

## **Viral Shedding from Vaccines**

*Mass immunizations in schools and communities  
May actually endanger the immune deficient via vaccine shedding.*

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**Shedding** is when the live virus that is injected via vaccine, moves through the human body and comes back out in the feces, droplets from the nose, or saliva from the mouth. Anyone who takes care of the child could potentially contract the disease for some time after that child has received certain live vaccines. This was a huge problem with the oral polio vaccine (OPV), and was one of the reasons why it was taken off the market in the US. The OPV is still used in developing countries.

**Secondary transmission** happens fairly often with some of the live virus vaccines. Influenza, Varicella, and Oral Polio Vaccine (OPV) are the most common. On the other hand it may happen very seldom or not ever with the measles and mumps vaccine viruses. Here are the vaccines that shed or have been known to result in secondary transmission:

**Measles Vaccine** - Although secondary transmission of the vaccine virus has never been documented, measles virus RNA has been detected in the urine of the vaccinees as early as 1 day or as late as 14 days after vaccination. (1)  
In France, measles virus was isolated in a throat swab of a recently vaccinated child 4 days after fever onset. The virus was then further genetically characterized as a vaccine-type virus. (2)

**Rubella Vaccine** - Excretion of small amounts of live attenuated rubella virus from the nose and throat has occurred in the majority of susceptible individuals 7-28 days after vaccination. Transmission of the vaccine virus via breast milk has been documented. (3)

**Chicken Pox Vaccine** - Vaccine-strain chickenpox has been found replicating in the lung (4) and documented as transmitting via zoster (shingles sores) (5) as well as "classic" chickenpox (6) rash post-vaccination.

### References:

- (1) [Detection of measles virus RNA in urine specimens of vaccinated persons](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC228449/) - Rota et al., Journal of Clinical Microbiology, 1995 can be accessed at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC228449/>
- (2) [Detection of measles vaccine in the throat of a vaccinated child](http://www.ncbi.nlm.nih.gov/pubmed/11858860?dopt=AbstractPlus) - Morefin, et al., Vaccine 2002, can be accessed at <http://www.ncbi.nlm.nih.gov/pubmed/11858860?dopt=AbstractPlus>
- 3) Prescribing Information, MMRII vaccine, can be accessed at [http://www.merck.com/product/usa/pi\\_circulars/m/mmr\\_ii/mmr\\_ii\\_pi.pdf](http://www.merck.com/product/usa/pi_circulars/m/mmr_ii/mmr_ii_pi.pdf)
- (4) Quinlivan et al, J Infect Dis. 2006, Vaccine Oka Varicella-Zoster Virus can be accessed at <http://www.journals.uchicago.edu/doi/full/10.1086/500835>
- (5) Brunell, et al., J. of Pediatrics 2000, [Chickenpox Attributable to a Vaccine Virus](http://pediatrics.aappublications.org/cgi/content/full/106/2/e28) can be accessed at <http://pediatrics.aappublications.org/cgi/content/full/106/2/e28>
- (6) Sauerbrei et al., J Clin Microbiol. 2004, [Genetic Profile of an Oka Varicella Vaccine Virus](http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=15583288) can be accessed at <http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=15583288>



## The Johns Hopkins Hospital Patient Information

Original Date

Oncology  
Revised Reviewed

### Care at Home for the Immunocompromised Patient

What can I do to prevent infection?

- Hand washing is the **best way** to prevent infection.
- Carry hand sanitizer with you at all times.
- Wash with soap and water or hand sanitizer
  - before and after you use the bathroom
  - before and after preparing or eating food
  - after touching pets or animals
  - after contact with someone who has an infection such as a cold or the flu
  - after touching surfaces in public areas (such as elevator buttons, handrails and gas pumps)



Do I need to wear a mask?

- Wear an N95 respirator mask when you travel to and from the hospital, when you are in the hospital, within two football fields of construction or digging, and in any public place.
- Close all car windows and turn on the re-circulate button of your ventilation system.
- Avoid crowds if possible. An area is crowded if you are within an arm's length of other people.
- Avoid closed spaces if possible.

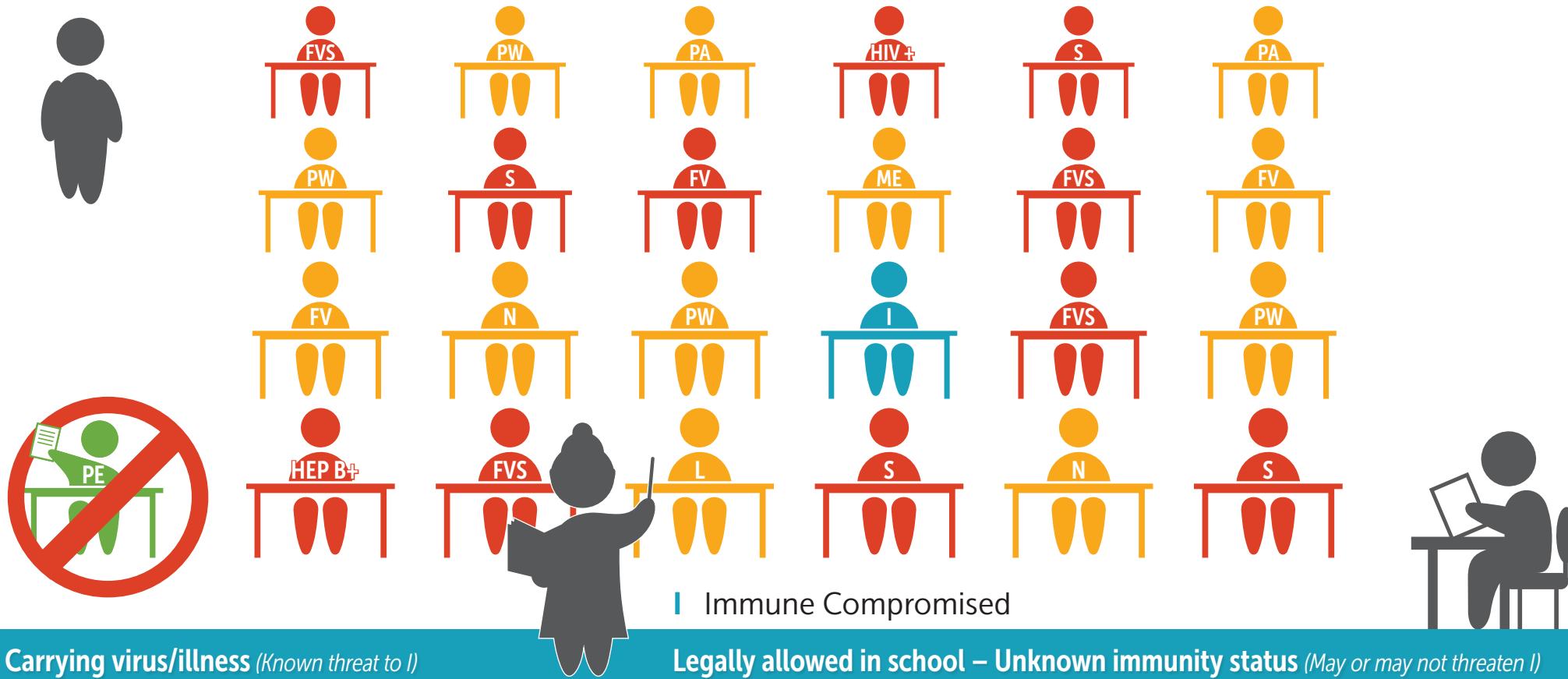
Can I have visitors?

- Tell friends and family who are sick, or have recently had a live vaccine (such as chicken pox, measles, rubella, intranasal influenza, polio or smallpox) not to visit.
- It may be a good idea to have visitors call first.
- Avoid contact with children who were recently vaccinated.

Are there any precautions I should follow about my medicine?

- Do not take aspirin or aspirin-like products (such as Advil™, Motrin™ or Excedrin™) unless told by your doctor.
- You should wear a medical alert bracelet that identifies you as a cancer patient or bone marrow transplant patient at risk for bleeding or infection.
- **Keep a current medication list with you at all times.**
- Do not take any herbal products.
- Avoid grapefruit juice, which interacts with many medications.

# Eliminating students with Philosophical Exemption does NOT protect the immune compromised



- S** Shedder, recent MMR, Varicella, or FluMist recipient – up to 28 days post vaccination via viral shedding – **FluMist is administered in schools!**
- HIV +** Legally allowed in school and medical privacy protected
- HepB +** Legally allowed in school and medical privacy protected
- FVS** Fully vaccinated child sick with common cold, strep, bronchitis, etc.
- FV** Fully vaccinated – immune status unknown

- PA** Provisional admittance, not fully vaccinated (7.9% is > than PE rate)
- PW** Vaccinated for pertussis but immunity has waned
- L** Low responder (vaccinated but antibody response low, not immune)
- N** Non-responder (vaccinated but no antibody response, not immune, 7% of MMR recipients)
- ME** Medically exempt – not fully vaccinated
- PE** Philosophical exemption, could be fully vaccinated but missing only 1 dose (First grade PE rates: DTaP 2.6%, Polio 2.9%, MMR 3.1%, HepB 3.3%, Chicken Pox 4.3%)

**Removing students with PEs does NOT protect the immune compromised, is discriminatory and denies healthy children the right to a free public education.**

**§100.3 Vaccine injury table.**

(a) In accordance with section 312(b) of the National Childhood Vaccine Injury Act of 1986, title III of Pub. L. 99-660, 100 Stat. 3779 (42 U.S.C. 300aa-1 note) and section 2114(c) of the Public Health Service Act (42 U.S.C. 300aa-14(c)), the following is a table of vaccines, the injuries, disabilities, illnesses, conditions, and deaths resulting from the administration of such vaccines, and the time period in which the first symptom or manifestation of onset or of the significant aggravation of such injuries, disabilities, illnesses, conditions, and deaths is to occur after vaccine administration for purposes of receiving compensation under the Program:

**VACCINE INJURY TABLE**

<b>Vaccine</b>	<b>Illness, disability, injury or condition covered</b>	<b>Time period for first symptom or manifestation of onset or of significant aggravation after vaccine administration</b>
I. Vaccines containing tetanus toxoid (e.g., DTaP, DTP, DT, Td, or TT)	A. Anaphylaxis or anaphylactic shock	4 hours.
	B. Brachial Neuritis	2-28 days.
	C. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
II. Vaccines containing whole cell pertussis bacteria, extracted or partial cell pertussis bacteria, or specific pertussis antigen(s) (e.g., DTP, DTaP, P, DTP-Hib)	A. Anaphylaxis or anaphylactic shock	4 hours.
	B. Encephalopathy (or encephalitis)	72 hours.
	C. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
III. Measles, mumps, and rubella vaccine or any of its components (e.g., MMR, MR, M, R)	A. Anaphylaxis or anaphylactic shock	4 hours.
	B. Encephalopathy (or encephalitis)	5-15 days (not less than 5 days and not more than 15 days).
	C. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above	Not applicable.

	which illness, disability, injury, or condition arose within the time period prescribed	
IV. Vaccines containing rubella virus (e.g., MMR, MR, R)	A. Chronic arthritis	7-42 days.
	B. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
V. Vaccines containing measles virus (e.g., MMR, MR, M)	A. Thrombocytopenic purpura	7-30 days.
	B. Vaccine-Strain Measles Viral Infection in an immunodeficient recipient	6 months.
	C. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
VI. Vaccines containing polio live virus (OPV)	A. Paralytic Polio	
	—in a non-immunodeficient recipient	30 days.
	—in an immunodeficient recipient	6 months.
	—in a vaccine associated community case	Not applicable.
	B. Vaccine-Strain Polio Viral Infection	
	—in a non-immunodeficient recipient	30 days.
	—in an immunodeficient recipient	6 months.
	—in a vaccine associated community case	Not applicable.
	C. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
VII. Vaccines containing polio inactivated virus (e.g., IPV)	A. Anaphylaxis or anaphylactic shock	4 hours
	B. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period	Not applicable.

	prescribed.	
VIII. Hepatitis B. vaccines	A. Anaphylaxis or anaphylactic shock	4 hours.
	B. Any acute complication or sequela (including death) of an illness, disability, injury, or condition referred to above which illness, disability, injury, or condition arose within the time period prescribed	Not applicable.
IX. Hemophilus influenzae type b polysaccharide conjugate vaccines	No Condition Specified	Not applicable.
X. Varicella vaccine	No Condition Specified	Not applicable.
XI. Rotavirus vaccine	No Condition Specified	Not applicable.
XII. Pneumococcal conjugate vaccines	No Condition Specified	Not applicable.
XIII. Hepatitis A vaccines	No Condition Specified	Not applicable.
XIV. Trivalent influenza vaccines	No Condition Specified	Not applicable.
XV. Meningococcal vaccines	No Condition Specified	Not applicable.
XVI. Human papillomavirus (HPV) vaccines	No Condition Specified	Not applicable.
XVII. Any new vaccine recommended by the Centers for Disease Control and Prevention for routine administration to children, after publication by the Secretary of a notice of coverage *	No Condition Specified	Not applicable.

\*Now includes all vaccines against seasonal influenza (except trivalent influenza vaccines, which are already covered), effective November 12, 2013.

(b) *Qualifications and aids to interpretation.* The following qualifications and aids to interpretation shall apply to the Vaccine Injury Table to paragraph (a) of this section:

(1) *Anaphylaxis and anaphylactic shock.* For purposes of paragraph (a) of this section, Anaphylaxis and anaphylactic shock mean an acute, severe, and potentially lethal systemic allergic reaction. Most cases resolve without sequelae. Signs and symptoms begin minutes to a few hours after exposure. Death, if it occurs, usually results from airway obstruction caused by laryngeal edema or bronchospasm and may be associated with cardiovascular collapse. Other significant clinical signs and symptoms may include the following: Cyanosis, hypotension, bradycardia, tachycardia, arrhythmia, edema of the pharynx and/or trachea and/or larynx with stridor and dyspnea. Autopsy findings may include acute emphysema which results from lower respiratory tract obstruction, edema of the hypopharynx, epiglottis, larynx, or trachea and minimal findings of eosinophilia in the liver, spleen and lungs. When death occurs within minutes of exposure and without signs of respiratory distress, there may not be significant pathologic findings.

(2) *Encephalopathy.* For purposes of paragraph (a) of this section, a vaccine recipient shall be considered to have suffered an encephalopathy only if such recipient manifests, within the applicable period, an injury meeting the description below of an acute encephalopathy, and then a chronic encephalopathy persists in such person for more than 6 months beyond the date of vaccination.

(i) An acute encephalopathy is one that is sufficiently severe so as to require hospitalization (whether or not hospitalization occurred).

(A) For children less than 18 months of age who present without an associated seizure event, an acute encephalopathy is indicated by a significantly decreased level of consciousness lasting for at least 24 hours. Those children less than 18 months of age who present following a seizure shall be viewed as having an acute encephalopathy if their significantly decreased level of consciousness persists beyond 24 hours and cannot be attributed to a postictal state (seizure) or medication.

(B) For adults and children 18 months of age or older, an acute encephalopathy is one that persists for at least 24 hours and characterized by at least two of the following:

(1) A significant change in mental status that is not medication related; specifically a confusional state, or a delirium, or a psychosis;

(2) A significantly decreased level of consciousness, which is independent of a seizure and cannot be attributed to the effects of medication; and

(3) A seizure associated with loss of consciousness.

(C) Increased intracranial pressure may be a clinical feature of acute encephalopathy in any age group.

(D) A “significantly decreased level of consciousness” is indicated by the presence of at least one of the following clinical signs for at least 24 hours or greater (see paragraphs (b)(2)(i)(A) and (b)(2)(i)(B) of this section for applicable timeframes):

(1) Decreased or absent response to environment (responds, if at all, only to loud voice or painful stimuli);

(2) Decreased or absent eye contact (does not fix gaze upon family members or other individuals);  
or

(3) Inconsistent or absent responses to external stimuli (does not recognize familiar people or things).

(E) The following clinical features alone, or in combination, do not demonstrate an acute encephalopathy or a significant change in either mental status or level of consciousness as described above: Sleepiness, irritability (fussiness), high-pitched and unusual screaming, persistent inconsolable crying, and bulging fontanelle. Seizures in themselves are not sufficient to constitute a diagnosis of encephalopathy. In the absence of other evidence of an acute encephalopathy, seizures shall not be viewed as the first symptom or manifestation of the onset of an acute encephalopathy.

(ii) *Chronic Encephalopathy* occurs when a change in mental or neurologic status, first manifested during the applicable time period, persists for a period of at least 6 months from the date of vaccination. Individuals who return to a normal neurologic state after the acute encephalopathy shall not be presumed to have suffered residual neurologic damage from that event; any subsequent chronic encephalopathy shall not be presumed to be a sequela of the acute encephalopathy. If a preponderance of the evidence indicates that a child's chronic encephalopathy is secondary to genetic, prenatal or perinatal factors, that chronic encephalopathy shall not be considered to be a condition set forth in the Table.

(iii) An encephalopathy shall not be considered to be a condition set forth in the Table if in a proceeding on a petition, it is shown by a preponderance of the evidence that the encephalopathy was

caused by an infection, a toxin, a metabolic disturbance, a structural lesion, a genetic disorder or trauma (without regard to whether the cause of the infection, toxin, trauma, metabolic disturbance, structural lesion or genetic disorder is known). If at the time a decision is made on a petition filed under section 2111(b) of the Act for a vaccine-related injury or death, it is not possible to determine the cause by a preponderance of the evidence of an encephalopathy, the encephalopathy shall be considered to be a condition set forth in the Table.

(iv) In determining whether or not an encephalopathy is a condition set forth in the Table, the Court shall consider the entire medical record.

(3) [Reserved]

(4) *Seizure and convulsion.* For purposes of paragraphs (b) (2) of this section, the terms, "seizure" and "convulsion" include myoclonic, generalized tonic-clonic (grand mal), and simple and complex partial seizures. Absence (petit mal) seizures shall not be considered to be a condition set forth in the Table. Jerking movements or staring episodes alone are not necessarily an indication of seizure activity.

(5) *Sequela.* The term "sequela" means a condition or event which was actually caused by a condition listed in the Vaccine Injury Table.

(6) *Chronic Arthritis.* (i) For purposes of paragraph (a) of this section, chronic arthritis may be found in a person with no history in the 3 years prior to vaccination of arthropathy (joint disease) on the basis of:

(A) Medical documentation, recorded within 30 days after the onset, of objective signs of acute arthritis (joint swelling) that occurred between 7 and 42 days after a rubella vaccination;

(B) Medical documentation (recorded within 3 years after the onset of acute arthritis) of the persistence of objective signs of intermittent or continuous arthritis for more than 6 months following vaccination; and

(C) Medical documentation of an antibody response to the rubella virus.

(ii) For purposes of paragraph (a) of this section, the following shall not be considered as chronic arthritis: Musculoskeletal disorders such as diffuse connective tissue diseases (including but not limited to rheumatoid arthritis, juvenile rheumatoid arthritis, systemic lupus erythematosus, systemic sclerosis, mixed connective tissue disease, polymyositis/dermatomyositis, fibromyalgia, necrotizing vasculitis and vasculopathies and Sjögren's Syndrome), degenerative joint disease, infectious agents other than rubella (whether by direct invasion or as an immune reaction) metabolic and endocrine diseases, trauma, neoplasms, neuropathic disorders, bone and cartilage disorders and arthritis associated with ankylosing spondylitis, psoriasis, inflammatory bowel disease, Reiter's syndrome, or blood disorders.

(iii) Arthralgia (joint pain) or stiffness without joint swelling shall not be viewed as chronic arthritis for purposes of paragraph (a) of this section.

(7) *Brachial neuritis.* (i) This term is defined as dysfunction limited to the upper extremity nerve plexus (i.e., its trunks, divisions, or cords) without involvement of other peripheral (e.g., nerve roots or a single peripheral nerve) or central (e.g., spinal cord) nervous system structures. A deep, steady, often severe aching pain in the shoulder and upper arm usually heralds onset of the condition. The pain is followed in days or weeks by weakness and atrophy in upper extremity muscle groups. Sensory loss may accompany the motor deficits, but is generally a less notable clinical feature. The neuritis, or plexopathy, may be present on the same side as or the opposite side of the injection; it is sometimes bilateral, affecting both upper extremities.



(ii) Weakness is required before the diagnosis can be made. Motor, sensory, and reflex findings on physical examination and the results of nerve conduction and electromyographic studies must be consistent in confirming that dysfunction is attributable to the brachial plexus. The condition should thereby be distinguishable from conditions that may give rise to dysfunction of nerve roots (i.e., radiculopathies) and peripheral nerves (i.e., including multiple mononeuropathies), as well as other peripheral and central nervous system structures (e.g., cranial neuropathies and myelopathies).

(8) *Thrombocytopenic purpura*. This term is defined by a serum platelet count less than 50,000/mm<sup>3</sup>. Thrombocytopenic purpura does not include cases of thrombocytopenia associated with other causes such as hypersplenism, autoimmune disorders (including alloantibodies from previous transfusions) myelodysplasias, lymphoproliferative disorders, congenital thrombocytopenia or hemolytic uremic syndrome. This does not include cases of immune (formerly called idiopathic) thrombocytopenic purpura (ITP) that are mediated, for example, by viral or fungal infections, toxins or drugs. Thrombocytopenic purpura does not include cases of thrombocytopenia associated with disseminated intravascular coagulation, as observed with bacterial and viral infections. Viral infections include, for example, those infections secondary to Epstein Barr virus, cytomegalovirus, hepatitis A and B, rhinovirus, human immunodeficiency virus (HIV), adenovirus, and dengue virus. An antecedent viral infection may be demonstrated by clinical signs and symptoms and need not be confirmed by culture or serologic testing. Bone marrow examination, if performed, must reveal a normal or an increased number of megakaryocytes in an otherwise normal marrow.

(9) *Vaccine-strain measles viral infection*. This term is defined as a disease caused by the vaccine-strain that should be determined by vaccine-specific monoclonal antibody or polymerase chain reaction tests.

(10) *Vaccine-strain polio viral infection*. This term is defined as a disease caused by poliovirus that is isolated from the affected tissue and should be determined to be the vaccine-strain by oligonucleotide or polymerase chain reaction. Isolation of poliovirus from the stool is not sufficient to establish a tissue specific infection or disease caused by vaccine-strain poliovirus.

(c) *Coverage provisions*. (1) Except as provided in paragraph (c)(2), (3), (4), (5), (6), or (7) of this section, the revised Table of Injuries set forth in paragraph (a) of this section and the Qualifications and Aids to Interpretation set forth in paragraph (b) of this section apply to petitions for compensation under the Program filed with the United States Court of Federal Claims on or after March 24, 1997. Petitions for compensation filed before such date shall be governed by section 2114(a) and (b) of the Public Health Service Act as in effect on January 1, 1995, or by §100.3 as in effect on March 10, 1995 (see 60 FR 7678, *et seq.*, February 8, 1995), as applicable.

(2) Hepatitis B, Hib, and varicella vaccines (Items VIII, IX, and X of the Table) are included in the Table as of August 6, 1997.

(3) Rotavirus vaccines (Item XI of the Table) are included in the Table as of October 22, 1998.

(4) Pneumococcal conjugate vaccines (Item XII of the Table) are included in the Table as of December 18, 1999.

(5) Hepatitis A vaccines (Item XIII of the Table) are included on the Table as of December 1, 2004.

(6) Trivalent influenza vaccines (Item XIV of the Table) are included on the Table as of July 1, 2005.

(7) Meningococcal vaccines and human papillomavirus vaccines (Items XV and XVI of the Table) are included on the Table as of February 1, 2007.

(8) Other new vaccines (Item XVII of the Table) will be included in the Table as of the effective date of a tax enacted to provide funds for compensation paid with respect to such vaccines. An amendment to this section will be published in the FEDERAL REGISTER to announce the effective date of such a tax.

[60 FR 7694, Feb. 8, 1995, as amended at 62 FR 7688, Feb. 20, 1997; 62 FR 10626, Mar. 7, 1997; 63 FR 25778, May 11, 1998; 64 FR 40518, July 27, 1999; 67 FR 48559, July 25, 2002; 73 FR 59530, Oct. 9, 2008; 76 FR 36368, June 22, 2011]

## Recent Scientific References

**MEASLES – pages 1-2**

**WHOOPING COUGH – pages 2-5**

### **MEASLES / MMR VACCINE | Recent science**

**Response of Viral Specific CD4 T Cells to in vitro Stimulation with Vaccine and Wild Measles Virus Strains in Vaccinated and Naturally Infected Subjects:** "...it is increasingly being considered that antibody-based definitions of vaccine success or failure may be incomplete."— [Czescik et al, Polish Journal of Microbiology, 2014](#)

**Outbreak of measles among persons with prior evidence of immunity, New York City, 2011:** In the NYC outbreak of 2011, "The index patient had 2 doses of measles-containing vaccine; of 88 contacts, 4 secondary patients were confirmed who had either 2 doses of measles-containing vaccine or a past positive measles IgG antibody." — [Rosen et al., Clinical Infectious Disease, 2014](#)

**Largest Measles Epidemic in North America in a Decade—Quebec, Canada, 2011: Contribution of Susceptibility, Serendipity, and Super spreading Events:** Detailed analysis of Quebec outbreak revealed under-diagnosis and under-reporting of measles in fully vaccinated persons. The mean age of case patients was 15 years and incidence was highest in adolescents and 20% of them had received 2-doses of vaccine as recommended. — [De Serres et al., Journal of Infectious Disease, 2013](#)

**Waning of Maternal Antibodies Against Measles, Mumps, Rubella, and Varicella in Communities With Contrasting Vaccination Coverage:** "Children of mothers vaccinated against measles and, possibly, rubella have lower concentrations of maternal antibodies and lose protection by maternal antibodies at an earlier age than children of mothers in communities that oppose vaccination. This increases the risk of disease transmission in highly vaccinated populations."— [Waijnenborg et al, Journal of Infectious Diseases, 2013](#)

**The Re-Emergence of Measles in Developed Countries: Time to Develop the Next-Generation Measles Vaccines?:** "Receiving less attention, however, is the issue of vaccine failure...At the same time, measles vaccine has a failure rate measured in a variety of studies at 2–10%...As a result, measles is re-emerging as a public health threat, and our current tool for prevention has limitations that increasingly look to be significant enough that sustained elimination, much less eradication, are unlikely."—[Poland et al, Vaccine](#)

**Loss of maternal protection as a consequence of the vaccination program was well documented in the literature as recently as 2009.**

**Implications of vaccination and waning immunity:** Implications of vaccination and waning immunity: "In the absence of vaccination, lifelong immunity is maintained through frequent encounters with infection, which act to boost the waning immune memory (this agrees with the findings of Whittle et al. 1999). However, when vaccination is introduced the prevalence of infection declines, which in turn reduces the amount of boosting and hence the level of immunity (in agreement with Muller 2001). What is more

## **Recent Scientific References**

surprising is that the interaction between vaccination and waning immunity can lead to pronounced epidemic cycles in which the peak levels of infection can be of the orders of magnitude greater than the mean.”—[Heffernan and Keeling, Proceedings of the Royal Society B, 2009](#)

**Modeling the Impact of Subclinical Measles Transmission in Vaccinated Populations with Waning Immunity:** “Several studies have shown that measles epidemics can occur even in highly vaccinated populations (1-4). A variety of factors are likely to be contributory to this observation including failure to seroconvert and waning of vaccine-induced immunity (5). It is well documented from outbreak investigations that current measles vaccines protect between 90-95 percent of vaccinees from typical measles (3, 6-8). However, evidence is accumulating which suggests that vaccine derived immunity might be less protective than previously assumed. There is a growing concern that among individuals who respond to vaccine, a substantial proportion are or will become susceptible to clinical (symptomatic) or subclinical (asymptomatic) infection.”—[Mossing, et al, American Journal of Epidemiology, 1999,](#)

**The future of measles in highly immunized populations. A modeling approach:**“The results of this study suggest that measles elimination in the United States has been achieved by an effective immunization program aimed at young susceptibles combined with a highly, naturally immunized adult population. However, despite short-term success in eliminating the disease, long-range projections demonstrate that the proportion of susceptibles in the year 2050 may be greater than in the pre-vaccine era. Present vaccine technology and public health policy must be altered to deal with this eventuality.” —[Levy, Am J Epidemiol \(1984\)](#)

## **WHOOPING COUGH/ DTap VACCINE | Recent science**

“The advantages and disadvantages of routine immunization of infants against whooping cough have been debated since 1933” [British Medical Journal Editorial, 1974.](#)

- [Martin et al, Clin Infect Diseases, 2015:](#) Patients who had received at least one dose of vaccine had a significantly higher odds of having PRN- B pertussis compared with unvaccinated patients.

**Acellular pertussis vaccines protect against disease but fail to prevent infection and transmission in a nonhuman primate model:** In this study, whooping cough vaccine failed to prevent infection & transmission in animal testing. Vaccinated animals asymptomatically carried the infectious bacteria for 42 days, longer than any of the other groups studied (including infected but unvaccinated animals). The infected but unvaccinated animals did not carry the bacteria upon re-infection. — [Warfel et al., Proceedings of the National Academy of Science, 2014:](#)

**Rapid Increase in Pertactin-deficient *Bordetella pertussis* Isolates, Australia: Rapid Increase in Pertactin-deficient *Bordetella pertussis* Isolates explains that evolution of *B. pertussis* may be occurring in response to “vaccine selection pressure.”—CDC [http://wwwnc.cdc.gov/eid/article/20/4/13-1478\\_article.htm](http://wwwnc.cdc.gov/eid/article/20/4/13-1478_article.htm) CDC April 2014**

## Recent Scientific References

"Clearly it is a red light in terms of how well the vaccination works," said Peter McIntyre, study author and director of the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases. "The fact that they have arisen independently in different countries suggests it's a response to the vaccine," said Ms Lam, of the University of NSW school of biotechnology and biomolecular sciences.

Summer 2014 [Statement from Professor Arthur Reingold](#), Head of Epidemiology at UC Berkeley's School of Public Health:

"You can be immunized and protected against getting the disease, pertussis, but still have the organism in your nose and throat and spread it to others. Or you can have a very mild illness that is caused by pertussis that causes you to cough, and thereby infect others. So the immunity is not 100 percent from the pertussis vaccine. And what it means is any kind of herd immunity—the way we see, for example, much more powerfully with measles—really can't be relied upon."

- **Resurgence of Pertussis.** As reported at the May 2013 BSC meeting, the recent resurgence in pertussis cases has been associated with waning immunity over time in persons who received the acellular pertussis vaccine (which is administered as the pertussis component of DTaP vaccine). However, a recent study suggests another explanation for decreased vaccine effectiveness: an increase in *Bordetella pertussis* isolates that lack pertactin (PRN)—a key antigen component of the acellular pertussis vaccine. A study that screened *B. pertussis* strains isolated between 1935 and 2012 for gene insertions that prevent production of PRN found significant increases in PRN-deficient isolates throughout the United States.<sup>2</sup> The earliest PRN-deficient strain was isolated in 1994; by 2012, the percentage of PRN-deficient isolates was more than 50%.

To assess the clinical significance of these findings, CDC used an IgG anti-PRN ELISA and other assays (PCR amplification, sequencing, and Western blots) to characterize 752 *B. pertussis* strains isolated in 2012 from six Enhanced Pertussis Surveillance Sites<sup>3</sup> and from epidemics in Washington and Vermont. Findings indicated that 85% of the isolates were PRN-deficient and vaccinated patients had significantly higher odds than unvaccinated patients of being infected with PRN-deficient strains. Moreover, when patients with up-to-date DTaP vaccinations were compared to unvaccinated patients, the odds of being infected with PRN-deficient strains increased, suggesting that PRN-bacteria may have a selective advantage in infecting DTaP-vaccinated persons.

**Above is from: Meeting of the Board of Scientific Counselors, Office of Infectious Diseases, Centers for Disease Control and Prevention.** Tom Harkins Global Communication Center, Atlanta, Georgia: February 2013 Statement made at the National Vaccine Advisory Committee meeting from Pertussis Epidemiology and Vaccination in the United States (Thomas Clark, M.D., M.P.H. of the CDC) [http://www.hhs.gov/nvpo/nvac/meetings/pastmeetings/2013/feb2013\\_certified\\_minutes.pdf](http://www.hhs.gov/nvpo/nvac/meetings/pastmeetings/2013/feb2013_certified_minutes.pdf)

"Dr. Clark also did not believe the problem is related to unvaccinated children, because it occurred nationally and is widespread, and because the majority of those affected were vaccinated. CDC is discussing whether a single repeat Tdap dose would be effective. There is potential for developing new or improved vaccines to better control pertussis in the long term, Dr. Clark concluded."

[Pertussis: Challenges Today and for the Future](#), 2013: According to expert Dr. James Cherry, the universal use of pertussis vaccines has been associated with genetic changes

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in circulating B. pertussis strains. —Cherry et al., <http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1003418>

"There are five possible reasons for the resurgence: 1) genetic changes in B. pertussis; 2) a decrease in vaccine efficacy; 3) a more rapid occurrence of waning immunity; 4) increased recognition and reporting of pertussis; and 5) newer laboratory diagnostic tests."

- [Klein, et al, N Eng J Med 2012](#), Waning Protection after Fifth Dose of Acellular Pertussis Vaccine in Children

**The following additional information was already shared with Vermont Legislators in 2012:**

### USA/Washington

"Early waning of immunity might be contributing to increasing population-level susceptibility." <http://jama.jamanetwork.com/article.aspx?articleid=1362036>

### USA/California

"In early 2010, a spike in cases appeared at Kaiser Permanente in San Rafael, and it was soon determined to be an outbreak of whooping cough -- the largest seen in California in more than 50 years. Witt had expected to see the illnesses center around unvaccinated kids, knowing they are more vulnerable to the disease. "We started dissecting the data. What was very surprising was the majority of cases were in fully vaccinated children. That's what started catching our attention," said Witt. <http://www.reuters.com/article/2012/04/03/us-whoopingcough-idUSBRE8320TM20120403>

### Israel

"Pertussis is considered an endemic disease, characterized by an epidemic every 2–5 years. This rate of exacerbations has not changed, even after the introduction of mass vaccination – a fact that indicates the efficacy of the vaccine in preventing the disease but not the transmission of the causative agent (B. pertussis) within the population." <http://www.ima.org.il/imaj/ar06may-2.pdf>

### Netherlands

"An important issue is whether vaccination has selected for the *ptxP3* strains. Several lines of evidence support this contention." "Based on mathematical modeling, vaccines designed to reduce pathogen growth rate and/or toxicity may result in the evolution of pathogens with higher levels of virulence" The authors "propose that waning immunity and pathogen adaptation have contributed to the resurgence of pertussis, although other factors such as increased awareness and improved diagnostics have also played a role." [http://wwwnc.cdc.gov/eid/article/15/8/08-1511\\_article.htm](http://wwwnc.cdc.gov/eid/article/15/8/08-1511_article.htm)

### Finland

## **Recent Scientific References**

“Pertussis is an infectious disease of the respiratory tract caused by *Bordetella pertussis*. Despite the introduction of mass vaccination against pertussis in Finland in 1952, pertussis has remained an endemic disease with regular epidemics.” and “During the last decade, the number of pertussis cases has increased in countries with high vaccination coverage rates including Finland.” <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1233997/>

“Reemergence of pertussis has been observed in many countries with high vaccination coverage. In the United States, reported cases of pertussis in adolescents and adults have increased since the 1980s, despite increasingly high rates of vaccination in infants and children. At the same time, clinical *B. pertussis* isolates have become antigenically divergent from vaccine strains. This observation has raised the question of whether vaccination has caused selection for the variant strains, and whether the reemergence of pertussis in vaccinated populations is due to vaccination not protecting against these antigenic variants as effectively as it protects against vaccine type strains. On the other hand, vaccine-induced immunity wanes over time, and pertussis is not only a childhood disease but also a frequent cause of prolonged illness in adults and adolescents today.” <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3294326/>