

# Preliminary study of ecologic determinants of tick-borne encephalitis (TBE) incidence in Poland



Paweł Stefanoff<sup>1</sup>, Steven J. Samuels<sup>2</sup>, Millicent Eidson<sup>2,3</sup>, Dale L. Morse<sup>2,3</sup>

- 1) Department of Epidemiology, National Institute of Hygiene, Warsaw, Poland
- 2) Department of Epidemiology and Biostatistics, University at Albany, SUNY, Rensselaer, NY, USA
- 3) New York State Department of Health, Albany, NY, USA

## BACKGROUND

- TBE is transmitted by the sheep tick, *Ixodes ricinus*
  - Natural hosts for the ticks are small mammals (mainly rodents) and, less often, birds.
  - Humans are exposed by tick bites or drinking unpasteurized milk.
  - TBE is endemic in certain areas such as popular tourist destinations that are popular especially among young people.
  - Predictive models are needed to improve vaccination policy and other control interventions.
- The purpose of the study was to explore the association of TBE incidence with factors related to tick activity measured at the district level.

## MATERIAL AND METHODS

- Cases from national surveillance system, Poland, 1999-2002 (n=607).

### Factors at the individual level:

- Year
- Age
- Gender
- Urban/rural residence

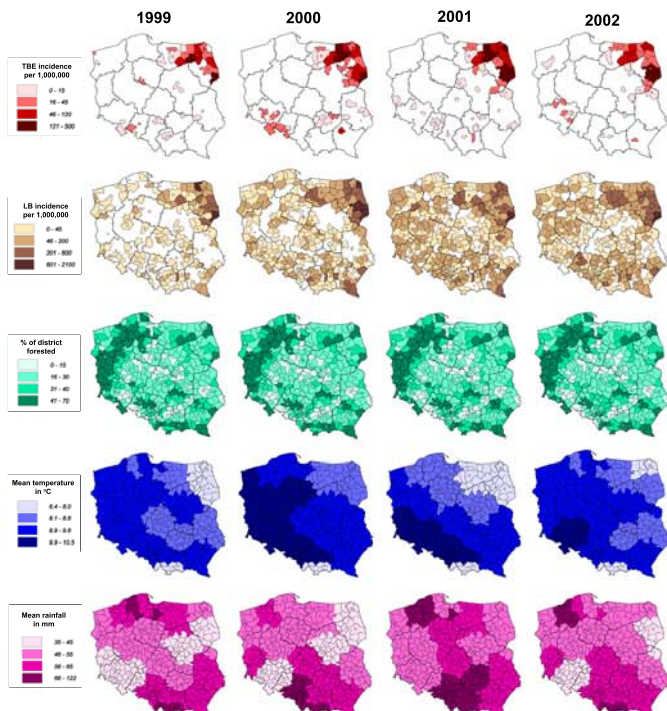
### Factors at the district level:

- Borreliosis incidence
- Percent forested area
- Mean monthly temperatures (measures from 21 Meteorological Stations)
- Mean monthly rainfall
- 'Endemicity' TBE case in the prior year

### Statistical analysis

- Description of the distribution of factors - TBE incidence rate and ecologic factors
- Comparison of districts with and without TBE cases
- Rank correlation of TBE incidence rate with ecologic factors
- Poisson regression with GEE Standard Errors to account for clustering
- Two separate models predicted best TBE rates in endemic and non-endemic districts (limited to years 2000-2002)

## RESULTS (1) Description of geographic distribution of studied factors



## RESULTS (2) Bivariate analysis

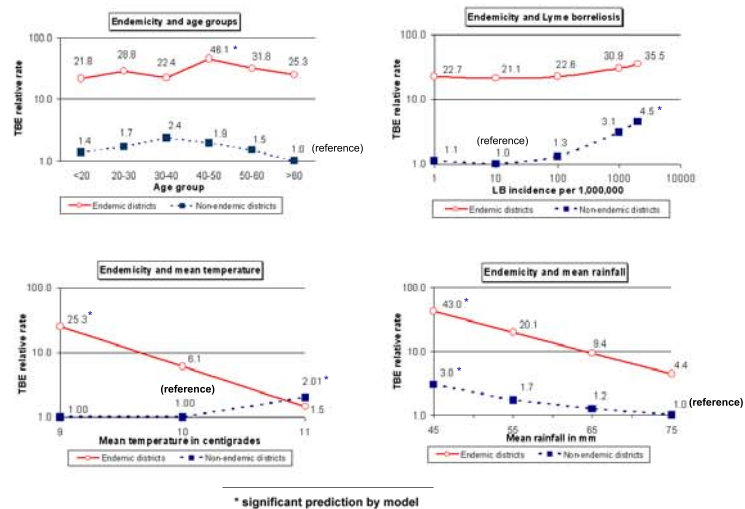
### Comparison of districts with and without TBE cases (data for 2000, Wilcoxon test):

- Districts with TBE reported higher borreliosis incidence rates, compared to districts without TBE cases (mean rate 151.16 vs. 35.44 per 1,000,000;  $p < 0.0001$ ).
- Districts with TBE cases had lower mean temperatures, compared to districts without TBE cases (mean 9.10 vs. 9.63°C;  $p < 0.0001$ )
- Districts with TBE cases had lower mean rainfall, compared to districts without TBE cases (mean 48.63 vs. 55.72 mm;  $p < 0.05$ )

### Association of TBE incidence rates with district characteristics (data for 2000, Spearman coefficients):

- Moderate association with borreliosis incidence rates ( $r = 0.523$ ,  $p < 0.001$ )
- No association with percent forested areas ( $r = 0.204$ ,  $p = 0.159$ )
- Moderate negative association with mean temperatures ( $r = -0.574$ ,  $p < 0.001$ )
- Moderate negative association with mean rainfall ( $r = -0.529$ ,  $p < 0.001$ )

## RESULTS (3) TBE relative rates predicted by 2 final models



## CONCLUSIONS

- Poisson model with GEE methodology was an effective tool to study TBE endemicity
- The multivariate analysis strengthened the findings of the bivariate analysis
- The strongest predictors of TBE incidence in endemic districts were temperature and rainfall
- Lyme borreliosis predicted TBE incidence more efficiently in non-endemic districts
- This is a preliminary model that requires further development with more precise measures and additional factors related to tick activity