Preventive strategies to lower the burden of Lyme borreliosis: A cost-utility analysis

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Background
Lyme borreliosis (LB), a bacterial tick-borne disease caused by *Borrelia burgdorferi*, has an increasing incidence in the Netherlands. A vaccine for LB is currently not available and mitigation therefore relies on strategies to prevent infections. However, their cost-effectiveness is not known. This project evaluated the public health impact of different LB prevention strategies in the Netherlands using a cost-utility analysis.

Methods
A country level, stochastic Monte-Carlo model was built to simulate the annual expected number of human LB cases. Main input parameters were the probability of attracting a tick bite while visiting woods or spending time in the garden. With a certain probability, *Borrelia* infections occurred after a tick bite, which subsequently could develop into one of three LB manifestations (erythema migrans, disseminated LB, or persisting symptoms). The model was calibrated with data on the incidence and the national public health burden expressed in disability-adjusted life years (DALY) from 2010.

Seven prevention strategies were compared to a default scenario mimicking the current situation. The cost-utility ratio (CUR) was calculated by dividing the total intervention costs by the number of DALYs reduced. Values for epidemiological input parameters and prices were estimated based on (scientific) literature.

Results
The default scenario resulted in, on average, 1,100,000 tick bites and 1,735 DALYs annually (Table). Due to comparable low intervention costs, the two educational strategies had the lowest CUR, and were therefore the most cost-effective; their public health improvement, however, was only moderate. The largest yearly public health impact could be obtained by the three environmental-based strategies but those strategies were also having moderate to large intervention costs. The two personal protective strategies resulted in a low public health improvement and also had high intervention costs, resulting in a low cost-effectiveness.

Scenario	Strategy[1]	Number of tick bites	Number of LB cases	DALY	Costs (€)	CUR (€/DALY)
Default	-	1,100,000	24,988	1735	-	-
Campaign	ED	1,014,365	21,064	1463	477,000	1752
Forest signs	ED	958,100	20,261	1407	191,340	583
Protective clothing	PP	1,074,766	24,416	1696	25,730,000	661,942
Repellent	PP	1,071,510	24,342	1690	27,350,000	613,016
Mowing grass	EN	863,500	19,617	1362	5,542,888	14,876
Sheep mopping	EN	721,600	16,393	1138	7,507,482	12,586
Fencing	EN	697,950	15,856	1102	29,561,600	46,680

[1]ED: educational; PP: personal protective; EN: environmental

Conclusions
Educational strategies are expected to be the most cost-effective strategies to lower the LB burden in the Netherlands. However, although being less cost-effective, environmental-

based strategies should be considered also since they result in the highest public health improvement. All prevention strategies should be evaluated on other dimensions (public acceptance, environmental impact, uncertainty, distribution of costs over stakeholders, etc.) before implementation.