Japanese encephalitis virus

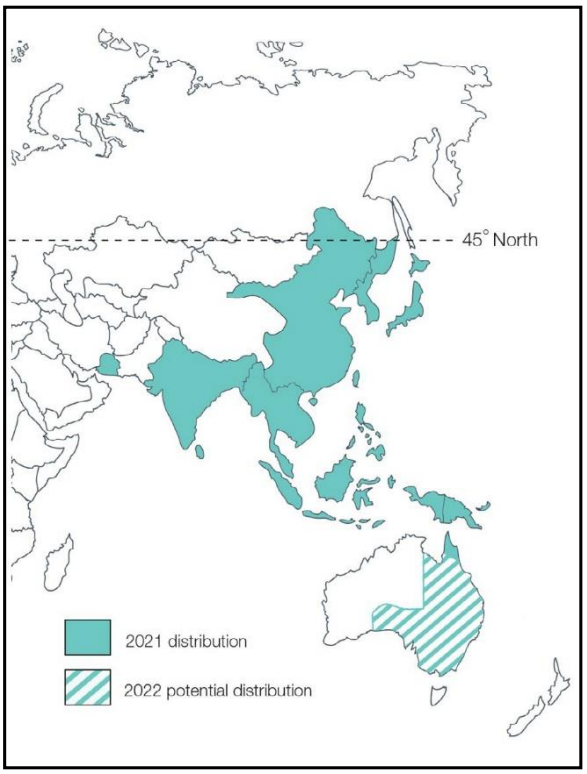
What is it, how did it get here, and what can we do about it?

Background:

Japanese encephalitis virus (JEV) is a virus spread to humans by the bite of an infected mosquito. It is common across tropical and temperate Asia (see map) where it causes 68,000 clinical cases and 20,000 deaths annually. In Asia it is expanding northwards. This may be the result of climate heating, and of increasing pig production (see facts 8 and 9 overleaf).

In Asia, only a small proportion of infected humans (about 1 in 250 [1]) develop clinical JE symptoms. However, for those people, the disease can manifest as a life-threatening encephalitis (inflammation of the brain) which can cause disorientation, seizures, coma and death. Tragically, a large proportion of survivors may suffer long-term neurological or cognitive disorders.

There is no cure for JEV. Treatment of hospitalised patients aims simply to manage and alleviate the most severe symptoms. There are however, extremely effective vaccines. Two of these are licensed in Australia (see facts 14 and 15 overleaf).



Distribution:

Japanese encephalitis virus is common throughout tropical and temperate areas of Asia, all the way to the 45th parallel.

In Australia, it was originally confined to far north Queensland where it first appeared in 1995.

Its current distribution may now include large parts of Queensland, New South Wales, Victoria and South Australia.

This figure is adapted from the WHO:

https://www.who.int/images/default-source/imported/map-japanese-encephalitis.png

Key facts

1. JEV is not new to Australia and has been circulating in the Torres Strait and Cape York for more than 25 years, first detected in 1995. The last human cases in Queensland were seen in 1998. More recently, there was a fatality in the Tiwi Islands, Northern Territory in March 2021. Queensland Health reported that domestic pigs in the northern peninsular area of Cape York had shown evidence of JEV exposure during 2020.

2. JEV was detected in piggeries in southern Queensland, NSW, Victoria and South Australia in late February and early March 2022. In domestic pigs, the disease is associated with higher than normal levels of abortion, stillborn and weak piglets. It was the post-mortem investigation of those piglets that led to the discovery of JEV.

3. The detection of JEV from samples sent to CSIRO from the index piggery in southern Queensland (near Goondiwindi) was the first identification of JEV in the current outbreak.

4. The almost simultaneous identification of JEV from piggeries across many states, and the similarly wide geographic spread of human cases, suggests that the virus had been circulating for some months before detection.

5. As of 12th October 2022 there have been 31 confirmed human cases of JEV notified in Australia during the current outbreak. An additional 10 probable cases have been reported. Sadly, 6 people have died including a four- month-old boy. During 2022, JEV was also found in >80 piggeries. Given that very few people exhibit symptoms, thousands of people may have been infected.

6. The pathway of the current JEV incursion into southern Queensland and the southern states of Australia is not clear. Infected mosquitoes, infected birds and infected feral pigs may all have played a role in the virus' expansion. At the moment, most commentators think that infected birds are the source. Their distributions are likely to have been impacted by La Nina and the appearance of new wetlands.

7. Aquatic wading birds (e.g. herons and egrets) have a central role in maintaining the virus. The importance of other animals, especially non-wading birds, and feral pigs is not well studied.

8. Domestic pigs often play a major part in transmission to humans. Pigs are "amplifying hosts" which means that they develop very high concentrations of virus in their blood. Adult pigs rarely show symptoms, but are very infectious to mosquitoes. JEV cannot be caught through eating pork or pig products.

9. Piggeries are usually quite close to human habitation, and that is why they may act as the source of human infection.

10 Humans and horses are “dead-end” hosts, meaning they can get sick but will not produce sufficient virus to infect mosquitoes. JEV cannot be spread directly from person to person.

11 JEV is principally transmitted in Australia by the freshwater mosquito *Culex annulirostris*. It can disperse over substantial distances during its life, so even people some kilometres from an infected piggery may be at risk.

12 This mosquito is largely active at dawn and dusk, so people should protect themselves from mosquito bites when and where these mosquitoes are abundant. Particular attention should be paid when close to piggeries and in areas where large numbers of aquatic wading birds congregate.

13 Personal protective measures include wearing long, loose fitting clothes, shoes that cover the feet and applying mosquito repellents (particularly those containing picaridin or DEET) to all exposed skin. In and around the home, coils and sprays can be used in small outdoor areas and where possible, doors and windows should be screened. Infants can be protected using mosquito proof netting over buggies and prams.

14 There are excellent vaccines available for those aged 2 months and over. Two products are currently recommended by the Australian Immunisation Handbook: JEspect® and Imojev® [2].

15 Because of the current outbreak in 2022, most JE vaccine stocks have been expropriated by state and federal departments of health, for administration to those groups deemed to be at greatest risk of infection. Those at-risk groups may include piggery employees, those who work with potentially infectious tissues (i.e. abattoir staff) and those who spend large amounts of time outdoors in affected areas. In 2022 the Federal Department of Health announced that it was procuring more JE vaccine.

Culex annulirostris (Japanese encephalitis vector, Australia)

The future

JEV is here to stay, although it may become extremely hard to detect in the winter months when mosquito numbers are low and transmission is slow.

Declining temperatures and drier weather will encourage the northward migration of wading birds and reduce the number of mosquitoes emerging from the wetlands. Declining temperatures will also increase the incubation time of the virus in mosquitoes, and that means that fewer mosquitoes will live long enough to transmit the virus.

Future summer outbreaks will be driven by the climate. Our climate is heating, and extreme weather events are becoming more common. The length of the interval between outbreaks of JEV will be driven partly by these events. Fortunately, with judicious use of vaccines, the human population can be protected.

Key references:

[1] https://www.who.int/news-room/fact-sheets/detail/japanese-encephalitis

[2] https://immunisationhandbook.health.gov.au/resources/handbook-tables/table-recommended-doses-of-japanese-encephalitis-vaccines

Further Information

DOH website for updates on human cases: https://www.health.gov.au/health-alerts/japanese-encephalitis- virus-jev/about

AUSVET 2020 JEV preparedness document: https://animalhealthaustralia.com.au/download/1647/

Mosquito Management, Piggeries: https://www.farmbiosecurity.com.au/wp-content/uploads/2022/03/Japanese-Encephalitis-Material_Publication_MosquitoManagementForPiggeries_final.pdf

QIMR Berghofer's role in a trial that aims to increase the availability of JEV vaccines at times of shortage: www.qimrberghofer.edu.au/BIJEV/

Furuya-Kanamori, L.; Gyawali, N.; Mills, D.J.; Hugo, L.E.; Devine, G.J.; Lau, C.L. The Emergence of Japanese Encephalitis in Australia and the Implications for a Vaccination Strategy. *Trop. Med. Infect. Dis.* **2022**, *7*, 85. https://doi.org/10.3390/tropicalmed7060085

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