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webinar series

**William Atkinson, MD, MPH**  
**Vaccination of Healthcare Personnel**  
**May 18, 2017**

# Why Are We Talking About This?

- **Work in healthcare increases the risk of exposure to several vaccine-preventable diseases**
- **Susceptible healthcare personnel (HCP) endanger themselves, their patients and their contacts**
- **Outbreaks in healthcare facilities can be dangerous and costly**

## NEWS

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### Measles outbreak hits Pima County

9 cases raise concerns that disease may spread

by *Amanda J. Crawford* - Apr. 1, 2008 12:00 AM  
The Arizona Republic

Health officials are worried that the measles could spread throughout the state, after nine cases of the highly contagious disease have been confirmed in Pima County since February.

Four adults and four children have been infected since a 37-year-old woman visiting from Switzerland was diagnosed at Northwest Medical Center in Tucson in mid-February. They came into contact with her or others infected with the disease at the hospital or a doctor's office, said Dr. Karen Lewis, a medical director with the Arizona Department of Health Services.

Officials say it could have spread out of Pima County.

# Healthcare-associated Measles Outbreak, Arizona, 2008

- 14 cases, 7 were acquired in hospital settings (EDs, inpatient)
- One unvaccinated HCP acquired measles and infected a patient who required ICU care
- 25% of 7,195 HCPs lacked documented evidence of measles immunity
  - 139/1,583 (9%) of those tested were measles IgG negative

# Healthcare-associated Measles Outbreak, Arizona, 2008

- Response costs in 2 affected hospitals was about \$800,000 or more than \$100,000 per case investigated
- Major component of cost was vaccination and furloughs related to lack of readily available records on evidence of measles immunity

# Influenza Transmission in Healthcare Settings

- Outbreaks in hospitals and LTC facilities are associated with low vaccination rates of HCP
- Attack rates of more than 60% have been reported during outbreaks in nursing homes
- Among those with influenza
  - 52% can develop pneumonia
  - 29% can be hospitalized
  - 10% can die

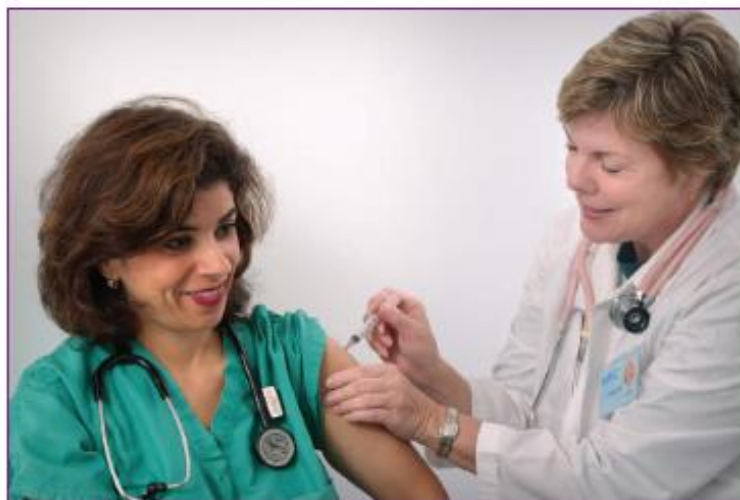
*Clin Infect Diseases* 2003;37:1094-1101

# **Advisory Committee on Immunization Practices (ACIP)**

- **The recommendations to be discussed are primarily those of the ACIP**
  - **composed of 15 experts in clinical medicine and public health who are not government employees**
  - **provides guidance on the use of vaccines and other biologic products to the Department of Health and Human Resources, CDC, and the U.S. Public Health Service**

## Immunization of Health-Care Personnel

### Recommendations of the Advisory Committee on Immunization Practices (ACIP)



Continuing Education Examination available at <http://www.cdc.gov/mmwr/cme/conted.html>.



U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention



# Vaccines\* Recommended for All Healthcare Personnel

- Hepatitis B
- Influenza
- Measles, mumps and rubella
- Varicella
- Pertussis

**\*or evidence of immunity in some cases  
MMWR 2011;60(RR-7):23.**

# Hepatitis B Vaccine

- **Contains recombinant HBsAg**
- **Intramuscular administration only**
- **Usual schedule: 0, 1, 6 months**
- **Variant schedules are acceptable (0, 1, 4 months, 0, 2, 4 months, 0, 1, 2, 12 months)**
- **No less than 16 weeks between doses 1 and 3**
- **Duration of immunity more than 20 years**

# Frequently Asked Question

- **How long an interval between the 2<sup>nd</sup> and 3<sup>rd</sup> doses of hepatitis B vaccine requires restarting the series?**
  - A. 6 months**
  - B. 1 year**
  - C. 5 years**
  - D. 10 years**
  - E. Restarting the series is not necessary regardless of the interval between doses**

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# Interruption of the Hepatitis B Vaccine Series

- It is not necessary to restart the series or add doses if the hepatitis B vaccine series is interrupted, regardless of the interval since the last dose

# Hepatitis B Evidence of Immunity

- Written documentation of a properly spaced 3-dose series of hepatitis B vaccine, and
- Confirmation of immunity (antibody to hepatitis B surface antigen [anti-HBs] >10 mIU/mL) 1 to 2 months after the third dose
- CDC recommends that HCP have both documentation of vaccination and a positive anti-HBs
- HCP lacking documentation of vaccination should be considered unvaccinated

# **Hepatitis B**

## **Postvaccination Serologic Testing**

- **HCP who have contact with blood or other body fluids or who are at risk for injury from blood-contaminated equipment should be tested for antibody to hepatitis B surface antigen (anti-HBs) 1 to 2 months after the third dose of vaccine**

# **The “New” Hepatitis B Serology Issue: HCP Vaccinated as Infants or Adolescents**

- **Routine hepatitis B vaccination of infants was first recommended in 1991**
- **Catch-up vaccination of adolescents recommended in 1995**
- **Vaccination coverage among 19-35 month-old children first exceeded 90% in 2000**
- **The oldest cohorts vaccinated as infants are now in their mid-20s**
- **Routine serologic testing of infants is not recommended (except if mother is HBsAg positive)**



# Hepatitis B Vaccination

- **95% of healthy infants will achieve seroprotection against hepatitis B 1 to 2 months after a complete 3-dose series**
- **By 18 years after vaccination approximately 84% of persons vaccinated at younger than 1 year of age will not have detectable anti-HBs**

**MMWR 2013;62(RR-10):1-19**

*Centers for Disease Control and Prevention*

**MMWR**

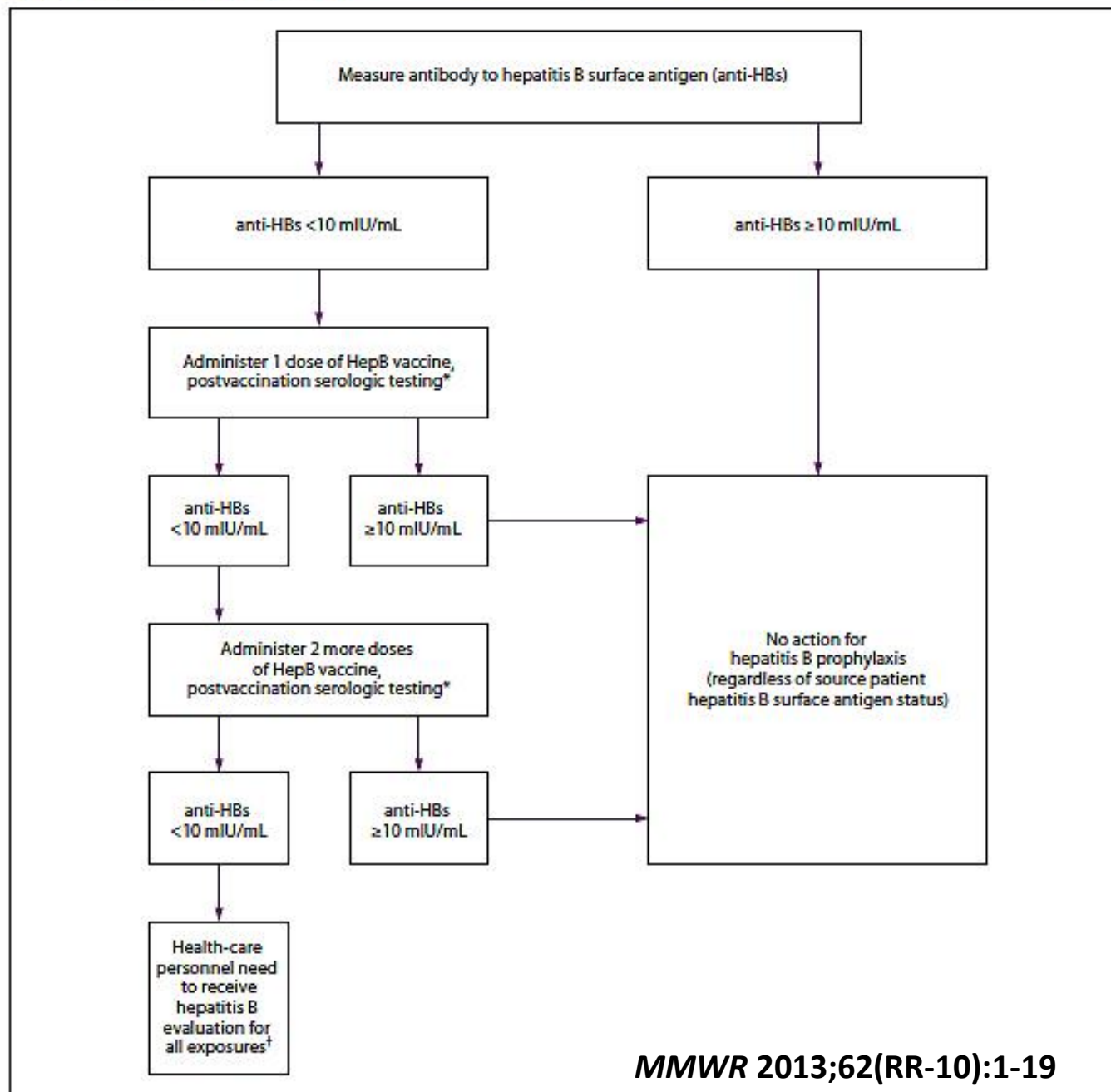
Morbidity and Mortality Weekly Report

Recommendations and Reports / Vol. 62 / No. 10

December 20, 2013

**CDC Guidance for Evaluating Health-Care Personnel  
for Hepatitis B Virus Protection and for  
Administering Postexposure Management**

FIGURE 6. Pre-exposure evaluation for health-care personnel previously vaccinated with complete,  $\geq 3$ -dose HepB vaccine series who have not had postvaccination serologic testing\*



# Hepatitis B Vaccine and HCP

- **Management of HCP who have written documentation of a complete series of hepatitis B vaccine doses in the past who were not tested for antibody response following the vaccination series and who now test negative for anti-HBs**
  - **administer 1 dose of hepatitis B vaccine then test for anti-HBs 1 to 2 months later**
  - **if positive (anti-HBs  $\geq 10$  mIU/mL) the person is immune and nothing else needs to be done**

# Management of Nonresponse to Hepatitis B Vaccine

- **For persons who remain seronegative after the “booster” dose**
  - **complete a second series of three doses (i.e., 2 more doses)**
  - **use the usual schedule of 0, 1 and 6 months (or compressed 0, 1, 4 month schedule)**
  - **retest for anti-HBs 1 to 2 months after completing the second series**

# Hepatitis B Revaccination

- **47% of 3-dose series recipients without protective antibody levels after a primary vaccination series develop vaccine-induced seroprotection after one additional dose of hepatitis B vaccine**
- **69% of initial nonresponders will develop seroprotection after 3 revaccination doses**

*Am J Prev Med* 1998;15:1-8

# Persistent Nonresponse to Hepatitis B Vaccine

- **ACIP does not recommend revaccination with more than 3 doses (i.e., more than 6 total doses)**
- **Check HBsAg and anti-HBc status if not already done**
- **If exposed, treat as nonresponder with HBIG postexposure prophylaxis**



# Interpretation of Hepatitis B Serologic Tests

Tests	Results	Interpretation	Vaccinate?
HBsAg anti-HBc anti-HBs	negative negative negative	susceptible	vaccinate if indicated
HBsAg anti-HBc anti-HBs	negative negative positive with $\geq 10\text{mIU/mL}^*$	immune due to vaccination	no vaccination necessary
HBsAg anti-HBc anti-HBs	negative positive positive	immune due to natural infection	no vaccination necessary
HBsAg anti-HBc IgM anti-HBc anti-HBs	positive positive positive negative	acutely infected	no vaccination necessary
HBsAg anti-HBc IgM anti-HBc anti-HBs	positive positive negative negative	chronically infected	no vaccination necessary (may need treatment)
HBsAg anti-HBc anti-HBs	negative positive negative	four interpretations possible†	use clinical judgment

\* Postvaccination testing, when it is recommended, should be performed 1-2 months after the last dose of vaccine. Infants born to HBsAg-positive mothers should be tested for HBsAg and anti-HBs after completion of at least 3 doses of a licensed hepatitis B vaccination series, at age 9-18 months (generally at the next well child visit).

†1. May be recovering from acute HBV infection

2. May be distantly immune, but the test may not be sensitive enough to detect a very low level of anti-HBs in serum

3. May be susceptible with a false positive anti-HBc

4. May be chronically infected and have an undetectable level of HBsAg present in the serum



**TABLE 2. Postexposure management of health-care personnel after occupational percutaneous and mucosal exposure to blood and body fluids, by health-care personnel HepB vaccination and response status**

Health-care personnel status	Postexposure testing		Postexposure prophylaxis		Postvaccination serologic testing†
	Source patient (HBsAg)	HCP testing (anti-HBs)	HBIG*	Vaccination	
Documented responder§ after complete series (≥3 doses)	No action needed				
Documented nonresponder¶ after 6 doses	Positive/unknown	—**	HBIG x2 separated by 1 month	—	No
	Negative	No action needed			
Response unknown after 3 doses	Positive/unknown	<10mIU/mL**	HBIG x1	Initiate revaccination	Yes
	Negative	<10mIU/mL	None		
	Any result	≥10mIU/mL	No action needed		
Unvaccinated/incompletely vaccinated or vaccine refusers	Positive/unknown	—**	HBIG x1	Complete vaccination	Yes
	Negative	—	None	Complete vaccination	Yes

Abbreviations: HCP = health-care personnel; HBsAg = hepatitis B surface antigen; anti-HBs = antibody to hepatitis B surface antigen; HBIG = hepatitis B immune globulin.

\* HBIG should be administered intramuscularly as soon as possible after exposure when indicated. The effectiveness of HBIG when administered >7 days after percutaneous, mucosal, or nonintact skin exposures is unknown. HBIG dosage is 0.06 mL/kg.

† Should be performed 1–2 months after the last dose of the HepB vaccine series (and 4–6 months after administration of HBIG to avoid detection of passively administered anti-HBs) using a quantitative method that allows detection of the protective concentration of anti-HBs (≥10 mIU/mL).

§ A responder is defined as a person with anti-HBs ≥10 mIU/mL after ≥3 doses of HepB vaccine.

¶ A nonresponder is defined as a person with anti-HBs <10 mIU/mL after ≥6 doses of HepB vaccine.

\*\* HCP who have anti-HBs <10 mIU/mL, or who are unvaccinated or incompletely vaccinated, and sustain an exposure to a source patient who is HBsAg-positive or has unknown HBsAg status, should undergo baseline testing for HBV infection as soon as possible after exposure, and follow-up testing approximately 6 months later. Initial baseline tests consist of total anti-HBc; testing at approximately 6 months consists of HBsAg and total anti-HBc.

# Frequently Asked Question

- **How often should a HCP with documented post-vaccination immunity to hepatitis B be retested?**
  - A. Every year**
  - B. Every 5 years**
  - C. Every 10 years**
  - D. Retesting is not necessary**

# Frequently Asked Question

- **How often should a HCP with documented post-vaccination immunity to hepatitis B be retested?**
  - A. Every year
  - B. Every 5 years
  - C. Every 10 years
  - D. Retesting is not necessary**

# Hepatitis B Serologic Testing

- HCP who have written documentation of a complete 3 (or more) hepatitis B vaccine series AND subsequent postvaccination anti-HBs >10 mIU/ml are considered to be immune
- Immunocompetent persons have long-term protection against HBV infection and do not need further periodic testing to assess anti-HBs levels

**Once immune, always immune**

**MMWR 2013;62(RR-10):1-19**

# Influenza Vaccine Recommendations

- Routine annual influenza vaccination is recommended for all persons age 6 months and older who do not have a contraindication
- Healthcare providers are a high priority for annual influenza vaccination
- Facilities that mandate HCP vaccination generally achieve higher coverage
- Only inactivated vaccine is recommended for the 2016-2017 season

**MMWR 2015;64:818-25**  
**MMWR 2016;65(RR-5)**

# Measles, Mumps and Rubella Immunity

- All persons who work in medical facilities should be immune to measles, mumps and rubella
  - written documentation of 2 doses of measles and mumps vaccine separated by at least 28 days and one dose of rubella vaccine on or after the first birthday, or
  - laboratory evidence of immunity, or
  - born before 1957 (except women of childbearing age)\*

\*non-outbreak conditions  
*MMWR* 2011;60(RR-7)10-14

# Measles Serologic Testing

- Serologic testing for immunity is not recommended for HCP who have 2 documented doses of MMR vaccine or other acceptable evidence of immunity to measles
- In the event that a HCP who has 2 documented doses of MMR vaccine is tested serologically and determined to have negative or equivocal measles titer results, it is not recommended that the person receive an additional dose of MMR vaccine
- Such persons should be considered to have presumptive evidence of measles immunity
- *Documented age-appropriate vaccination supersedes the results of subsequent serologic testing*



# Mumps outbreaks reported across USA

 **USA TODAY NETWORK** [Mary Bowerman](#), USA TODAY Network

Published 12:56 p.m. ET March 10, 2017 | Updated 8:32 p.m. ET March 10, 2017



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(Photo: Sean Gallup, Getty Images)

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Hundreds of cases of mumps have been reported across the country since the start of 2017, according to the Centers for Disease Control and Prevention.

As of March 4, [the CDC had received reports](#) of 1,242 cases of mumps, a contagious viral infection that can result in swollen salivary glands

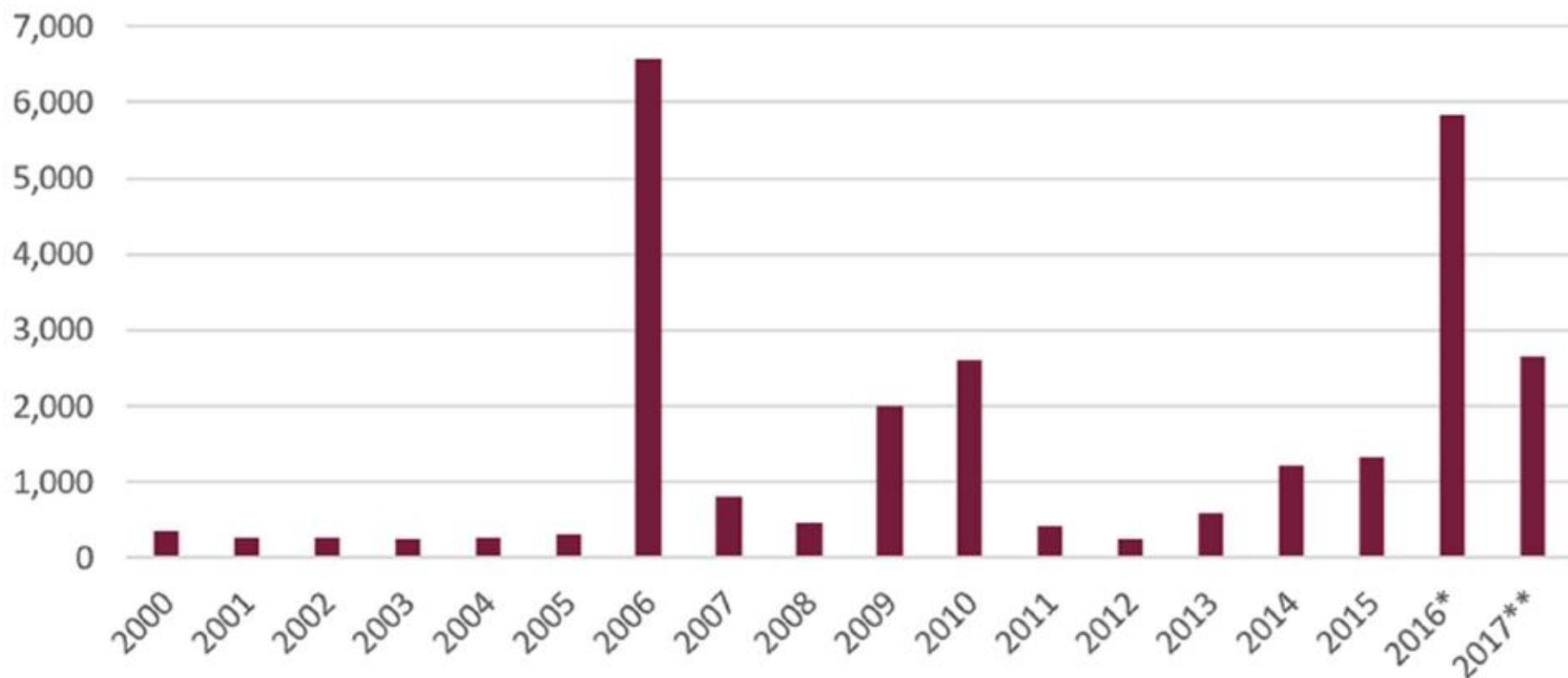
and flu-like symptoms. In Washington state, Seattle and King County Health officials said a dozen University of Washington students, all connected to sororities or fraternities, contracted the illness, [KING-TV reported](#). This year, there have been 563 reported cases of mumps and probable mumps statewide, an increase from last year when 154 cases were reported in the state, [according to the Washington State Health Department](#).

In Tulsa, officials investigated five confirmed cases of mumps [in the area](#), [KFOR-TV reported](#). In Illinois, the [Lake County Health Department](#) announced its partnering with Barrington School District 220 to hold a vaccination clinic after four cases of confirmed mumps were reported and 35 probable cases identified in the area.

Though cases of the mumps fluctuate each year from a few hundred to a few



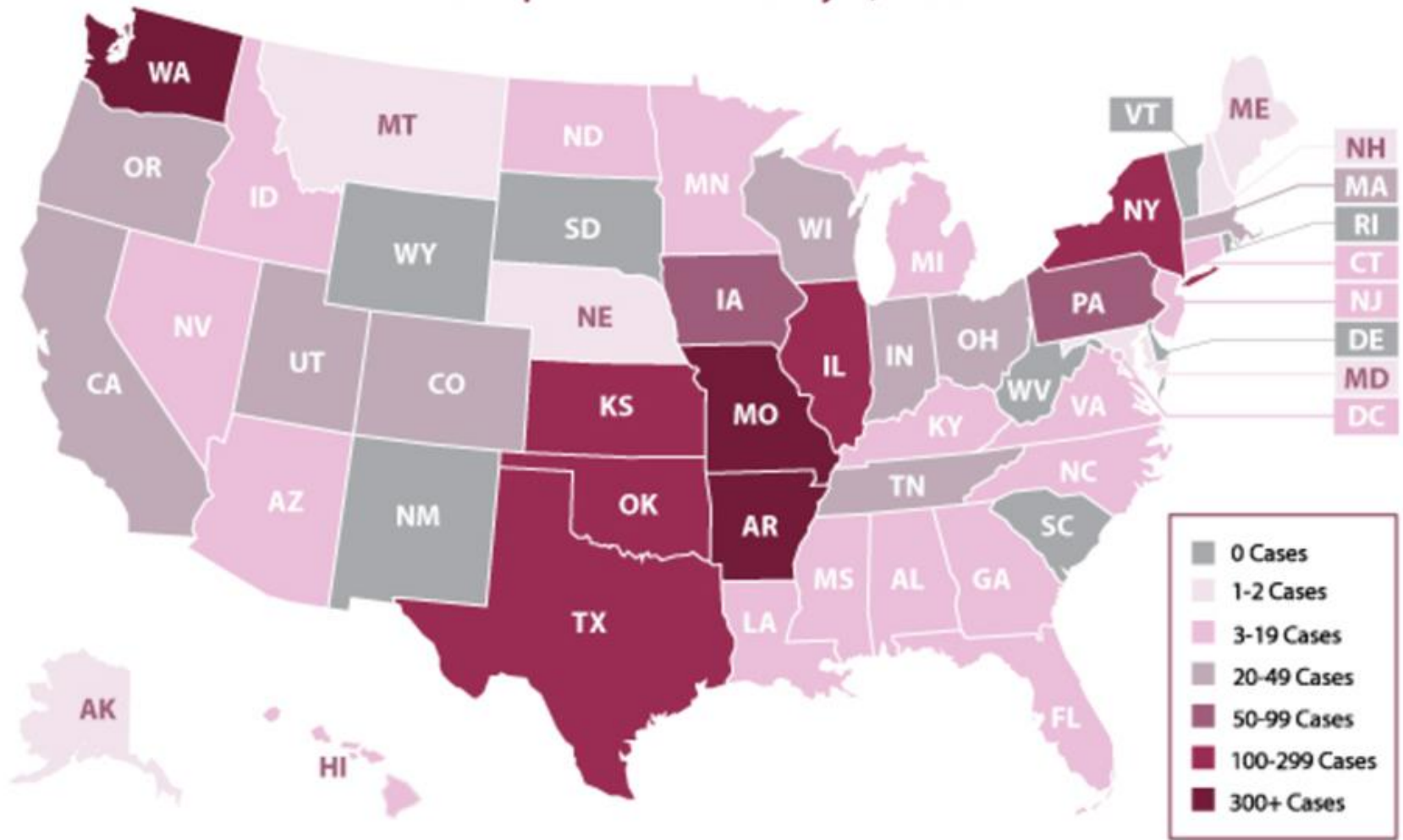
## Mumps Cases in U.S., by Year



\* Case count is preliminary and subject to change.

\*\*Cases as of April 22, 2017. Case count is preliminary and subject to change.

## Mumps Cases as of May 1, 2017



# Mumps and MMR Vaccine

- Mumps outbreaks can occur any time of year
- A major factor contributing to outbreaks is being in a crowded environment, such as attending the same class, playing on the same sports team, or living in a dormitory with a person who has mumps
- Two doses of MMR are 88% effective at protecting against mumps (range: 66 to 95%)
- One dose is 78% effective (range: 49% to 92%)

# Mumps Epidemiology

- Mumps vaccine has reduced disease by 97%
- Most recent cases are in fully vaccinated college students
- Mumps vaccine strain is effective against circulating mumps virus strain
- 2-dose schedule may be sufficient for general population
- Third doses may be offered in outbreaks
- Benefit of third dose in general population needs to be assessed

Discussion at ACIP meeting, February 23, 2017

# Mumps Presumptive Immunity for Healthcare Personnel

- **Written documentation of vaccination with 2 doses of live mumps virus-containing vaccine\*, or**
- **Laboratory evidence of immunity\*\*, or**
- **Laboratory confirmation of disease, or**
- **Born before 1957**

**\*separated by at least 28 days**

**\*\*mumps IgG-equivocal results should be considered negative**

**MMWR 2013;62(RR-4):19**

# Mumps Serologic Testing

- Serologic testing for immunity is not recommended for HCP who have 2 documented doses of MMR vaccine or other acceptable evidence of immunity to mumps
- In the event that a HCP who has 2 documented doses of MMR vaccine is tested serologically and determined to have negative or equivocal measles titer results, it is not recommended that the person receive an additional dose of MMR vaccine
- Such persons should be immune to mumps
- *Documented age-appropriate vaccination supersedes the results of subsequent serologic testing*

MMWR 2011;60(RR-7)14-16

# Acceptable Evidence of Varicella Immunity Among HCP

- Written documentation of age-appropriate vaccination
- Laboratory evidence of immunity or laboratory confirmation of varicella disease
- Healthcare provider diagnosis or verification of varicella disease
- History of herpes zoster based on healthcare provider diagnosis
- Birth in the U.S. before 1980 is not acceptable as evidence of immunity for HCP

*MMWR* 2007;56(RR-4):16-17

# Varicella Serologic Testing

- Serologic testing before vaccination may be cost-effective
- Routine testing for varicella immunity after 2 doses of vaccine is not recommended
- Commercial assays are often not sensitive enough to detect antibody after vaccination
- *Documented age-appropriate vaccination supersedes the results of subsequent serologic testing*



# Herpes Zoster Vaccine

- Live attenuated varicella virus
- Higher titer (14x) of varicella vaccine virus than standard varicella vaccine
- Recommended by ACIP at age 60 years or older
- Receipt of zoster vaccine alone is NOT acceptable evidence of varicella immunity

**MMWR 2008;57(RR-5):19-22**

# Tdap Vaccines

- **Boostrix (GlaxoSmithKline)**
  - approved for a single dose for persons 10 years of age and older
- **Adacel (Sanofi Pasteur)**
  - approved for a single dose for persons 10 through 64 years of age
- **Either product may be given at an interval less than 10 years since receipt of last tetanus toxoid-containing vaccine**

**MMWR 2011;60 (No. 1):13-5**

# Tdap Vaccine and Healthcare Personnel

- All previously unvaccinated HCP, regardless of age\*, should receive a single dose of Tdap as soon as feasible
- Either brand of Tdap may be used\*
- Both brands of Tdap are currently licensed and recommended for one dose
  - if needed the remaining doses of the tetanus and diphtheria series should be given as Td

**\*off-label recommendation for Adacel**  
***MMWR 2011;60 (No. 1):13-5***

# Tdap Revaccination

- Revaccination with Tdap applies **ONLY** to pregnant women
- ACIP does not recommend Tdap revaccination for HCP
- Focus on current Tdap program
  - improve adult Tdap coverage, including HCP (46% in 2015)
  - vaccination of pregnant women
- Tdap may be used for decennial tetanus booster if Td is not available\*

\*off-label recommendation. *MMWR* 2013;62(No.7):131-5

# **Additional Vaccines Recommended for Some Laboratory Personnel**

- **Meningococcal conjugate**
  - every 5 years
- **Meningococcal serogroup B**
  - 2- or 3-dose series, no booster dose recommendation
- **Typhoid (rarely indicated in the U.S.)**
  - booster doses based on type of vaccine used
- **Polio (rarely indicated in the U.S.)**
  - one lifetime booster dose if documented childhood series

**MMWR 2011;60 (RR-07):1-29**  
**MMWR 2015;64(No 22):608-11**

# Hepatitis A Vaccine and Healthcare Providers

- Hepatitis A vaccination is not routinely recommended for healthcare providers or employees who have occupational exposure to human waste (plumbers, environmental engineers)
- Nosocomial hepatitis A transmission is rare
- Data from serologic surveys of have not indicated an increased prevalence of hepatitis A infection among HCPs compared with control populations

*MMWR* 2006;55(RR-7):1-23

# Immunization of HCPs

## Summary

- Hepatitis B- vaccination and serology
- Influenza- annual vaccination
- MMR- vaccination or serology, not both
- Varicella- vaccination or serology, sometimes both (for older persons with uncertain disease history)
- Tdap- one dose for all HCP
- Meningococcal conjugate and serogroup B vaccines for some microbiologists\*

\*also typhoid and polio vaccines in some unusual circumstances

# Resources

- **General Best Practices Guidelines for Immunization**
  - [www.cdc.gov/vaccines/hcp/acip-recs/general-recs/index.html](http://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/index.html)
- **Immunization of Healthcare Workers**
  - MMWR 2011;69(RR-7):1-45
- **CDC Guidance for Evaluating Health-Care Personnel for Hepatitis B Virus Protection and for Administering Postexposure Management**
  - MMWR 2013;62(RR-10):1-19
- **Immunization Action Coalition**
  - [www.immunize.org](http://www.immunize.org)



# Questions?