Lyme Disease and Climate Change

Lyme disease is the most common tick borne disease in Europe and results from an infection with the bacteria *Borrelia burgdorferi*. The disease occurs when infected *Ixodes ricinus* ticks which have been infected with this organism. Although the deer is the principal carrier of the tick in most European countries, woodland birds are the main reservoir hosts in Ireland, and unlike Central Europe, rodents are hardly involved in the transmission of Lyme disease in Ireland as a part of their life cycle within their habitat where they are vulnerable to environmental factors including temperature and rainfall. Changed climatic conditions may therefore impact on the incidence of vector borne disease, not only in the central European countries where this organism is highly abundant, but also in Ireland where the environment for a part of their life, but, in addition, the occurrence of their preferred habitat and species behaviour of the host may also result from climate change in Ireland. Significant changes have occurred in the Irish climate in recent times, with an increase of 0.5°C in mean temperatures has been observed in the 20th century, the rise being most marked in the last decade. A change in the incidence of Lyme disease from present levels may therefore be expected as temperatures increase as a result of climate change.

Lyme Disease

Lyme disease is the only vector borne disease of significance in Ireland. Following the bite, which may have gone unnoticed, the disease is characterized by general malaise, fever, headache, muscle and joint aches, and lymphadenopathy. A red circular lesion, erythema migrans, produced and include the dermatological, neurological, musculoskeletal and cardiac manifestations of this multi-system disease characterized by general malaise, fever, headache, muscle and joint aches, and lymphadenopathy. A red circular lesion, erythema migrans, produced and include the dermatological, neurological, musculoskeletal and cardiac manifestations of this multi-system disease.

The reported incidence of Lyme disease varies widely, from an average of 300 per 100,000 in Austria, to 43 cases per 100,000 per year in the Netherlands and to 0.3 and 0.6 per 100,000 in the U.K. and Ireland respectively. Lyme disease is not a notifiable disease in Ireland and consequently the actual incidence is not known. However, no clear trend is apparent in the incidence of Lyme disease in recent years (Table 1).

Environmental requirements

The optimal habitat for the infected tick in Ireland has been described; it is comprised of mature heterogenous woodland that is inhabited with an abundant and diverse fauna, such as birds and small mammals for the earlier larval and nymph stage, and larger mammals for the adult phase. This optimal habitat outlined is scarce in Ireland at the moment, in comparison with some continental European countries, and is one reason why the incidence of Lyme disease in Ireland is low. In addition, many infected ticks, a relatively small red deer do not carry borrelia, in one particular reserve, approximately 15% of the tick population was infected. Interestingly, evidence of past infection with borrelia in Irish blood donors correlates well with the perceived risk of the location concerned. Finally, the most predominant type of borrelia (*B. valaisiana*) in Ireland has not been associated to date with Lyme disease, and many strains of the second commonest variety (*B. garinii)* may be of low pathogenicity. The environmental requirements of ticks have been defined, and warmer and temperate climates particularly during the winter, accelerate their development; the tick also required a microclimate with at least 80% humidity to avoid dessication in the non-parasitic phase, and they are therefore restricted to areas with a good vegetation cover in summer time in order to preserve humidity. Lyme disease is not a notifiable disease in Ireland and consequently the actual incidence is not known. However, no clear trend is apparent in the incidence of Lyme disease in recent years (Table 1).

Future incidence

With both increases in mean temperatures of between 1.5 and 2.5°C and changes in rainfall expected over the coming decades in Ireland, it is possible that changes may be expected in the incidence of Lyme disease. Already changes in no distribution linked to changed climatic conditions have been described, where the distribution has moved northwards in Sweden, and to higher altitudes in the Czech Republic. Increased forest cover in Ireland, with the risk of occurrence of the disease extending to later in the year and possibly also in early spring in the future. A lack of data on climate change and distribution of the risk of Lyme disease in Ireland could be expected. An analysis of Irish data has shown that the tick will continue to seek hosts if there is appropriate vegetation cover available. Therefore, it is significant that forest cover is anticipated to double in Ireland in the next twenty-five years to increase the habitats for host animals.

The future incidence of the disease in Ireland will also be determined by the exposure of the population to infected ticks, and it is important to act accordingly to minimize the risk of tick borne disease. Alterations in land use patterns and residential developments in wooded areas have been linked to changes in the incidence of Lyme disease in the USA, for example Ireland in the coming decades, coupled with warmer weather will result in increased opportunities for exposure from both occupational and leisure activities. Farming practices may also change as a result of climatic influences, again altering habitats and exposure patterns, and geographic information systems could be used to identify communities at risk of developing Lyme disease. To reliably anticipate the future impacts of climate change on biodiversity, it will be necessary to expand baseline ecological monitoring, and to combine the results of such analysis with meteorological data combined with accurate spatial and temporal data on the incidence of Lyme disease. The importance of surveillance for Lyme disease has been stressed, however, there are no plans to make Lyme disease a notifiable disease in Europe. Lyme disease surveillance systems, and it is not a notifiable disease in Ireland. There are also difficulties surrounding accurate serological diagnosis of Lyme disease and this is a task for specialist laboratories. Many reactive samples from Ireland are sent to the Lyme Borreliosis Unit at Southampton General Hospital, UK, for confirmation.

The public health approach to this disease must include promotion of health education and emphasise the importance of reducing opportunities for exposure to this disease. Consideration might also be given to making this disease notifiable. This would be a major step forward in elucidating the complex relationship between our environment and the incidence of this disease.

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Email: elizabeth.cullen1@hse.ie

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