

We inevitably associate malaria with tropical climates where the vector *Anopheles* mosquitoes are abundant. In 2017, there were an estimated 219 million cases worldwide, predominately in sub-Saharan Africa and India, resulting in 435 000 deaths.¹ Often forgotten is that malaria is widely believed to have been formerly endemic to the UK. The last outbreak involving locally acquired cases occurred between 1917 and 1921. Could vector-borne disease pose a threat today?

MALARIA IN THE UK

Febrile-like illnesses, probably malarial in origin, were historically common in lowland marshland areas.² Known variously as 'marsh fever', 'agues', or 'tertian fevers', these illnesses affected areas of low-lying Essex, Sussex, Kent, the Somerset levels, the Yorkshire Holderness, and the Lancashire Ribble Valley.² These were likely caused by *Plasmodium vivax* or *Plasmodium malariae*, and were probably transmitted by the native mosquito *Anopheles atroparvus*. By the 20th century, such indigenous malaria was becoming rare, banished by land drainage and better housing.

THE FIRST WORLD WAR: MALARIA VICTORIOUS

To break the Western Front deadlock of the First World War, a military front was opened in 1915 in Salonika in the Balkans. Malaria was endemic here; it proved the only victor. Throughout the campaign, 162 517 troops were admitted with malarial illness.³ Troops repatriated back to the UK

Tiger mosquito.



Figure 1. GB War Office, anti-malaria brigade. Credit: Wellcome Collection. CC BY.

were stationed in field camps nationwide. Many had suffered malaria, or were incubating infection. An estimated 15 000 to 25 000 such infected troops returned to the UK,⁴ many falling ill on their return. Unfortunately, and with amazing lack of foresight, one camp was situated on the Isle of Sheppey, Kent, an area notorious for marshland fevers and mosquito vectors.

OUTBREAK

Large numbers of infected troops, stationed where mosquitoes were abundant, provided a ready source of infection from which an outbreak could become established. Locally acquired cases, seemingly triggered by the presence of these infected troops, were soon reported. A focus of infection was Kent, with 270 cases reported in 1917 and 1918.⁴ Most were concentrated on the Isle of Sheppey, the Isle of Grain, and Sandwich. Troops and civilians living locally, who had never been abroad, contracted infection.

However, the picture was confused: whether cases originated from returning infected troops, or were of truly native indigenous malaria already present in the area, was unclear.

Controlling the outbreak took considerable effort. Notification of malaria was made compulsory in 1919. Insecticides were used, and areas of standing water cleared (Figures 1 and 2). Reported cases continued until 1921. Writing afterwards, malaria specialist Percy Shute reported that there had been 481 indigenous cases between 1917 and 1921, all of the *Plasmodium vivax* form.⁵ The last known indigenous case of malaria occurred as late as 1957.

CLIMATE CHANGE

Could mosquito-borne disease return? Improved housing, reduced exposure to vectors, and a lack of infected people, mean renewed outbreaks are unlikely. People do not live in field camps in the UK.

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Figure 2. GB War Office, anti-malaria detachment, Sandwich. Credit: Wellcome Collection. CC BY.

However, climate change may mean that new mosquito species, harbouring new diseases, appear.

Warmer conditions may have led to the urban-dwelling Asian tiger mosquito *Aedes albopictus* moving into Northern Europe; this is a most invasive coloniser and vector of chikungunya virus and dengue fever.⁶ Previously unknown mosquitoes are being discovered in the UK, possibly because of climate change. For example, *Culex modestus*, a vector of West Nile virus, has

been found in Kent and south eastern Essex recently.⁷ Ports are now monitored for invasive mosquitoes.⁷ As the 1917 outbreak demonstrates, inadvertent introductions easily occur.

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