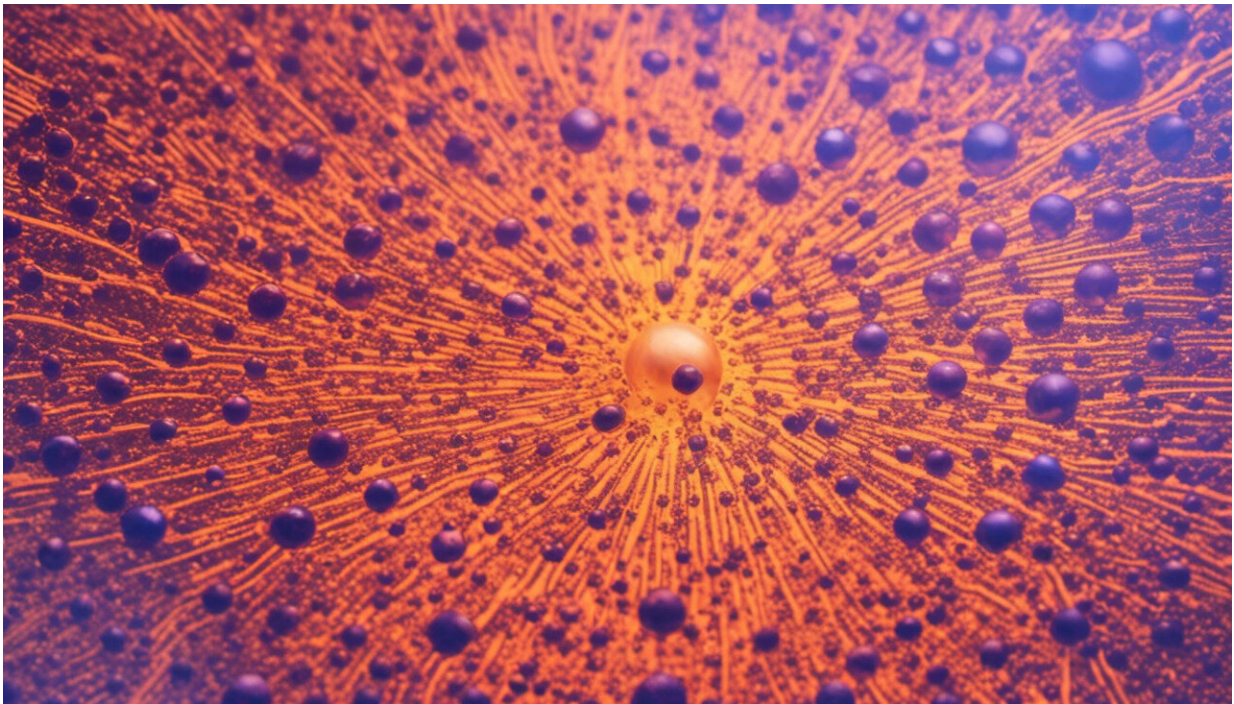


Researchers pinpoint where smallpox outbreak would hit hardest

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Credit: AI-generated image ([disclaimer](#))

The ease of creating a smallpox-like virus, and the growing number of vulnerable people with weakened immune systems, present challenges for emergency response planners, researchers have warned.

Unprecedented levels of immunosuppression in countries such as

Australia and the US must be considered in planning for the real risk of smallpox re-emerging in the world, an expert in [infectious diseases](#) warned.

"Smallpox was eradicated in 1980 but in 2017 Canadian scientists created a smallpox-like virus in a lab using just mail-order DNA," said UNSW Professor of Infectious Disease Epidemiology Raina MacIntyre. "In 2018, these same scientists published a step-by-step method to create a pox virus in a lab, making the threat of smallpox re-emergence even greater.

"Experts have long feared this scenario, and it is now a reality.

"This highlights the real risk of smallpox re-emerging in the world, without terrorists needing to access closely guarded stockpiles of the virus," said Professor MacIntyre, who is also Director of the NHMRC Centre for Research Excellence, Integrated Systems for Epidemic Response.

In the nearly 40 years since smallpox was eradicated, much has changed in society. Advances in medicine mean that many more people today – such as people with HIV, and people being treated for cancer and autoimmune conditions – live with a weakened immune system.

Research led by Professor MacIntyre published in the US Centers for Disease Control and Prevention journal *Emerging Infectious Diseases* used a mathematical model to identify the impact of smallpox re-emerging in cities such as Sydney and New York, and identified that the highest rates of smallpox infection would be in people aged under 20 years, but the highest death rates would be among people aged 45 and over. Almost one in five people in cities like Sydney and New York have a weakened immune system, which would make the impact of an attack with smallpox much more severe, the study says.

"The rates of immunosuppression were even higher for the age group 60-65 years, because of natural decline of the immune system with age. We have an ageing population, and this must be considered when planning for a bioterrorism attack, and vaccination strategies during an outbreak," Professor MacIntyre said.

The study is also a tale of two cities with very different vaccination policies. Smallpox vaccine was routine in New York, but not used widely in Sydney. Professor MacIntyre said almost 22% of the New York population was vaccinated for smallpox, compared with only 10% of the Sydney population – and these people were mostly migrants vaccinated in their country of origin.

The modelling found that despite widespread past vaccination in New York, the impact of smallpox in this city would be more serious than in Sydney due to New York's larger number of immunosuppressed people.

Immunologist and HIV expert Professor Tony Kelleher, from the Kirby Institute, said that "immunosuppression would likely drive the impact of smallpox more than past vaccination, especially with so many people today living with HIV, or receiving cancer therapy or other medical treatments that suppress the immune system".

"Vaccine immunity wanes over time, and recent vaccination is needed for protection. The good news is, people who have been vaccinated in the past would have a faster response to re-vaccination in the event of an outbreak," Professor MacIntyre said. "The bad news is, both cities show the highest smallpox infection rates for unvaccinated young people, aged 5 to 20 years."

The study also notes the importance of vaccination for health workers, and the need for hospitals to have appropriate isolation facilities to minimise a [smallpox](#) outbreak.

More information: C. Raina MacIntyre et al. Influence of Population Immunosuppression and Past Vaccination on Smallpox Reemergence, *Emerging Infectious Diseases* (2018). [DOI: 10.3201/eid2404.171233](https://doi.org/10.3201/eid2404.171233)

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