Measles and mumps outbreaks in the United States: Think globally, vaccinate locally

Measles and mumps outbreaks in the United States have claimed numerous headlines over the past six months. The 397 measles cases in the U.S. from January 1 to June 6, 2014 have surpassed the highest annual totals since the 2000 declaration of measles elimination in the U.S. [1]. Mumps outbreaks have made their marks across college campuses in Ohio and New York. What similarities have there been in the recent U.S. measles and mumps outbreaks? Both have highlighted the importance of imported infections to the U.S. among unvaccinated travelers. Both have illuminated “failure to vaccinate” cracks in MMR vaccine coverage in Western Europe and the U.S., which largely have their roots in the anti-vaccine movement and scientifically unfounded concerns about the measles-mumps-rubella (MMR) vaccine. Both have raised questions of vaccine failure.

Measles is one of the most contagious viruses known in humans and has a secondary attack rate in susceptible contacts of greater than 90% [2]. Before the advent of the measles vaccine, 500,000 measles cases were reported annually in the U.S., with 500 measles-related deaths, 48,000 hospitalizations, and 4000 cases of encephalitis leaving nearly 1000 of those patients permanently deaf or with neurologic impairment [3]. Worldwide, it is estimated the measles vaccine saved an estimated 12.7 million lives during the years of 2000–2008 [3]. Global reductions in measles morbidity and mortality are tremendous public health achievements. Measles is targeted for elimination in five WHO regions by 2020 [4], and WHO has concluded that measles eradication is feasible and a future goal [5]. Despite these advances, large measles outbreaks in countries that do not lack access to MMR vaccine continue to occur. The United Kingdom declared measles endemic again in 2008 [6]. The WHO European Region reported >30,000 cases of measles in 2011 and was the source of nearly half of the measles importations to the U.S. in 2011 [7].

Of the 288 measles cases reported from January 1 to May 23, 2014, 97% were associated with importations from 18 different countries [8]. Forty of the 45 importations (89%) were from U.S. residents returning from abroad [8]. Only five importations were identified from foreign visitors. Forty-nine percent of the importations were from the Philippines, with an additional 16% being associated with travel to the WHO Western Pacific Region, 18% to WHO Southeast Asia, 9% to European, and 8% to Americas regions [8]. The majority (69%) of the 288 cases occurred in unvaccinated individuals or those who had unknown MMR vaccination status (20%). But importantly, 10% of cases occurred in previously vaccinated individuals [8], and this represents a serious concern in terms of the long-term prospects of eradicating measles with the current vaccine [9]. This is in keeping with the past 10 years of measles outbreaks in the U.S., where the majority of cases have occurred in unvaccinated individuals [9]. Of those who were affected and not vaccinated (195 U.S. residents), 85% reported declining vaccines because of “religious, philosophical, or personal objections.” Only 6% of the unvaccinated cases were due to missed opportunities for vaccination, and only 5% were in children too young to receive vaccination [8]. In the 1989–1991 U.S. measles outbreaks, 20–40% of those infected had been previously immunized with at least one dose of vaccine [10]. While there have been measles vaccine failures [11], the overwhelming culprit of the 2014 U.S. measles outbreaks appears to be the rejection of MMR vaccine by U.S. residents due to personal objections. While the inciting events may have been of a global nature, the local failure to vaccinate allowed for transmission of the highly contagious virus among pockets of highly susceptible individuals. Has the same rejection of MMR vaccine led to recent mumps outbreaks?

Mumps is a less efficiently transmitted virus than measles, with a secondary attack rate of approximately 30% [12]. Serious complications of mumps infection include meningitis, encephalitis, deafness, orchitis, and oophoritis, which may lead to infertility. Widespread administration of the mumps vaccine since licensure in 1967 and the two-dose childhood MMR vaccine regimen decreased mumps rates in the U.S. by >99% in 2005 from the pre-vaccine era rates [13]. Despite this tremendous progress, mumps outbreaks continue to occur in the U.S. In 2006, there was a multi-state outbreak of 6584 mumps cases [13]; in 2009–2010, there were outbreaks that involved 3502 cases [11], and from January 1, 2014 to May 2, 2014, 464 cases of mumps have been reported as a result of college campus outbreaks in Ohio and New York [14].

Data on vaccination and imported infection status for this year’s mumps cases in the U.S. has not yet been determined. However, a review of the data from previous recent U.S. mumps outbreaks is instructive. A large outbreak in New York and New Jersey in 2009 of 3502 cases was traced back to an index case of a twice-vaccinated 11-year-old boy who had traveled and acquired mumps in the UK [15,16]. He attended a summer camp for Orthodox Jewish boys, where multiple other camp attendees became infected and later transmitted the infection in their local communities. Of the 2317 cases who had verified vaccination status, only 10% were unvaccinated, 14% had received one MMR vaccine, and 76% had
received two MMR vaccines [16]. The highest proportion of cases (27%) occurred among adolescents who were 13–17 years of age. Among the 884 cases who were 13–17 years old with verified vaccination status, 89% had received two doses of MMR vaccine, which was the same vaccination rate for the same age group in New York City [16]. Thus, this outbreak appeared to be due largely to vaccine failure, rather than a failure to vaccinate. A California outbreak in 2011 was traced back to an unvaccinated college student who had traveled to, and acquired mumps infection in, Western Europe. In this California outbreak, 76% of mumps illnesses occurred among persons previously vaccinated with the recommended two doses of MMR vaccine [17]. In the largest nationwide mumps epidemic in the past 28 years during 2006, the highest attack rate was among persons 18–24 years of age and, of the case-patients, 76% had been previously vaccinated, with 57% of them receiving two doses. Of the 18–24-year-old group, 80% had received two doses of MMR vaccine [18]. Therefore, 80% coverage with two doses of MMR vaccine appears to be sub-optimal and sheds light on gaps in MMR coverage. However, the mumps outbreaks, contrasted with measles outbreaks, demonstrate that there are higher rates of vaccine failure for mumps than for measles. Research on waning mumps immunity and the development of more effective mumps vaccines is needed, but has not been a priority at the NIH thus far.

These measles and mumps outbreaks illustrate that infectious diseases are global diseases. As John Donne once penned, “No man is an island entire of itself; every man is a piece of the continent, a part of the main … any man’s death diminishes me, because I am involved in mankind.” Global vaccination programs are paramount in decreasing the morbidity and mortality of vaccine-preventable diseases worldwide. On a more local public health point of view, they are also critical in preventing the importation of diseases to our shores. Measles and mumps are also local diseases. On our home shores, we must not become complacent and accepting of low immunization coverage rates. When the proverbial “bell tolls” (or the electronic medical record alert flashes) for a vaccine that is due, we must help our patients understand that the bell is tolling for them and that their vaccine refusal not only affects them as individuals, but affects their communities, and humanity as a whole. For mumps, we can advocate that not only do we need better vaccine coverage, we also need better vaccines. For measles, we can posit (and one of us has written on this topic before) that more immunogenic and efficacious vaccines may aid in the ultimate goal of measles eradication [9], but the imminent threat appears to be a war that has been more challenging than the complex topic of rational vaccine design—fighting the ongoing tide of vaccine hesitancy, vaccine rejection, and fear. For these conditions, more multidisciplinary research and new models for achieving higher levels of vaccine acceptance are needed. One model gaining interest is the “preferred cognitive styles and decision-making model,” which argues for health care providers to better understand how patients make decisions, and the cognitive styles they use to do so, in directing educational efforts [19]. Better vaccines, better delivery models, better educational efforts, and better research can all contribute to the control and eradication of these eminently preventable diseases. But, until then, each of us must do our part by giving strong recommendations and support for our patients to be fully immunized and up to date with all recommended vaccines. There is no substitute for highly informed patients, and all health care providers play decisive roles in this regard.

References

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