

Title: Measles Outbreak Due to Vaccine Failure in the Federated States of Micronesia

Activities: Manage cold chain

Stakeholders: National and subnational health authorities; World Health Organization

Phases: Detection, Early response, Intervention

Years: 2014

Countries: Federated States of Micronesia

Agent: Measles (rubeola virus)

Case study prepared by: Hannah Todd, June 23, 2020

Please include full case study text below this line.

The Federated States of Micronesia (FSM) had not reported measles for twenty years until it reported 393 cases between February and August 2014. This spread was attributed to delays in detecting the initial cases, underscoring the importance of including measles as a diagnostic possibility in any case of febrile rash illness. The vast majority (about two-thirds) of cases occurred in adults. The patients had largely received at least 1 dose of MCV (measles-containing vaccine). Due to the relatively high incidence of measles cases among vaccinated adults, failure of the vaccine was suspected.¹

Causes of vaccine failure include improper vaccine storage and handling. The environment of FSM posed distinct challenges to vaccine storage, such as high ambient temperatures, power outages, and difficulty with inter-island shipping. Very few cases in children were identified. The low incidence among children highlighted the efficacy of routine vaccination programs and supplementary immunization activities, and dispelled the theory that recent cold chain practices were inadequate. Upon comparing adult cases to pediatric cases, researchers pointed to historical cold chain breaches as the most plausible explanation for the higher rate of infection in adults. Earlier issues with storage and handling of the vaccine could have resulted in a failure to protect individuals from infection.

A secondary attack rate study to evaluate MCV effectiveness concluded that low vaccine effectiveness was a major source of measles susceptibility. Researchers proposed that this

¹ Breakwell L, Moturi E, Helgenberger L, et al. Measles Outbreak Associated with Vaccine Failure in Adults--Federated States of Micronesia, February-August 2014. *MMWR Morb Mortal Wkly Rep.* 2015;64(38):1088-1092. Published 2015 Oct 2. doi:10.15585/mmwr.mm6438a7.

diminished effectiveness could be attributed to historical cold chain inadequacies and/or waning immunity.² This outbreak illuminated challenges with cold chain management in resource-limited settings. As well, there is a need for more thermostable vaccines and expansion of vaccination campaigns.

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After twenty years without a measles case, the Federated States of Micronesia reported 393 cases. The vast majority were adults. Many of those infected had received one or more dose of the measles-containing vaccine, suggesting vaccine failure. Upon further investigation, researchers concluded that low vaccine effectiveness could be attributed to historical cold chain inadequacies and/or waning immunity.

² Hales CM, Johnson E, Helgenberger L, et al. Measles Outbreak Associated With Low Vaccine Effectiveness Among Adults in Pohnpei State, Federated States of Micronesia, 2014. *Open Forum Infect Dis.* 2016;3(2):ofw064. Published 2016 Mar 24. doi:10.1093/ofid/ofw064.