Needle-free vaccine patch offers protection against Zika virus in preclinical trial

December 1 2023

The high-density microarray patch (HD-MAP) up close. Credit: UQ

A simple-to-apply, needle-free vaccine patch is being developed to protect people from the potentially deadly mosquito-borne Zika virus.

A prototype using The University of Queensland-developed and Vaxxas-commercialized high-density microarray patch (HD-MAP) has delivered a University of Adelaide-developed vaccine and elicited an effective immune response to Zika virus in mice.

The research is published in *Molecular Therapy—Nucleic Acids*.

UQ alum and Vaxxas researcher Dr. Danushka Wijesundara said Zika virus was a risk to people across the Pacific, Southeast Asia, India, Africa and South and Central America.

"We can change the way we combat Zika virus with the HD-MAP patch because it is an effective, pain-free, simple to apply, and easy to store vaccination method," Dr. Wijesundara said.

"HD-MAP delivers the vaccine to immune cells beneath the skin's surface with thousands of tiny microprojections.

"In our preclinical trial, the vaccine provided rapid protection against live Zika virus, targeting a specific protein called NS1 which is crucial to the virus's survival.

"The vaccine patch evoked T-cell responses that were about 270% higher than from a needle or syringe vaccine delivery."

Zika virus generally causes a mild illness but infection in pregnancy can lead to miscarriage and stillbirths or infants born with congenital malformations.

In February 2016, the World Health Organization declared a Public Health Emergency of International Concern when Zika virus spread across 40 countries in Latin America, causing more than 1.5 million confirmed or suspected cases in a six-month period.

Technicians working with the high-density microarray patch in the Vaxxas cleanroom. Credit: Vaxxas

Dr Jovin Choo applying vaccine to the high-density microarray patch (HD-MAP). Credit: UQ

The University of Adelaide's Associate Professor Branka Grubor-Bauk said limited global surveillance shows Zika virus is active in at least 89 countries and territories but there is no currently licensed vaccine.

"This vaccine is unique because it targets a protein inside, rather than outside of the virus meaning it won't enhance the symptoms of closely related viruses such as dengue fever, in people who've been vaccinated," Dr. Grubor-Bauk said.

Dr. David Muller from UQ's School of Chemistry and Molecular Biosciences said the microarray patch and the vaccine could have

benefits beyond the ability to protect from Zika virus.

"Because the protein we're targeting plays a central role in replication in a virus family known as flaviviruses, there's the potential to apply our approach to target other flaviviruses such as dengue or Japanese encephalitis," Dr. Muller said.

"It could also deliver a vaccine mixture to target the whole family of viruses, providing greater protection.

"A major benefit of the HD-MAP delivery platform is vaccine stability at elevated temperatures—we found the patch retained vaccine potency when stored at 40° Celsius for up to four weeks.

"This increases the reach of vaccines in low- and middle-income countries where refrigeration is challenging."

More information: Danushka K. Wijesundara et al, Superior efficacy of a skin-applied microprojection device for delivering a novel Zika DNA vaccine, *Molecular Therapy—Nucleic Acids* (2023). DOI: 10.1016/j.omtn.2023.102056

Provided by University of Queensland