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EDITORIAL

West Nile Virus in the United Kingdom: Its Latest Destination

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Introduction

Vector-borne diseases and in particular mosquito-borne diseases are responsible for approximately 17% of all diagnosed infections worldwide. More worryingly, >80% of the global population are now at risk of vector-borne diseases with dengue virus and malaria leading with regards to global population at risk and disease incidence respectively (Aryaprema et al, 2023; WHO, 2024). West Nile virus (WNV) is an orthoflavivirus with a single-stranded RNA viral genome and as a member of the Japanese encephalitis complex group possesses neurotropic properties. While originally detected in Uganda in 1937, WNV has continued to spread to involve the rest of the African continent and has since become endemic in Asia, Europe and the Americas (ECDC, 2023; Lu et al, 2024; Simonin, 2024). The 1999 New York outbreak helped raise global awareness of this important condition (Asnis et al, 2000). Of the 9 WNV lineages only lineage 1 and more recently lineage 2 have been isolated in human cases and the latter specifically in European and Mediterranean cases where outbreaks now occur annually (Lu et al, 2024). In 2018, the largest European WNV epidemic to date occurred with over 2000 cases and 181 deaths recorded (Simonin, 2024). This convergence of WNV across all habitable continents mirrors the increasing dissemination of the *Culex* mosquito which acts as the primary vector of WNV. While several bird species, including crows, serve as the primary and amplifying host and are susceptible to the disease, horses and humans function however as dead-end hosts within the WNV lifecycle in which infection may also prove fatal (Laverdeur et al, 2025).

The acclimatisation of the *Culex* mosquito to urban environments and new geographical areas is underpinned by global warming which has influenced the epidemiology of other arboviruses of import. With increasing environmental temperatures, mosquito maturity and breeding rates quicken, incubation periods of arboviruses such as WNV within the mosquito host shorten (2–14 days) and mosquito behaviour is altered (e.g., increased biting rates) culminating in increased transmission risk (Erazo et al, 2024; Wang et al, 2024; Laverdeur et al, 2025). As such, with time it is possible that the transmission of WNV and other arboviruses will move from a seasonal to perennial pattern in endemic areas (Wang et al, 2024).

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Arboviruses in the UK

The United Kingdom (UK) is not immune to the advance of arboviruses and there is a great need to anticipate the risks they afford to the National Health Service (NHS). In 2024, there were 904, 112 and 16 imported cases of dengue, chikungunya and zika, respectively (UKHSA, 2025a). This highlights the importance of routinely considering these illnesses as part of undifferentiated fever and fever in the returning traveler by physicians to institute appropriate testing, management and follow up. Complementing these are changes to the UK mosquito population through mosquito importation which have made the risk of WNV and other related viruses with similar life cycles which frequently co-exist (e.g., Usutu virus) more acute and may allow them to become sustained in the UK (Simonin, 2024; UKHSA, 2025b). The UK Medical Entomology & Zoonoses Ecology (MEZE) group currently conducts passive mosquito surveillance schemes. These include nationwide mosquito recording and nuisance biting reporting as well as active surveillance at used vehicular tyre storage areas, airports, ports and motorways (Vaux and Medlock, 2015; UKHSA, 2025b). These integrated schemes have indicated the dominance and widespread nature of *Culex pipiens* (*Cx. pipiens*) which is the principal vector of WNV and preferentially breeds within urban environments. Indeed, a recent nationwide research study demonstrated *Cx. pipiens* in practically all sampled areas of England and Wales, in particular London and South England, with a positive association existing between *Cx. pipiens* mosquito population number, human population number and artificial structure number (Widlake et al, 2025).

In 2012, it was estimated that approximately 5 WNV infected mosquitoes were imported from the United States per flight. Heathrow airport was predicted to represent the greatest importation risk of WNV due to its intense flight activity and surrounding ecology which could support WNV's enzootic cycle (Brown et al, 2012). In May 2025, the first UK detection of WNV viral fragments were reported within *Aedes vexans* (*Ae. vexans*) mosquitoes isolated from Nottinghamshire and collected in July 2023 (UKHSA, 2025c). Importantly, however, no evidence of human or equine cases of WNV have been reported within the UK although the implications of this first detection are profound and predict its emergence within the local human and animal populace. Virological studies indicate that, *Ae. vexans* is a highly competent vector of WNV which closely approaches that of *Cx. pipiens* and likely significantly contributes to WNV enzootic cycle in endemic areas (Wöhnke et al, 2020). This detection coincides with the findings between 2018–2020 that *Ae. vexans* density in Nottinghamshire increased markedly reaching a peak of 5000 female mosquitoes per trap/night, making it the highest in the UK (Vaux et al, 2021). Given that *Ae. vexans* thrive in floodwater with flooding increasingly common in the UK and their eggs able to persist within the environment for several years, the ability of *Ae. vexans* to inhabit new areas of the UK is likely (Vaux et al, 2021). This highlights the possibility that imported WNV has already secured a foothold in other UK native mosquitoes. Therefore, it is imperative to direct further testing of our native mosquito species, to accurately map and identify active and potential mosquito breeding sites and understand further native mosquito competence for WNV. Using

such data to inform modelling studies may assist to predict future zoonotic outbreak and manage resources accordingly. This could include coordinated integrated vector control methods such as microbial (e.g., Bacillus thuringiensis), larval and adult biocides, light traps, sweep nets, vegetation management, and personal protection measures (Bellini et al, 2014; Vaux et al, 2021). This would augment other control measures including reductions in standing water, particularly in artificial containers, investment in flood defenses and upregulating vector control methods where flooding occurs and especially in the summer months (Bellini et al, 2014). Moreover, taking into consideration that WNV outbreaks within the animal populace, namely birds and horses, are often followed by human infections, enhanced active animal health surveillance is necessary including birds and equines (WHO, 2017). At present, there have been no equine or avian cases of WNV acquired in the UK and risk to the public remains low. Furthermore, there is an equine vaccine available which is provided to horses visiting endemic regions during vector season and so could be used domestically in the UK if national risk was to change (BEVA, 2025). Finally, taking into consideration the risks of human-to-human transmission of WNV placentally, via blood transfusion and organ transplantation, the identification of WNV in the UK may require changes to our national donor screening protocols in the future. Currently those who have travelled from endemic areas should defer donation for 28 days while those with symptoms suggestive of WNV or diagnosed with WNV are unable to donate for 6 months post-acquisition (JPAC, 2024).

Challenges in WNV

The detection of WNV in the UK may change the medical approach to the undifferentiated fever or, indeed, encephalitis diagnostics within the UK in mosquito season in the coming years. This is relevant given that up to 62% of encephalitis cases remain without an aetiological diagnosis (Ellul and Solomon, 2018). WNV presents challenges, however, in both its diagnosis and management. Firstly, approximately only 20% of WNV cases are symptomatic and, where present, often manifest non-specifically as a flu-like illness with myalgia, arthralgia, retro-orbital pain and maculopapular rash although multi-organ involvement is described. Secondly, only 1% of cases are neuroinvasive with the geriatric and immunocompromised population, including diabetic and alcohol dependent individuals, amongst those at the highest risk. Where neurological disease occurs, it may do so in a myriad of ways including meningitis, encephalitis, meningoencephalitis or acute flaccid paralysis, while rarely, it may present as neuromuscular weakness (e.g., Guillain Barré syndrome, myasthenia gravis and brachial plexopathy) in the presence of normal neuroradiology and an associated mortality rate of 10% (Leis and Stokic, 2012; Vittor et al, 2020; MacIntyre et al, 2023). Finally, difficulties arise in diagnosing WNV due to the cross-reactivity of WNV antibodies with other flaviviruses as well as vaccinations (e.g., yellow fever, Japanese encephalitis). Moreover, WNV immunoglobulin M (IgM) may persist for up to 8 years in serum complicating the diagnosis of acute and past infection highlighting the need for convalescent serol-

ogy to demonstrate seroconversion (Murray et al, 2013). In the first few days of symptomatic disease, there is a short-lived viraemia, and as such serum should also be tested for WNV RNA via real-time reverse transcription polymerase chain reaction. As seen in other flaviviruses, the utilisation of urine for molecular studies is increasingly being used as it can remain positive for longer than in serum and thus nullify the risks of serological cross-reactivity and false negativity (Cvjetkovic, 2023). As such, it is important that paired cerebrospinal fluid serology is performed where neurological symptoms exist to identify intrathecal WNV IgM production which is specific for diagnosing the disease. However, where intrathecal IgM testing is not possible, cerebrospinal fluid real time reverse transcription polymerase chain reaction should be undertaken (MacIntyre et al, 2023). This is particularly important given the persistent symptoms and poor functional outcomes seen in WNV patients regardless of neurological involvement. Where neurological involvement occurs, however, symptomatology and pathology can overlap significantly with Parkinson's and Alzheimer's disease (Sejvar et al, 2008; Vittor et al, 2020). At present, there are no licensed therapeutics for WNV with management being supportive, although intravenous immunoglobulin, ribavirin and interferon have been used with mixed results (CDC, 2024). Increasingly, the role of immunotherapies such as broadly neutralising antibodies are being considered in this arena and may allow for broader protection against Japanese encephalitis virus as well as other orthoflaviviruses (Yang et al, 2023). Of course, vaccination offers the greatest possibility of achieving WNV disease control. While major developments have been made in this regard within other arboviruses, notably dengue, chikungunya, Japanese encephalitis and tick-borne encephalitis, no such human vaccine is present in WNV although promising phase 1 trials are underway (National Library of Medicine, 2025).

Conclusion

In summary, although there have been no known human or animal acquired cases of WNV infection in the UK so far, this virus continues its relentless spread and emphasises the need for health system preparation, environmental management and public education into the increasing threat of WNV and associated arboviruses within the UK. Given this discovery, clinicians should remain vigilant and consider WNV as a possible differential diagnosis even in the absence of relevant travel history. With greater national and international surveillance and cooperation, greater understanding of WNV transmission dynamics may be made allowing for the aversion of WNV epidemics. Moreover, increasing research in the condition could allow for disease modifying therapeutics to be developed which are currently lacking. It remains clear, however, that climate change predicts that the burden of many vector-borne diseases in the UK will dramatically increase in the coming years which should sound alarm.

Key Points

- West Nile Virus (WNV) global epidemiology is evolving and for the first time has been detected in UK mosquitoes.
- Detection of WNV within the UK predicts the emergence of human disease and other arboviruses.
- While the public threat from WNV is low, WNV remains an important cause of meningoencephalitis and should be considered in those without an aetiological diagnosis.
- Through enhanced surveillance and transmission modelling outbreaks of WNV may be averted.

Availability of Data and Materials

All data included in this study are available from the corresponding author upon reasonable request.

Author Contributions

DW and MZ designed the work. DW and MZ drafted the manuscript. Both authors contributed to the important editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

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Conflict of Interest

The authors declare no conflict of interest.

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