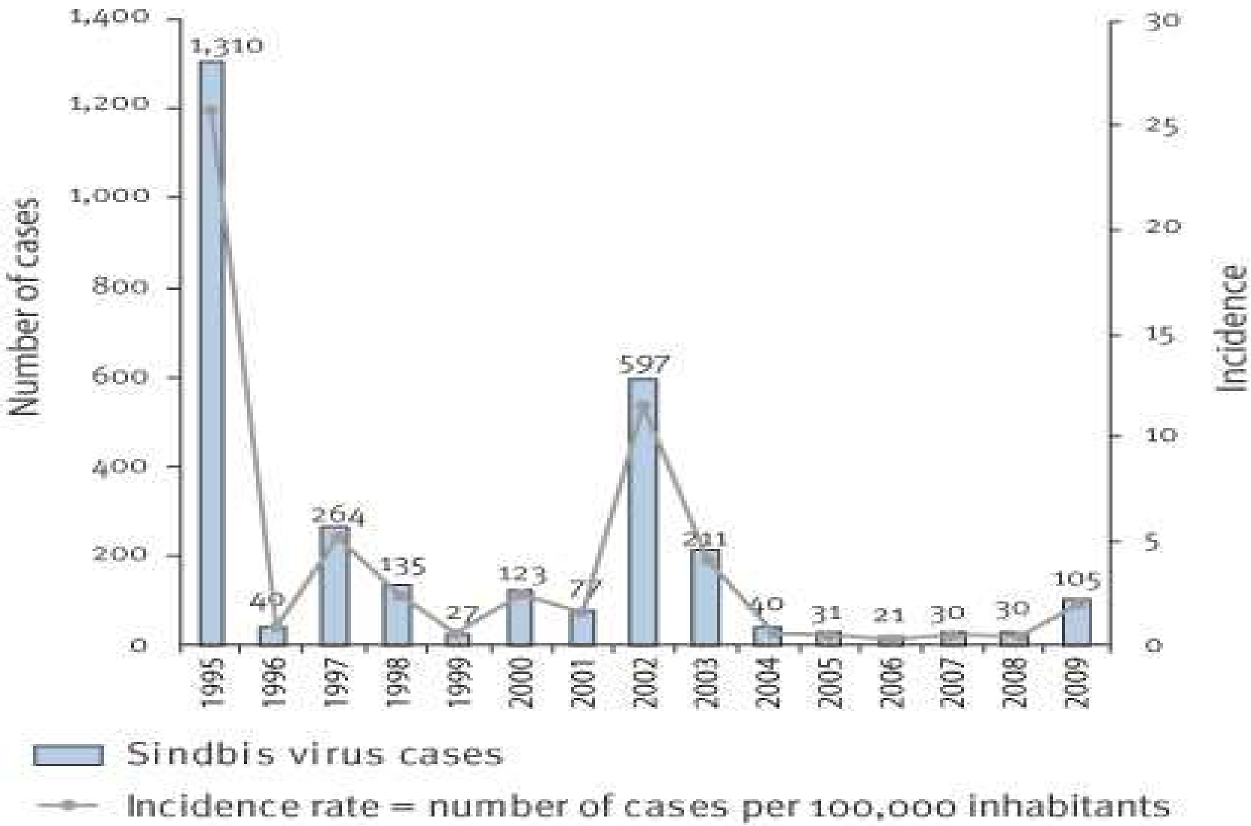
Puumala virus (PUUV) causes mild haemorrhagic fever with renal syndrome, a rodent-borne zoonosis. To evaluate the disease burden of PUUV infections in Finland, we analysed data reported by laboratories to the National Infectious Disease Registry during 1995–2008 and compared these with data from other national registries (death, 1998–2007; hospital discharge, 1996–2007; occupational diseases, 1995–2006). A total of 22 681 cases were reported (average annual incidence 31/100 000 population); 85% were in persons aged 20–64 years and 62% were males. There was an increasing trend in incidence, and the rates varied widely by season and region. We observed 13 deaths attributable to PUUV infection (case-fatality proportion 0·08%). Of all cases, 9599 (52%) were hospitalized. Only 590 cases (3%) were registered as occupational disease, of which most were related to farming and forestry. The wide seasonal and geographical variation is probably related to rodent density and human behaviour.

Epidemiol Infect 2010

Sindbis virus infection = ”Pogosta disease”, Finland 1995-2009

FIGURE 1

Number and incidence rates of laboratory confirmed Sindbis virus cases, Finland, 1995-2009 (n=3,041)

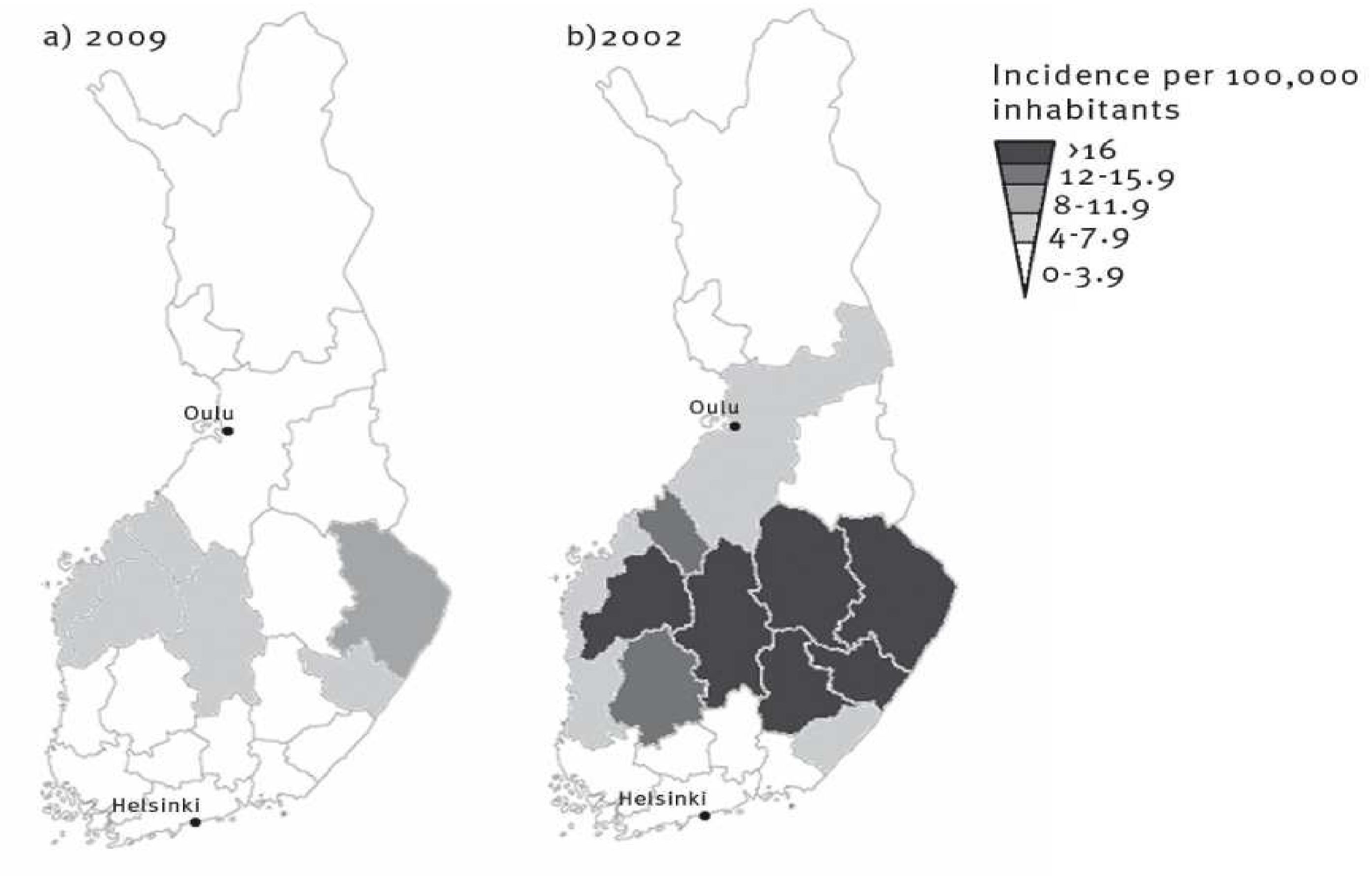


Sane J, Guedes S, Kurkela S, Lyytikäinen O, Vapalahti O. Epidemiological analysis of mosquito-borne Pogosta disease in Finland, 2009. Euro Surveill. 2010;15(2):pii=19462

Rates of SINV infection by HCD, Finland, 2002 and 2009

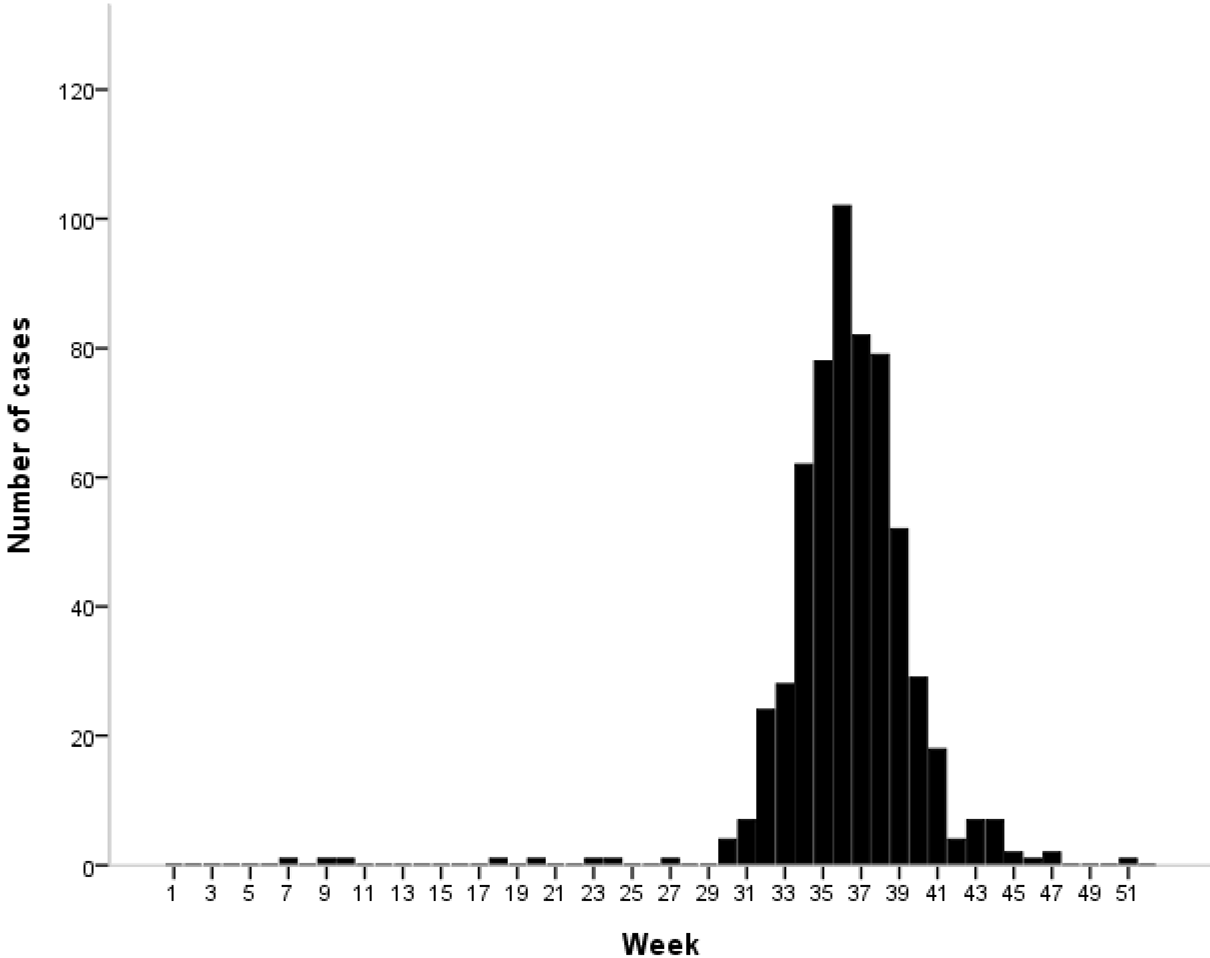
FIGURE 2

Number and incidence rates of laboratory confirmed Sindbis virus cases, by health care districts, Finland 2009 (n=105) and 2002 (n=597)



Sane J, Guedes S, Kurkela S, Lyytikäinen O, Vapalahti O. Epidemiological analysis of mosquito-borne Pogosta disease in Finland, 2009. Euro Surveill. 2010;15(2):pii=19462

Laboratory confirmed cases of SINV infection by week of diagnosis, Finland 2002



Epidemic Sindbis Virus Infection in Finland: A Population-Based Case-Control Study of Risk Factors

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Background. Sindbis virus (SINV) is an arthropod-borne alphavirus that causes rash and arthritis. In Finland, epidemics occur cyclically, but factors associated with clinical SINV infection are largely unknown. We conducted a population-based case-control study during the epidemic year 2002.

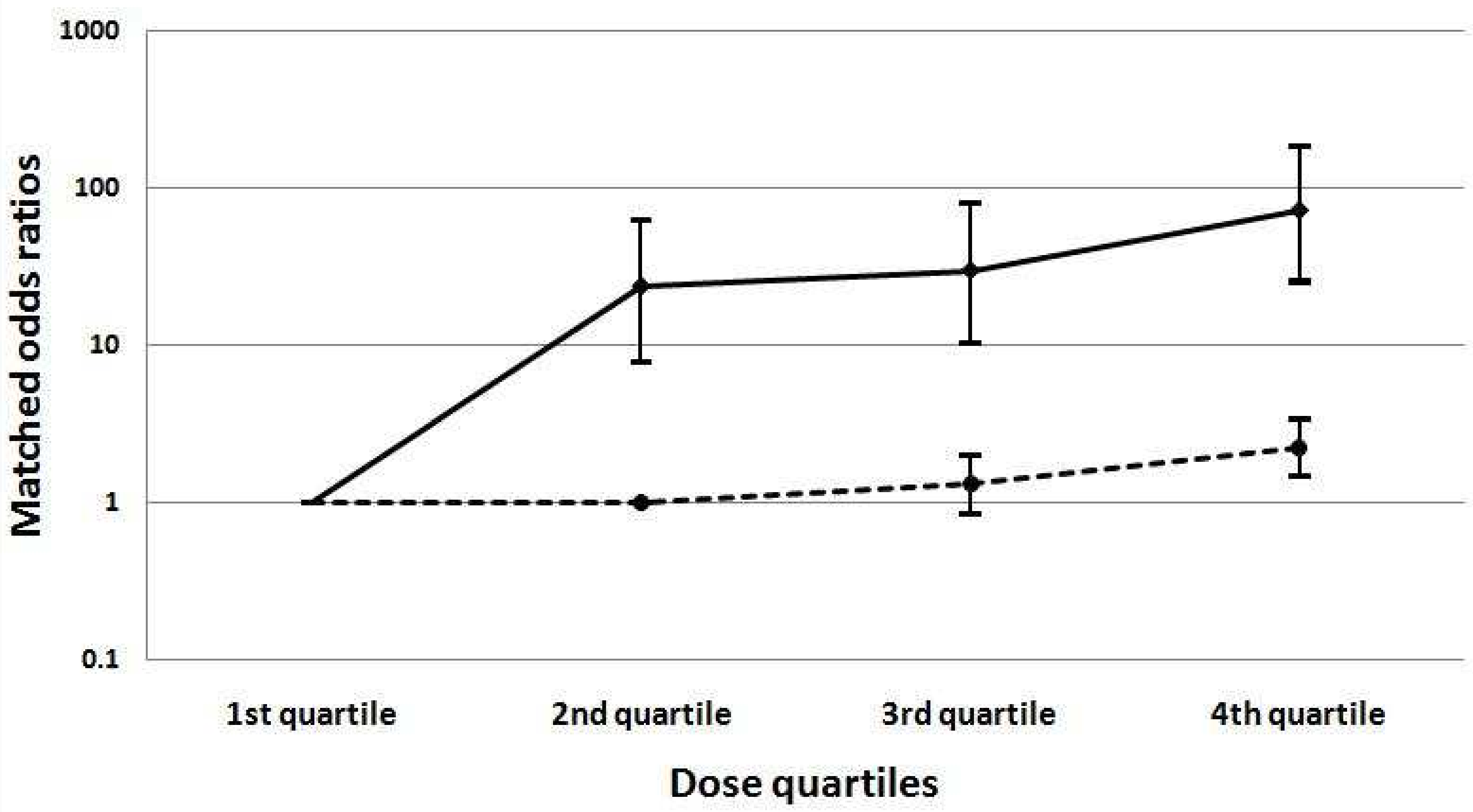
Methods. SINV cases were serologically confirmed and reported to the National Infectious Disease Registry. Five control subjects, matched for age, sex, and residence, were selected from the National Population Information System. Data were collected using a self-administered mail survey. Conditional logistic regression models were used to identify independent risk factors; missing data were addressed using Bayesian full-likelihood modeling.

Results. A total of 337 case patients (58% female; age range, 1–94 y) and 934 control subjects were enrolled. Reported exposure to mosquito bites (matched odds ratio [mOR], 16.7; 95% confidence interval [CI], 9.1–33.4) and spending time in woods or marshland (mOR, 1.8; 95% CI, 1.3–2.5) were independently associated with SINV infection in the multivariable model. The population-attributable risk for mosquito bites was 87.2%. There were dose-response relations for increased number of insect bites (mOR, 23.8–72.5) and increased time spent in woods or marshland (mOR, 1.3–2.2).

Conclusions. Educating the public in endemic areas to avoid mosquito exposure and use protective measures remain important prevention measures for SINV infection.

J Infect Dis 2011; 204:459-66

Dose-response relations for number of insect bites and time spent outdoors vs. odds of SINV infection



J Infect Dis 2011; 204:459-66

Tularemia

- In 2009, 405 microbiologically confirmed tularemia cases (7.6/100,000) were reported
- Most cases between August and September
  - All age groups affected, most frequently 40–65-year-olds; 62% were male
- Large tularemia epidemics seem to occur in 3-year cycles
- Annual rates vary considerably (0.5–18/100,000 pop).
- Previous peak years: 2000 (926 cases), 2003 (823 cases) and 2006 (475 cases).
- Primary mode of transmission: insect bites
- Pulmonary form from inhaling hay dust during harvesting
  - farmers' occupational disease.

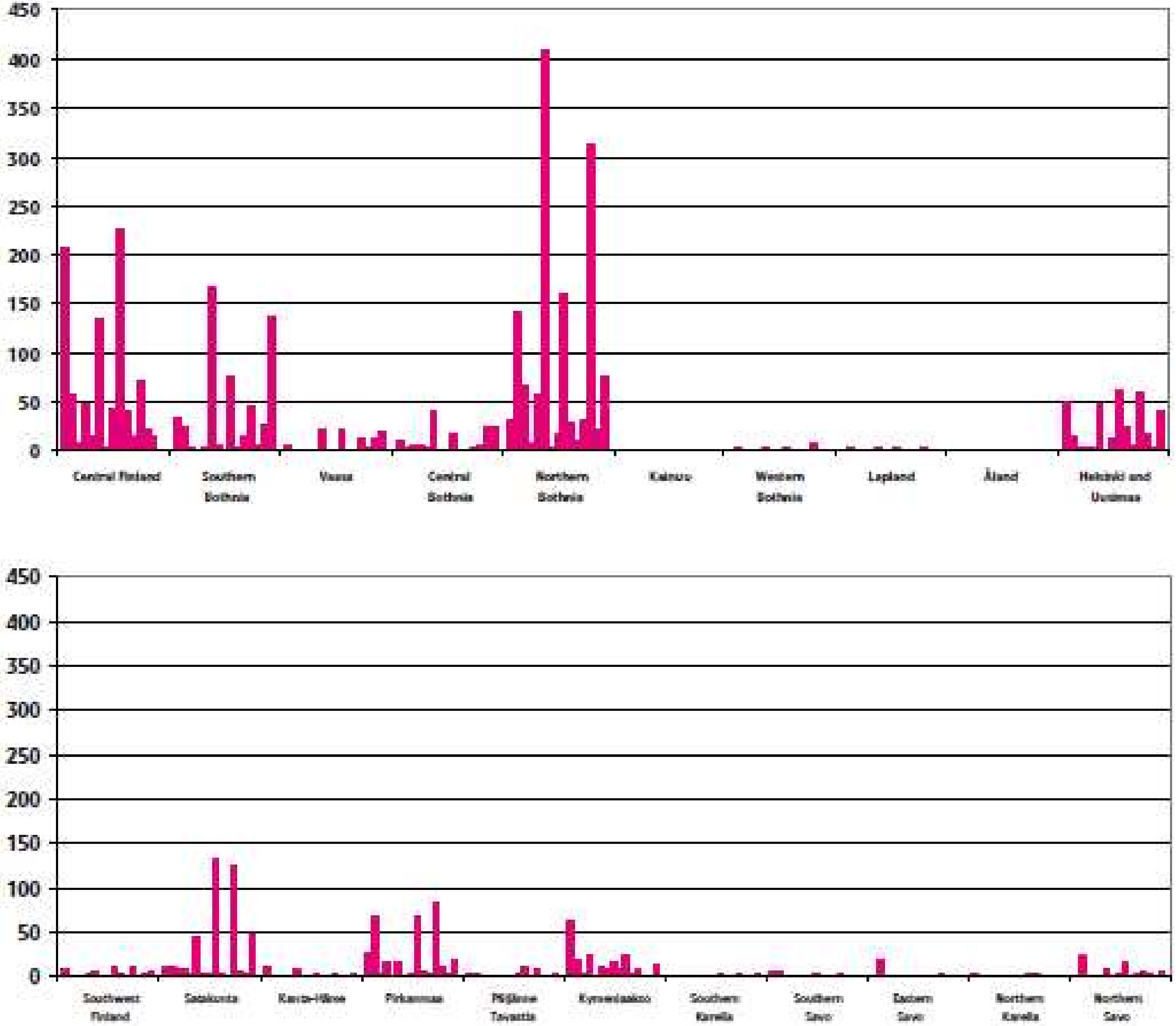
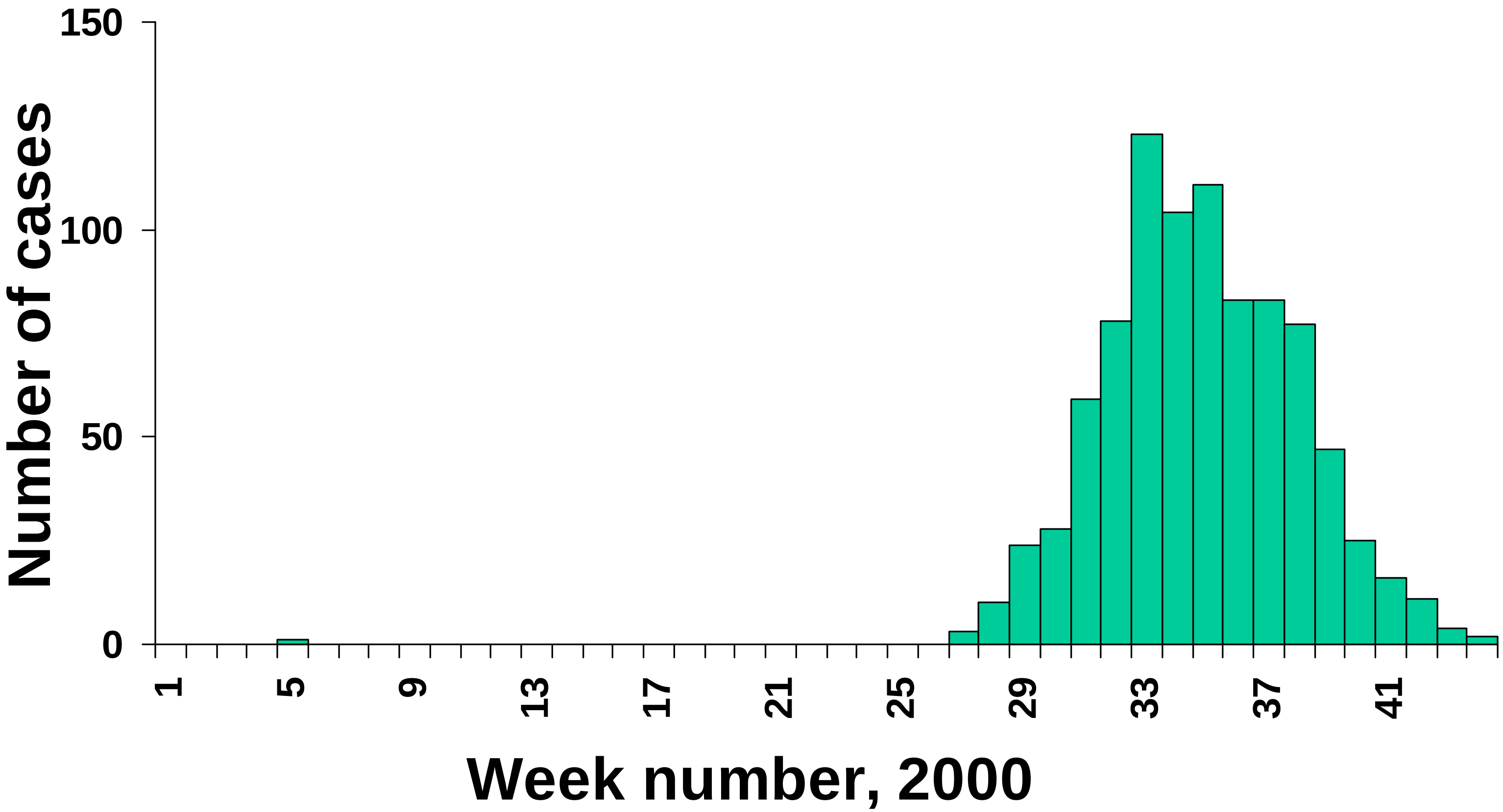


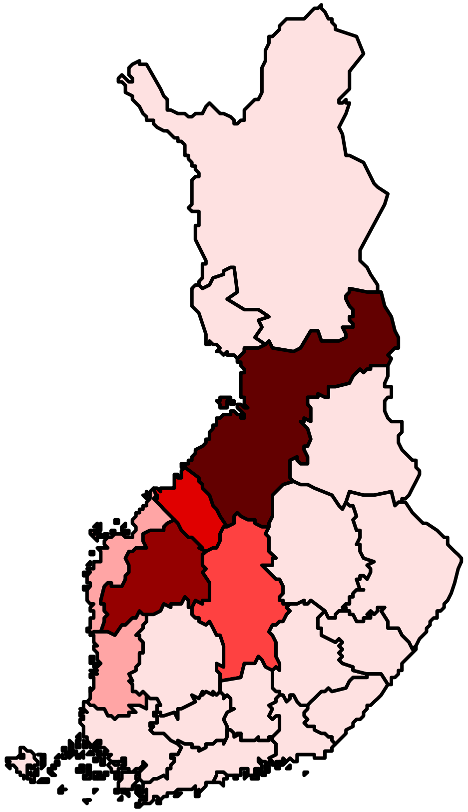
Figure 33a/33b. Tularemia cases by hospital district 1995–2009, number.

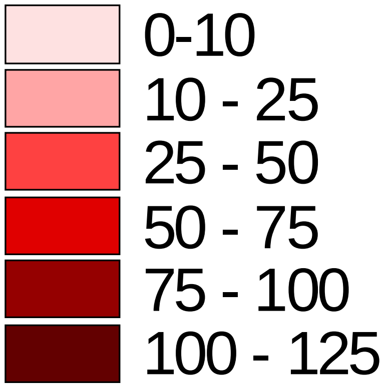
Tularemia cases by week of onset, Finland, 2000



Nuorti et al. IDSA 2001

Rates of tularemia by Health Care District, Finland 2000





Rate per 100,000 population

Nuorti et al. IDSA 2001

Independent risk factors for tularemia – conditional logistic regression models

Variable	Odds ratio (95% CI)	P-value
Ulceroglandular tularemia		
Mosquito bites	19.1 (4.4-83.4)	< 0.001
Use of mosquito repellent	0.8 (0.4-1.5)	0.44
Outdoor activities in the woods	2.1 (1.1-3.9)	0.02
Handling dead animals	4.3 (1.0-18.0)	0.04
Harvesting hay	2.34 (1.0-5.8)	0.06
Other farming activities	1.9 (0.9-3.9)	0.09
Tularemia pneumonia		
Harvesting hay	6.2 (1.2- 29.7)	0.02

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Borreliosis (Lyme disease) cases by HCD, Finland 2010

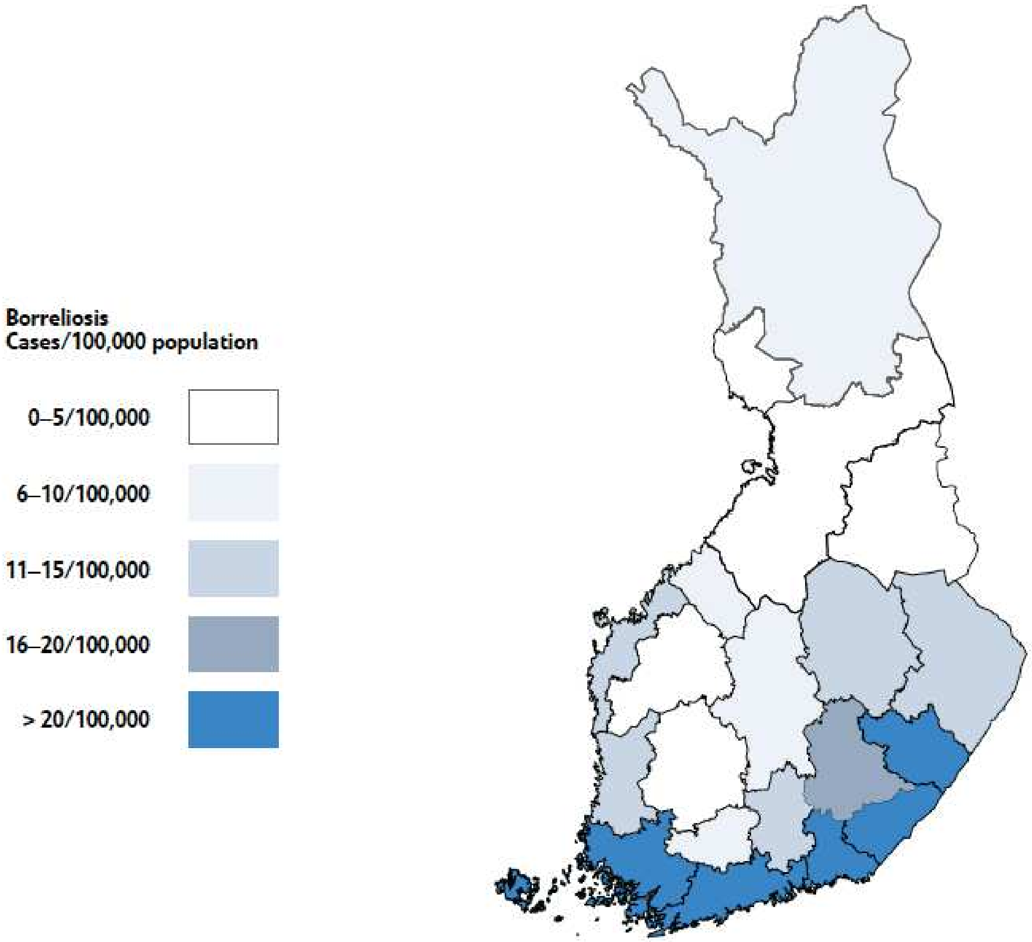


Figure 17. Borreliosis cases by hospital district, 2010 (no. of cases/100,000).

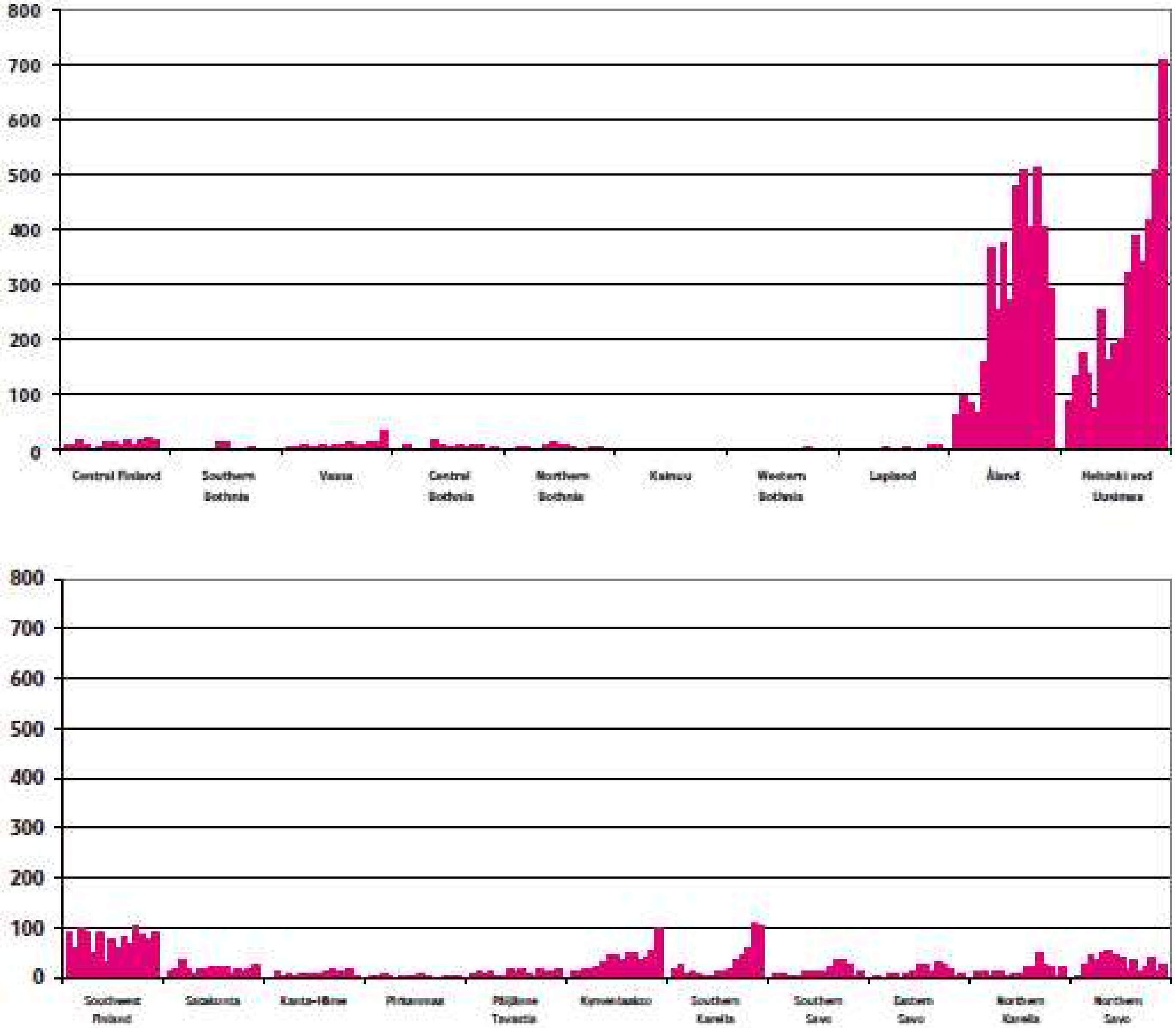


Figure 36a/36b. Borreliosis cases by hospital district 1995–2009, number.

TBE in Finland

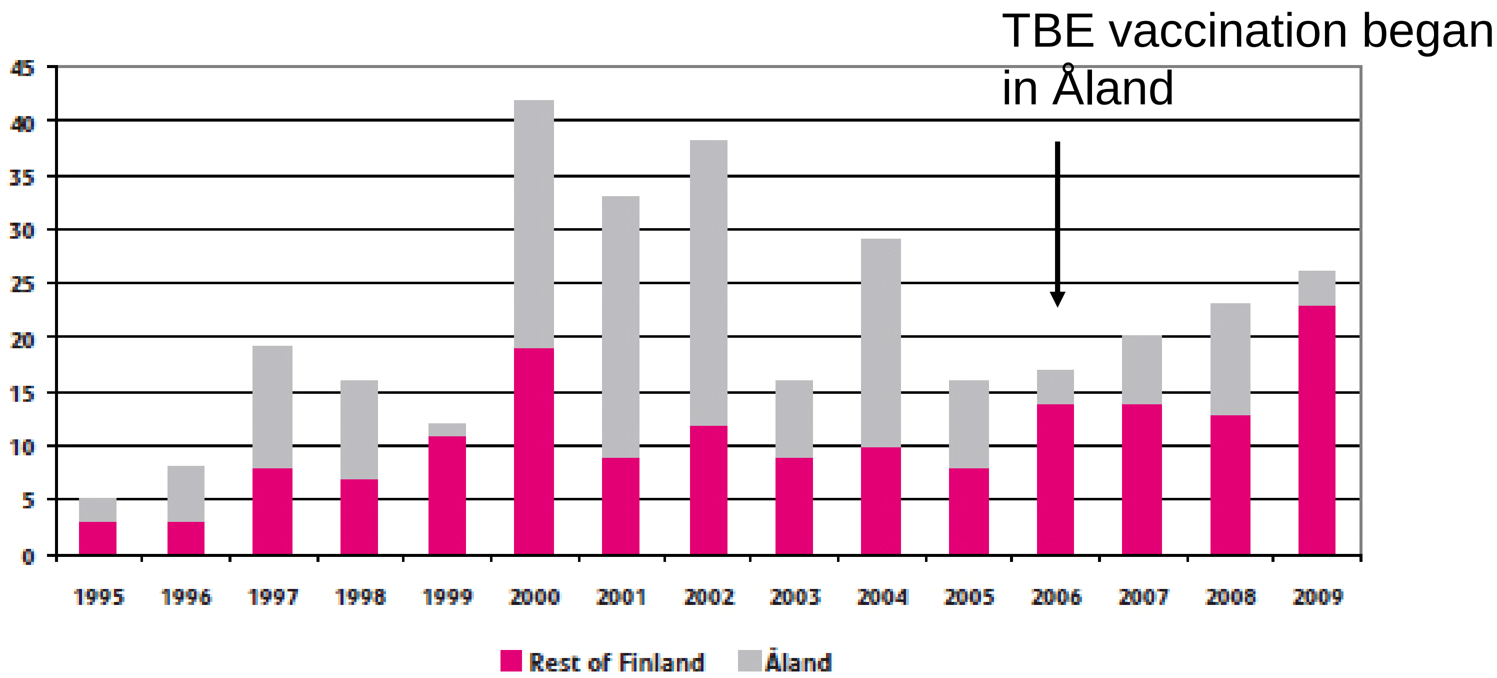
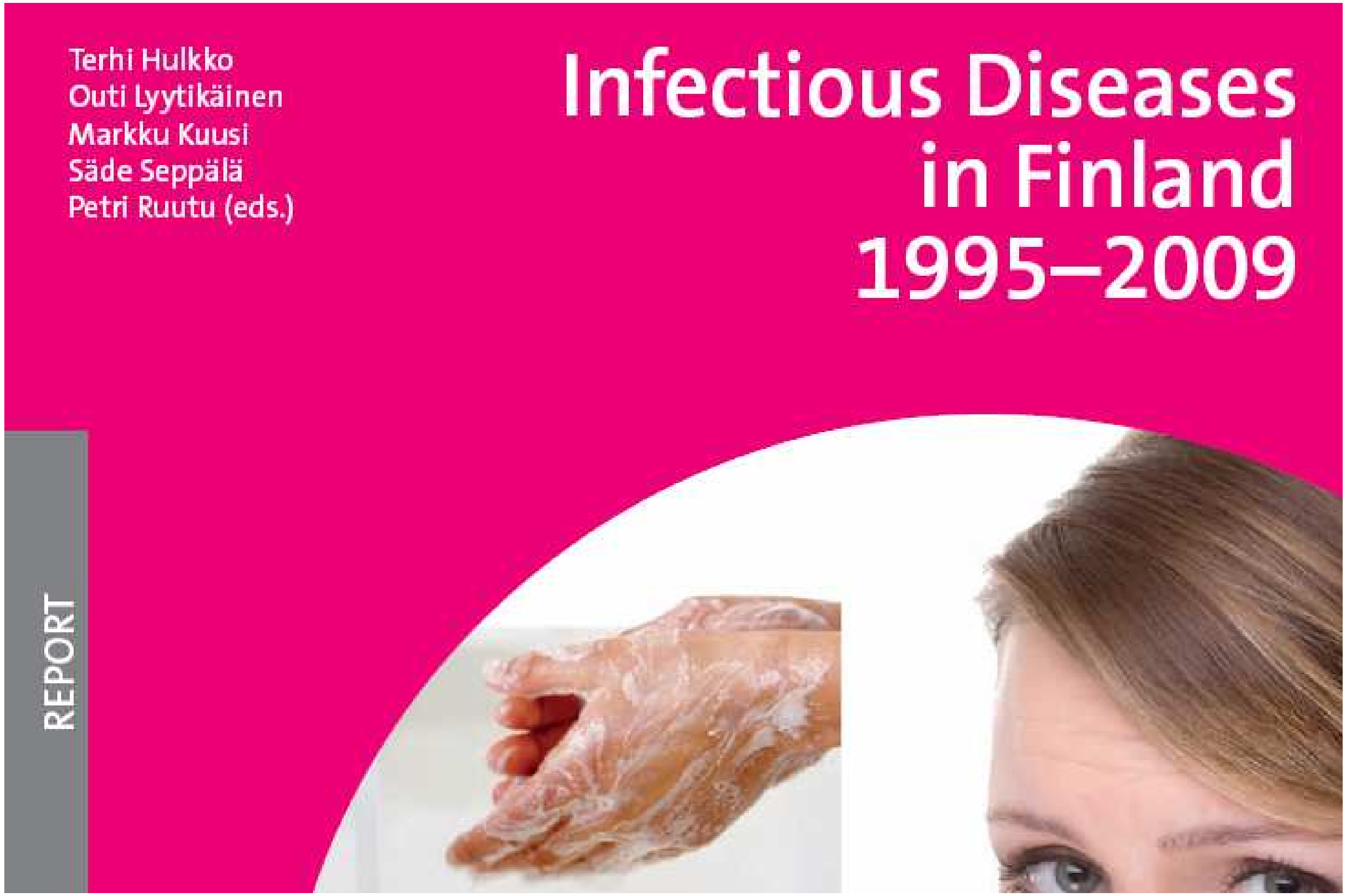


Figure 32. Tick-borne encephalitis, Åland and rest of Finland 1995–2009, number.

Summary

- Since 1995, population-based and laboratory-based surveillance for important vector-borne diseases, which are potentially influenced by climate change
- Ability to link national surveillance data with population-based health registries and population information systems by using national identity code
- Epidemiologic research and outbreak investigations
  - Puumala, Sindbis,Tularemia
- Ongoing collaboration with University of Helsinki, Department of virology

Reference



Available online at: www.thl.fi

Acknowledgments

- Markku Kuusi, Outi Lyytikäinen, Peter Makary, Jukka Ollgren, Terhi Hulkko, Petri Ruutu and others at THL
- Jussi Sane, Satu Kurkela and Olli Vapalahti at University of Helsinki, Department of Virology