

# Measles: Going, Going, But Not Gone

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(See the article by Chen et al, on pages 1517–25.)

For those of us engaged in disease investigation and response at the state and local level, the report by Chen and colleagues [1] in this issue of the *Journal* makes for sobering reading. It describes an outbreak of measles in Arizona where virus transmission predominantly occurred in the health care setting, a scenario of great concern to us all. In reading through the report, I was repeatedly reminded of the adage “What a fool does in the end, the wise do in the beginning.” One hopes that a report of this nature will spur at least some health care systems, hospitals, and physicians’ offices to act wisely before they too are confronted with a case of measles in their facilities. The Tucson outbreak also highlights many of the challenges faced by public health departments around the country with respect to a disease that, vaccine controversies notwithstanding, has been receding in memory and importance for many health care practitioners, institutions, and the public.

In the United States, we entered the “postelimination” era in 2000 [2]. But

in the context of measles, “elimination” does not mean that there are no cases occurring. This is because the disease continues to be still too common in other parts of the world, and international travels produce opportunities for continued introduction [3]. As a result, between 2000 and 2008, an average of 56 cases per year have been confirmed in the United States [3]. And paradoxically, the number of cases may actually be rising as segments of the population increasingly opt out of vaccination, producing uneven vaccination rates and pockets of susceptibility [4]. This raises concerns that sustained transmission can occur if measles is introduced into the wrong setting at the wrong time.

Consequently, even a single case of measles sets off alarms in every health department around the country and often prompts an extensive investigation like the one described in Tucson. Such investigations usually involve tracking large numbers of contacts; hastily arranged mass vaccinations; isolation, quarantine, and exclusion; expensive laboratory testing; and an enormous drain on resources [5, 6]. These actions are geared toward rapid containment to minimize the potential for transmission and, especially, multigeneration outbreaks. A major take-home lesson from Tucson is that some of the actions taken, and certainly many of the costs, were avoidable had common-sense measures

been in place beforehand, rather than after the fact. At least one hopes that that lesson was learned and that these common-sense measures were applied after the fact.

First, as so well described by Chen and colleagues, case diagnosis and reporting were repeatedly delayed in Tucson. This happened even after the presence of measles was known, presumably the medical community had been alerted, and statewide active surveillance for measles was instituted. With the index case who was an international traveler, a full week elapsed between rash onset, establishment of a definitive diagnosis, and reporting of the case to the health department. Even while the patient was hospitalized, 3 days elapsed before the diagnosis of measles was even considered for this patient, followed by 2 more days before a lab test (which unfortunately had a negative result) was ordered. Only after a second test came back with a positive result was the case reported to health department investigators. With a highly transmissible infection such as measles, every day is crucial for successful containment. Even when the disease is only suspected, it should be immediately reported so that health authorities can get the jump on contact tracing (eg, the airline passengers on the patient’s flight and care providers and patients in the emergency department), identifying susceptible individuals, and

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implementing prevention measures (prophylaxis and exclusion) while they are still feasible. Given the many challenges in obtaining airline manifests (especially for international flights) and tracking down widely dispersed travelers, the  $\geq 2$  weeks that elapsed before passengers were contacted are clearly too long for effective intervention.

Prompt tracking and investigation of the emergency department contacts of the index case patient would have led to the second case patient (presuming she was there as a patient) and allowed the health department to alert her medical team to her exposure and the possible diagnosis during her first hospitalization, rather than during her second. This would have avoided exposure by this patient of the health care worker who so unfortunately transmitted measles to her family member and to another patient. A similar missed opportunity occurred with an 11-month-old boy who was in the same emergency department at the same time as another case patient but was not tracked down as a contact or diagnosed until 2 weeks later, despite 3 visits in the interim to the pediatrician's office.

If for no other reason than its public health implications, measles should remain high in the differential diagnosis of any febrile rash illness, but especially when the patient is an international traveler or has an unknown (or inadequate) vaccination history. Although "only" 14 cases occurred in this outbreak, the consequences were severe and the costs exorbitant. The fact that the last 5 cases had no clear link to other confirmed cases or health care settings suggests that unidentified transmission occurred in the community and that the outbreak was larger than appreciated. In places with large transient populations due to tourism or migration, like Arizona, when even small proportions of the population are undervaccinated, the risk for subsequent transmission increases, as evidenced by a 2008 outbreak

that occurred in San Diego, California [6, 7].

A second equally vexing concern relates to occupational health issues in the involved hospitals. We are currently in the midst of a major national drive for electronic health records [8]. So how in 2011 can it be acceptable to still have paper-based employee health records? Yet experience suggests that this remains the case in many hospitals, long-term care facilities, and outpatient clinics. Medical records are often poorly maintained, incomplete, or out of date. Often a substantial proportion of workers (employees or contractors) lack documentation of immunization (and not just for measles). In Tucson-area hospitals, this was the case for 30% of the employees. Insufficient records resulted in excessive testing, use of vaccine, and worker furloughs and produced the bulk of the \$800,000 in costs for outbreak containment. These costs were fully avoidable.

There is virtually no reason (except for vaccine contraindications or failure) that any health care worker in the United States should lack measles immunity [9]. Health care workers are at substantially higher risk of exposure than the general population, and a health care worker with measles will inevitably result in large numbers of exposed, high-risk patients [10, 11]. And as seen in Tucson, illness from health care worker-to-patient transmission can be very serious.

Any facility with a substantial number of health care workers should maintain electronic occupational health records and should require that their workforce be uniformly immune to vaccine-preventable infections such as measles. The latter is a longstanding recommendation of both the Advisory Committee for Immunization Practices and the Healthcare Infection Control Practices Advisory Committee [12, 13] and is supported by professional societies. Yet in the Tucson metropolitan area's 7 hospitals, documentation of measles

immunity was lacking in 30% of the workforce, and 9% of the workers tested in the 2 outbreak hospitals were found to be nonimmune. That represents an unacceptable and avoidable patient safety and liability risk that likely also exists elsewhere in the country. There is now a rising tide of support for mandatory vaccination of health care workers against influenza [14, 15]. This requires an annual vaccination campaign with its attendant complexities. But if we can't accomplish universal health care worker vaccination for measles, which requires only a single (or 2-dose) vaccination, how can we possibly achieve a better outcome for influenza vaccination?

Until measles elimination efforts make substantially more progress elsewhere in the world than they have to date, we will continue to deal with the potential for disease importation and subsequent transmission in the United States [16]. Today measles remains a substantial public health concern. However, health care settings should not contribute to the likelihood for transmission of this virus. Although we cannot eliminate the measles threat, through continued vigilance for the diagnosis, prompt reporting of suspected cases to health authorities, adherence to recommendations requiring documented health care worker vaccination, and use of administrative measures such as masking and prompt patient isolation, if we act wisely, it is within our ability to eliminate additional outbreaks like the one reported by Chen and colleagues from occurring.

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