BRIEF REPORT

## **Risk of infections transmitted by arthropods and rodents in forestry workers**

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Abstract. One hundred and fifty-one forestry workers and 151 matched office clerks were compared as to the presence of antibodies against *Borrelia burgdorferi*, tick-borne encephalitis virus, Puumalavirus and lymphocytic choriomeningitis virus. Their occupational risks of being infected by *Borrelia* was fourfold and significant, by Puumalavirus and lymphocytic choriomeningitis virus was increased but not significant. No seropositivity has been established against tick-borne encephalitis virus.

Key words: Forestry workers, Hantavirus nephropathy, Lyme borreliosis, Lymphocytic choriomeningitis, Occupational risk, Tick-borne encephalitis

The medical community is becoming increasingly interested in infectious diseases which are difficult to detect by ordinary clinical investigation, such as tick-borne encephalitis (TBE), haemorrhagic fever with renal syndrome (HFRS), and lymphocytic choriomeningitis (LCM), or which incidentally are difficult to distinguish from other clinical entities, such as lyme borreliosis (LB). Recent studies indicate that these four diseases are widely distributed throughout the world [1–5]. In fact they are the most important infectious diseases transmitted to humans by arthropods and rodents in the forested areas in Western Europe.

LB, a spirochetosis caused by *Borrelia burg*dorferi, is tick-borne with small rodents as reservoir – as is TBE, which is caused by a member of the Flaviviridae family [6, 7]. In Europe both are mostly transmitted through bites by ticks (*Ixodes* ricinus).

HFRS, caused by the Puumalavirus (PUUV) of the genus Hantavirus, a member of the Bunyaviridae family [8, 9], and LCM, which is caused by lymphocytic choriomeningitis virus, a member of the Arenaviridae family are transmitted through direct or indirect contacts wild rodents [10].

Individuals who are professionally involved in forestry work and those who live in forested areas may be expected to be at increased risk of acquiring these infections. A number of studies have been devoted to such populations [11–14]. However, they lacked the use of a matched control group. Therefore, we report here on the comparison of a sample of forestry workers with a matched control group with regard to the prevalence of seropositivity against these four infectious diseases.

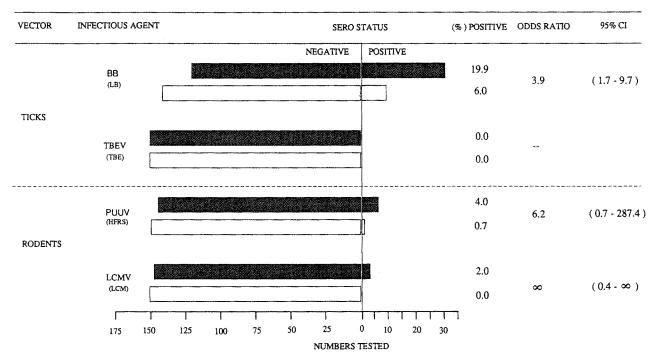
Dutch forestry workers employed in the maintenance of state-owned woodland, heathland and national parks are public employees. This population (n = 750) receives occupational medical care from the State Occupational Health Service. A cohort of 151 of these forestry workers, employed at six of the 23 forestry stations (20%), were screened for markers of these infectious diseases in April 1989 and April 1990. The first screening also included a control group of office clerks, also civil servants categorically matched to the 151 participating forestry workers by age (same decennium) and occupational health centre as a proxy variable for area of domicile.

Serum samples were stored after collection at -20 °C until use. The commercially available flagellum enzyme-linked immunosorbent assay (ELISA) (K416, Dakopatts, Glostrup, Denmark) was used for the detection of IgG directed against *Borrelia burgdorferi* and used as described by the manufacturer. Sera with optical density (OD) value above the cutoff of 0.40 were considered positive after confirmation by Western blot [15, 16].

TBEV-specific antibodies were measured using the commercially available indirect FSME ELISA (Virotech, Heidelberg, Germany).

For the detection of Hantavirus-specific IgG antibodies the indirect ELISA was used as described elsewhere [9]. Hantavirus-positive ELISA reactions were captured by indirect immunofluoresence assay (IFA).

LCMV-specific antibodies were measured by



**Figure 1.** Seroprevalence of arthropod and rodent transmitted infections in forestry workers in the Netherlands. **m** forestry workers;  $\Box$  non-forestry workers.

indirect ELISA. The viral and control antigen were prepared from ATCC VR134 virus-infected and uninfected BHK cells. Five days after infection medium was removed and the cells were washed with phosphate buffered saline, pH 7.2 (PBS), trypsinised, washed with PBS plus 10% FCS and centrifuged for 5 min at 580g. The cell pellet was resuspended in 1 ml PBS and sonicated twice for 15 seconds. Cellular debris was removed by low-speed centrifugation. The supernatant was inactivated with 1% ethylene oxide and used as antigen after storage at -70 °C. The LCM virus IgG-ELISA was performed as described for Hantavirus-specific antibodies [8]. The indirect IFA was used to confirm the OD values higher than 0.2 above the control antigen level, using drop slides with LCM virus-infected and uninfected BHK cells fixed with 70% ethanol and stored at -70 °C until use.

The results of the screening for tick-transmitted infections show that 30 (19.9%) of the forestry workers versus nine (6.0%) of the clerks (odds ratio 3.9, exact estimation) had serum antibodies to Borrelia burgdorferi [17], a statistically significant difference, whereas no serum antibodies against TBE were found in either group (Fig. 1). The results of the screening for serum antibodies to the viruses transmitted through contacts with rodents show that six (4.0%) forestry workers had serum antibodies to PUUV versus one (0.7%) of the clerks. It is interesting to note that four of the PUUV-seropositive individuals worked in areas where 14 clinical cases of HFRS had been diagnosed before [8, 18]. Three (2.0%) forestry workers had serum antibiotics to LCMV versus none (0.0%) of the clerks.

A hundred and fifty-one forestry workers were sampled for the second time in April 1990. Five of them, who had no serum antibodies to LB in 1989, were seropositive in 1990 [18]. None of these five individuals had developed clinical symptoms suggestive of LB during the period between the two samplings [17, 19]. No seroconversions towards TBE, PUUV and LCMV were found in the 151 individuals.

Taken together, our data suggest that forestry workers in The Netherlands have an increased risk of LB. Their occupational hazards to PUUV and LCMV infections however, remain to be corroborated.

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