Annual screening for *Borrelia* exposure

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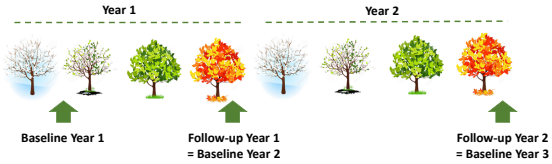
Background: Lyme Borreliosis

- Most common tick-transmitted infectious disease in the Northern hemisphere
- Caused by various species of the spirochetal bacterium *Borrelia burgdorferi*
  - US: mostly *B. burgdorferi sensu stricto*
  - Europe/Asia: mostly *B. afzelii*, *B. garinii* and *B. burgdorferi sensu stricto*
- ~30% of infected individuals do not develop the typical erythema migrans (bulls-eye rash)
- Seroconversion without clinical symptoms more common in Europe than US, clinical significance yet unknown
- Increased exposure risk for outdoor workers (green maintenance, forestry, water management)
- Recognized as occupational disease in US and European countries

Objective: Annual screening program for subjects at increased risk of exposure to *Borrelia*

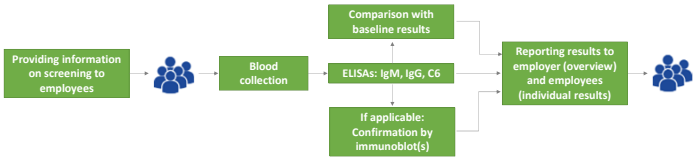
Longitudinal follow-up

- Baseline measurement prior to tick season to determine existing serology status
- Yearly follow-up after the tick season



Stringent two-tiered approach (3 ELISAs, confirmation by immunoblot)

- According to national guidelines (US, Europe)
  - Initial testing by ELISA (whole cell sonicate and recombinant antigens)
  - Confirmation by 2-3 immunoblots (recombinant antigens from various *Borrelia* species)



Results: Winter 2017-2018 Follow-up measurements

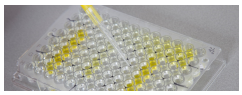
Participants

- 803 individuals from 20 organizations in The Netherlands
- 57% water management (n=455); 22.5% green maintenance (n=183); 21.5% ecologists, biologists, engineers (n=165)
- Age range: 22-78 years
- 11% female; 89% male
- Baseline measurement before tick season 2017
- Follow-up between Oct 2017 – Feb 2018

Serological tests

ELISAs

- Euroimmun Anti-Borrelia IgM ELISA
- Euroimmun Anti-Borrelia plus VlsE IgG ELISA
- Immunetics C6 ELISA

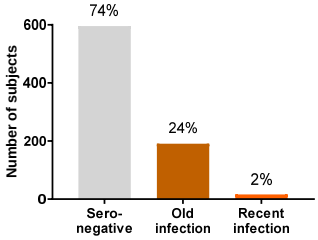


Immunoblots

- Euroimmun Anti-Borrelia EUROLINE-RN-AT IgG blot
- Euroimmun Anti-Borrelia EUROLINE-RN-AT IgM blot
- Mikrogen recomLine Borrelia IgG blot

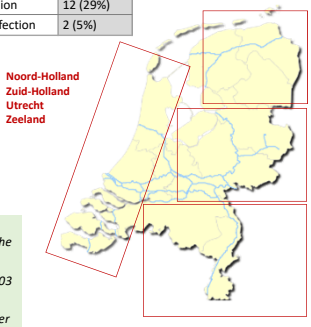
2017 Annual Lyme screening shows high seroprevalence and 2% new infections in high risk group

A



B

	Participants
Total	41
All sero-positive	14 (34%)
Old infection	12 (29%)
Recent infection	2 (5%)



	Participants
Total	200
All sero-positive	52 (26%)
Old infection	48 (24%)
Recent infection	4 (2%)

	Participants
Total	335
All sero-positive	95 (28%)
Old infection	88 (26%)
Recent infection	7 (2%)

	Participants
Total	227
All sero-positive	46 (20%)
Old infection	43 (19%)
Recent infection	3 (1%)

C

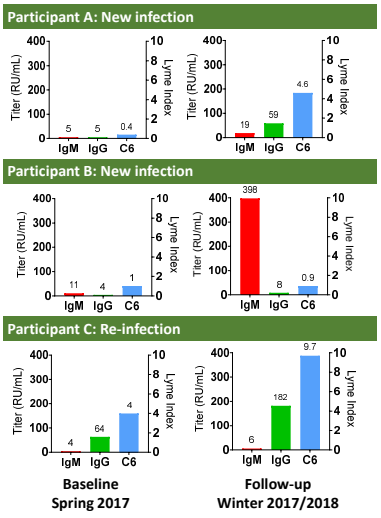


Figure 1: Old and recent infections detected by annual Lyme screening.
Serum samples were analyzed using the ELISA and immunoblot assays according to the manufacturers instructions.

Panel A *shows the total number and proportion of old and new infections amongst 803 individuals followed up in Oct 2017 – Feb 2018.*

Panel B *shows the regional distribution of seroprevalence, old and new infections after the 2017 tick season.*

Panel C *shows ELISA data for 3 individuals with either a new or re-infection. Borderline or positive ELISA results were confirmed by immunoblot for all 3 donors. New infections were identified based on seroconversion in the IgM ELISA (with or without positive C6 and IgG). Re-infections were defined based on strongly increased C6 and IgG titers, in absence of changes in IgM titers.*

Conclusion & Outlook

- **Benefit for individual**: Recent *Borrelia* infection in absence of an erythema migrans can be identified and treated before disease/long-lasting symptoms occur
- **Benefit for employer**: Helpful in risk identification and evaluation (RI&E) and evidence-based method to evaluate effectiveness of protective measures
- **Benefit for society**: Systematic survey of antibody prevalence for *Borrelia* in different regions
- Screening program expanded to >1700 participants in Winter 2018-2019
- Future perspective: Expand annual screening to **other tick-born diseases**

References

Borchers et al. **Lyme disease: A rigorous review of diagnostic criteria and treatment**. Journal of Autoimmunity. 2014.