*Feedback from operational stakeholders who manage or respond to outbreaks is that they are often too busy to review literature or obtain relevant background information to assist them with acute response. Unlike a traditional analytical outbreak investigation report,* ***Watching Briefs*** *are intended as a rapid resource for public health or other first responders in the field on topical, serious or current outbreaks, and provide a digest of relevant information including key features of an outbreak, comparison with past outbreaks and a literature review. They can be completed by responders to an outbreak, or by anyone interested in or following an outbreak using public or open source data, including news reports.*

# Watching brief

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| **Title** | Outbreak of Measles Amongst USA-Bound Afghan Evacuees |
| **Authors** | Dr Elise Buisson<br>Kirby Institute Biosecurity Program, University of New South Wales |
| **Date of first report of the outbreak** | September 7th, 2021 |
| **Disease or outbreak** | Measles |
| **Origin (*country, city, region*)** | Afghanistan |
| **Suspected Source (specify food source, zoonotic or human origin or other)** | Human to human transmission |
| **Date of outbreak beginning** | September 5th, 2021 |
| **Date outbreak declared over** | Ongoing as of October 8th, 2021 |
| **Affected countries & regions** | **Wisconsin:**<br>- Fort McCoy, Munroe County**:** 22 cases (1)<br><br>Index case confirmed on September 5th through comprehensive health screening.<br><br>**Virginia:**<br>- Central Region: 2 cases<br>- Northern Region: 11 cases (2) |

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| | A number of evacuees carrying the measles virus transited from the Afghan capital of Kabul to Dulles International Airport in the state of Virginia (3). A total of 13 cases have subsequently been confirmed in evacuees in Virginia to October 5th, with no known community transmission (2).<br><br>USA-based Afghan evacuees are additionally located in military bases including: Marine Corps Base Quantico, Fort Lee and Fort Pickett in Virginia; Holloman Air Force Base in New Mexico; Fort Bliss in Texas; Joint Base McGuire-Dix-Lakehurst in New Jersey; and Camp Atterbury in Indiana (3).<br><br>**Germany:**<br><br>- Single case identified amongst evacuees at Ramstein Air Base (4). |
| **Number of cases (specify at what date if ongoing)** | **Virginia:** 13 cases as of October 5th (2)<br>**Wisconsin:** 22 cases total as of October 8th (1)<br>**Germany:** 1 case as of September 16th (4) |
| **Clinical features** | CDC Clinical Description:<br><br>“An acute illness characterized by:<br>• Generalized, maculopapular rash lasting ≥3 days; and<br>• Temperature ≥101°F or 38.3°C; and<br>• Cough, coryza, or conjunctivitis” (5)<br><br>Predominate clinical features in the current outbreak have not been publicly described. Individuals with the above symptoms should receive confirmation testing through polymerase chain reaction testing for measles RNA and through serum identification of measles-specific IgM antibody (6). |
| **Mode of transmission (dominant mode and other documented modes)** | Dominant: Transmission via respiratory droplets or aerosols (7).<br><br>Airborne transmission can occur up to two hours after an infected individual leaves an indoor area (6). |
| **Demographics of cases** | **Wisconsin, USA:**<br><br>All 22 cases occurred within an age range of 4 months to 26 years, with additional age breakdown not publicly available (1).<br><br>**Virginia, USA:** |

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| | All 13 cases are in children aged 19 or under, with a predominance in the 1-10 age group with an even gender distribution.<br><br>Sex<br>- Male: 7 (53.8%)<br>- Female: 6 (46.2%)<br><br>Age<br>- <1: 3 (23.0%)<br>- 1-10: 9 (69.2%)<br>- 11-19: 1 (7.7%) (2)<br><br>**Germany:**<br><br>One case; no demographic information publicly released (4). |
| **Case fatality rate** | 0%; no reported fatalities.<br><br>In previous measles outbreaks within Afghan populations, where less than two thirds of the population is vaccinated (8), the case fatality rate is estimated by the WHO to be 8 – 13% (9). Two factors may have contributed to the 0% case fatality rate in this instance. First, the rapid roll out of a mass vaccination program amongst Afghan evacuees following recognition of the outbreak likely reduced both the number of cases and the severity of infection amongst affected individuals (10). The availability of first world healthcare to affected individuals located within the USA may have additionally contributed, as access to healthcare is a determinant of case fatality rate in measles outbreaks (10). |
| **Complications** | The known complication rate in measles cases is 10% (7).<br><br>Common complications (6)<br>- Diarrhea, otitis media, bronchopneumonia, laryngotracheobronchitis<br><br>Rare complications (6) (11)<br>- 1/1000: Acute encephalitis<br>- 1-3/1000: Death secondary to respiratory and neurological sequelae<br>- Frequency dependant on population: Blindness secondary to xeropthalmia<br><br>Very rare complications (6)<br>- <1/1000 Subacute sclerosing panencephalitis |

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| **Available prevention** | Prevention strategies:<br><br>(i) Inoculation with two doses of the Measles Mumps Rubella (MMR) or Measles Mumps Rubella Varicella (MMRV), administered at least 4 weeks apart, in adherence with local guidelines. These vaccines contain live attenuated viruses and are contraindicated in immunocompromised or pregnant individuals (7).<br>(ii) Post exposure prophylaxis can be provided within 72 hours of first exposure. This consists of either Normal Human Immunoglobulin (NHIG) or inoculation, depending on age and vaccination status of exposed individuals (7).<br><br>Contacts of known cases have been tested for immunity to measles, and post exposure vaccination or immunoglobulin administered, as appropriate (8). The CDC has required inoculation with the MMR vaccine and subsequent 21-day period of quarantine for all arriving Afghans currently located in military bases in the USA. The same period of quarantine has been recommended to Afghan evacuees located in military bases outside the USA (8). 49,000 evacuees within the USA have been provided with MMR vaccines to October 4th (12). |
| **Available treatment** | While treatment of measles is primarily supportive, a severe clinical course should prompt initiation of a three-dose schedule of Vitamin A in affected children, dosed according to age. Benefits include improved recovery, and a lower rate of complications including blindness secondary to acute vitamin A deficiency (13). This is particularly important given measles is the primary cause of preventable childhood blindness in low-income countries (11); the prevalence of Vitamin A deficiency in South Asia (14); and, previously documented Vitamin A deficiencies in adolescent refugee populations (15).<br><br>Fourteen (64%) cases in Fort McCoy, the centre of the outbreak, have received healthcare from local hospitals (1). This information is not publicly available for other locations. |
| **Comparison with past outbreaks** | Previous measles outbreaks amongst displaced populations have highlighted the foundational role of mass vaccination in curbing and preventing outbreaks (16) (17) (18) (19), and identified coinfection with other vaccine preventable diseases as an additional risk (16). Documented attack rates (AR) for measles in these populations range from 0.04% - 25.5% (20), though this is not directly comparable across outbreaks given differing surveillance approaches and levels of pre-existing immunity. |

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| | Preventative vaccination campaigns must include all children, including young infants. Analysis of measles cases amongst Myanmar refugees in Saudi Arabia found the mean age of those affected was 6 +/- 2 (range 1-9), while an outbreak in Côte d'Ivoire refugee camps recorded highest incidence (18.5%) in children aged 0-9 months (16). Including those aged >15 may provide additional benefit (17). Population screening for IgG antibodies is a potential strategy for prioritising vaccination during outbreaks, suggested by study of asylum seekers in Italy which noted high measles IgG seroprevalence (18). A measles outbreak across four refugee camps in Tanzania exposed waning compliance with vaccination policies over time, highlighting the importance of continued vigilance in high-risk settings (17).<br><br>Factors that may increase the difficulty of surveillance include movement across camps, frequent arrivals and departures and insecure housing (21). Providing measles education to family members may contribute to early outbreak recognition (22).<br><br>Ongoing symptoms of fever and rash following a vaccination campaign prompted recognition of a concomitant rubella outbreak in Côte d'Ivoire refugee camps (16), illustrating the need for comprehensive health assessments in these populations. |
| **Unusual features** | This measles outbreak has occurred in the context of the mass evacuation of 124,000 people from Afghanistan to the USA. The evacuations occurred following the withdrawal of US troops from Afghanistan and subsequent Taliban rule (23). The evacuation process exacerbated the risk of measles transmission, with evacuees placed in close contact in poorly ventilated settings including closed aircrafts (8). In response, a nationwide medical advisory has notified doctors to be on alert for measles cases in Afghan evacuees, as some left USA military bases prior to the index case being identified (8).<br><br>The CDC has highlighted known cases of COVID-19, varicella, hepatitis A, leishmaniasis, tuberculosis and malaria in the current outbreak, which may present as coinfection with measles (3). Low levels of immunity against a range of vaccine preventable diseases have been previously documented in asylum seeker populations, including those originating from Afghanistan (24). Evacuees have thus received comprehensive health evaluations, as well as inoculation against a range of diseases including COVID-19 and polio in addition to the MMR vaccine (12). |
| **Critical analysis** | Measles outbreaks occur frequently in Afghanistan, where the national vaccination rate is just 60% (8). The USA has maintained measles elimination status since 2000, despite intermittent outbreaks secondary to returned |

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| | international travellers (25). The absence of reported community transmission in this outbreak (2) is significant, as the USA narrowly avoided loss of its measles elimination status in 2019 after experiencing two large outbreaks in New York State Orthodox Jewish communities with low vaccination rates (26). While 90.8% American children are vaccinated against measles by 24 months (27), pockets of anti-vaccination sentiment pose a threat to ongoing measles elimination. This was highlighted in the 2014 'Disneyland' measles outbreak, the initial source of which remains unidentified (28). The outbreak came to health authorities' attention when an unvaccinated 11-year-old child was hospitalised with measles after visiting the theme park (28). One hundred and twenty five cases were subsequently identified across 8 US states between December 2014 and February 2015 (28). Forty nine cases were known to have occurred in unvaccinated individuals, 57% of whom were unvaccinated due to personal beliefs (28).<br><br>Diagnosis of the index case in the current outbreak halted transfer of additional Afghan evacuees bound for America (29). Quarantine of Afghan evacuees already in the USA has been facilitated by an Executive Order issued September 17th, 2021 that expanded existing quarantine powers to include measles (3). Following a mass vaccination and quarantine campaign, Afghan evacuees temporarily housed in Germany and Qatar military bases resumed travel to the USA from October 4th (30).<br><br>Modelling has previously quantified the benefits of rapid vaccination in a measles outbreak within a Rohingya refugee population (31). The daily effective reproductive number was reduced from 4.3 to >1 through mass vaccination, estimated to have preventing thousands of additional cases (31). As such, a rapid decrease in case numbers in the current outbreak is anticipated, secondary to mass vaccination.<br><br>A limitation of this outbreak analysis is its inability to calculate an attack rate for this outbreak. While it is known that around 124,000 Afghans were transported from Kabul to the USA during the September 2021 evacuations (23), the number of evacuees exposed to confirmed measles cases has not been publicly commented upon. |

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| **Key questions** | What rapid health assessment strategies can be developed to address the risks of infectious disease transmission in future humanitarian crises?<br><br>How can risk mitigation strategies including mass vaccination campaigns be rapidly deployed in high-risk environments, such as temporary camps and closed aircraft, when transporting evacuees from nations with known outbreaks of airborne disease/s?<br><br>How does the pre-evacuation health status of affected children and youth interact with their risk of developing complications of measles? |
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