

# Prevention of Influenza

Carol E. Hayes, CNM, MN, MPH

## INTRODUCTION

According to the Centers for Disease Control and Prevention (CDC), 5% to 20% of the population acquires influenza each year in the United States.<sup>1</sup> Most recover in 1 to 2 weeks. However, viral influenza infection is associated with increased morbidity and mortality in the young, the elderly, persons with chronic medical conditions, and pregnant women. Complications include bacterial infections of the inflamed mucous membranes (sinuses, ears, and bronchi) and pneumonia. More than 200,000 people are hospitalized annually from influenza complications, and about 36,000 people die from influenza every year.<sup>2</sup> The majority of persons suffering severe complications are over 65 years of age.<sup>2</sup>

Pregnant women who acquire influenza have a three- to four-fold higher risk for developing complications than their non-pregnant counterparts.<sup>3</sup> Pregnant women are hospitalized more often than non-pregnant women who contract influenza.<sup>4,5</sup> One study suggested a significant increase in overall complications of pregnancy related to influenza in pregnancy, although no single complication increased significantly.<sup>6</sup> Although the virus itself has not been recovered from newborns of infected mothers, increased fetal risk is related primarily to the fever and maternal and fetal inflammatory response that occurs during the course of the illness.<sup>6-8</sup> Fetal and newborn conditions that have been associated with maternal influenza include congenital malformations, altered brain development, miscarriage, and stillbirth.<sup>6,8</sup> Recent epidemiologic studies have found an association between in utero exposure to influenza and an increased risk of developing Parkinson's disease and schizophrenia later in life.<sup>8</sup> These epidemiologic data cannot demonstrate causation, but should prompt clinicians to prioritize the prevention of influenza in pregnant women. Prevention of acquisition of the influenza virus is achieved in two ways: hygiene and vaccination.

## TRANSMISSION OF INFLUENZA

The virus that causes influenza is transmitted through aerosols, large droplets, or direct contact with secretions. It can be acquired from being in any public place frequented by persons incubating or symptomatically infected with the virus.<sup>9</sup> The drier the air, the longer the viral particles live. This contributes to the virus being more prevalent in winter months when the air is colder

and drier, nasal passageways are drier, and the air in heated buildings is dry as well. The contagious period lasts from 1 to 2 days before and to up to 5 days after symptoms begin. Children appear to incubate the virus for longer periods than adults. Viral particles can live on non-porous surfaces, such as doorknobs and telephones, for up to 24 hours, and on paper surfaces, such as tissues, cloth, or paper, for up to 15 minutes.<sup>10</sup> Strict hand washing during cold and influenza season is a very effective strategy to prevent the spread of the virus.

## INFLUENZA VACCINE: TIMING AND EFFICACY

The most effective way to prevent acquisition of influenza is vaccination. Persons for whom annual vaccination is recommended include children 6 to 59 months of age; women who will be pregnant during the influenza season; persons over 50 years of age; those 18 to 49 years old with conditions such as pulmonary, cardiovascular, metabolic, and immunodeficiency conditions; and all health care workers (to prevent spreading influenza to patients).<sup>2</sup> The best time for vaccinating individuals is before the influenza season begins. The influenza season usually lasts from November through May, generally peaking in January; vaccination is best offered in October and November. After the vaccine is administered, it takes approximately 2 weeks for full immunity to develop.

Vaccine efficacy depends on the age and immunocompetence of the person receiving the vaccine. The very young and the elderly are less protected. Because of their inability to mount a complete immune response after only one vaccine administration, the CDC recommends that children 6 months to 8 years receive two doses of the vaccine.<sup>2</sup> If vaccine availability becomes limited, certain individuals have priority for the available vaccine. Those most at risk for complications are the young, the elderly, persons with chronic medical conditions, and pregnant women. Current recommendations from the American College of Obstetricians and Gynecologists are that all pregnant women be vaccinated.<sup>11</sup>

The vaccine developed each year targets the strains of the influenza virus that the CDC determines will be most prevalent. Therefore, it is not effective against every strain of the influenza virus, which means some persons may develop influenza even if vaccinated. As noted above, it takes about 2 weeks for the immune system to process the vaccine before full immunity is developed. If someone comes in contact with the influenza virus immediately before or after being vaccinated, they will develop influenza despite having been vaccinated. This

---

Address correspondence to Carol E. Hayes, CNM, MN, MPH, P.O. Box 4019, Atlanta, GA 30302-4019. E-mail: [chayes@gsu.edu](mailto:chayes@gsu.edu)

contributes to persons assuming that the vaccine caused their influenza.<sup>2</sup>

## TYPES OF INFLUENZA VACCINES

There are two types of vaccines available. One is inactivated vaccine (with killed virus) given via injection; it is known as the trivalent inactivated influenza vaccine (TIV). The other is a live attenuated influenza vaccine (LAIV) FluMist (Medimmune, Gaithersburg, MD), which is a nasal spray containing live weakened viral particles. The LAIV was recently approved by the US Food and Drug Administration (FDA) for use in healthy children as young as ages 2 to 5 years old (24–59 mos old) without a history of recurrent wheezing, as well as for healthy persons 5 to 49 years of age who are not pregnant.<sup>12</sup> This recent change lowers the age of safety for the live vaccine in healthy individuals from 5 to 2 years. The LAIV administered via intranasal spray produces a stronger immune response in young persons, but with mixed results in adults.<sup>2</sup> The disadvantage of the LAIV is the potential to transmit live influenza viral particles to others.<sup>13</sup> Persons with serious or chronic health conditions, immune system problems, pregnant women, or women planning pregnancy should not be given the LAIV. Instead, they should be vaccinated with the injectable influenza vaccine.<sup>2</sup> Pregnant women do not need to avoid contact with persons recently vaccinated with LAIV, according to the CDC; however, those who have received LAIV should avoid contact with immunocompromised individuals.<sup>2</sup>

Breastfeeding does not adversely affect the immune response and is not a contraindication for vaccination. The CDC recommends the inactivated influenza vaccine as safe for mothers who are breastfeeding and their infants. However, the CDC notes that “because excretion of LAIV in human milk is unknown and because of the possibility of shedding vaccine virus given the close proximity of a nursing mother and her infant, caution should be exercised if LAIV is administered to nursing mothers.”<sup>1</sup>

## VACCINATION IN PREGNANCY

There are few data on actual influenza vaccination rates in pregnant women. A population-based survey completed in 2005 estimates that only 15% of pregnant women receive the influenza vaccine during pregnancy.<sup>2</sup> Dispensing and administering vaccines historically has not been a service offered by women’s health care providers, despite the fact that the majority of pregnant

women are accepting of being vaccinated during pregnancy.<sup>14–16</sup> Studies have demonstrated the inactivated influenza vaccine to be safe in pregnancy, with no increased risk of maternal complications or adverse fetal outcomes.<sup>16,17</sup> There is also benefit to the newborn of a woman who was vaccinated during pregnancy; the immunoglobulin G formed by the mother crosses the placenta.<sup>18,19</sup> These newborns have higher antibodies to the influenza virus, thus protecting them during the first year of life.<sup>20</sup>

## THE THIMEROSAL CONTROVERSY

Thimerosal is a mercury preservative used since the 1930s in multi-dose vaccines to prevent bacterial contamination. Its use has come under increased scrutiny in recent years because of a concern about potential adverse effects of mercury. Recent studies have found no relationship between thimerosal and developmental delays in children.<sup>21–24</sup> However, thimerosal has been removed or reduced in all vaccines recommended for children under age 6 years. Trace amounts of thimerosal are established as 1 mcg or less of mercury per dose. The US Environmental Protection Agency recommends that mercury consumption be limited to 2.05 mcg per day or 14.35 mcg per week.<sup>25</sup> The FDA considers the influenza vaccine with or without thimerosal safe for pregnant women.<sup>26</sup> The official FDA guidelines read as follows: “Because pregnant women are at increased risk for influenza-related complications and because a substantial safety margin has been incorporated into the health guidance values for organic mercury exposure, the benefits of thimerosal-reduced influenza vaccine or thimerosal preservative containing–influenza vaccine outweigh the theoretical risk, if any, of thimerosal.”<sup>26</sup> The multi-dose vials of trivalent inactivated vaccine contain trace amounts of thimerosal. Thimerosal-free influenza vaccine is available this year from two manufacturers: a single dose trivalent inactivated vaccine, Fluzone (Sanofi Pasteur, Lyon, France), and the LAIV Flumist.<sup>2</sup>

## ADMINISTRATION AND ADVERSE REACTIONS

The injectable vaccine is administered to adults in the deltoid muscle, using a needle at least 1-inch long to ensure penetrating the muscle. Most vaccinated persons experience mild local reactions and some experience systemic reactions after the vaccine is administered. Local reactions are typically limited to soreness at the site of injection, lasting a day or two. Systemic reactions occur more often in previously unvaccinated individuals and include fever, malaise, myalgia, and headache. Immediate allergic reactions rarely occur and presumably are related to vaccine components including egg protein. Persons with a history of anaphylaxis related to eggs should not receive the injectable inactivated vaccine. The LAIV delivered via nasal spray has side effects in adults

---

Carol E. Hayes, CNM, MN, MPH, received her master’s in nursing and her master’s in public health at Emory University. She is a Clinical assistant professor at Byrdine F. Lewis School of Nursing at Georgia State University and represents the American College of Nurse-Midwives on the non-profit board of the Immunization Action Coalition.

that include runny nose, headache, sore throat, and cough. Children may have those side effects, as well as wheezing, vomiting, myalgia, and fever.<sup>2</sup> Health care professionals providing influenza vaccines should follow CDC guidelines and report “all clinically significant adverse events after influenza vaccination, even if the health care professional is not certain that the vaccine caused the event” to the Vaccine Adverse Event Reporting System.<sup>2</sup>

## CONCLUSION

For those midwives interested in offering the vaccine to clients, the vaccine can be ordered from a number of commercial suppliers. The CDC produces a publication entitled *Vaccine Management: Recommendations for Storage and Handling of Selected Biologicals* with details for the provider.<sup>27</sup> The non-profit Immunization Action Coalition also offers material to assist providers in ordering, storing, and administering the vaccine. They also publish *Vaccinate Women*, an annual publication for health professionals providing services to women.<sup>28</sup> Additional resources are listed in Appendix A.

Regardless of whether clinicians choose to offer the influenza vaccine, all women’s health care providers should educate their clients, especially pregnant women, on the importance of preventing influenza through both hand hygiene and vaccination.

## REFERENCES

1. Centers for Disease Control and Prevention. Key facts about influenza and the influenza vaccine. Available from: [www.cdc.gov/flu/keyfacts.htm](http://www.cdc.gov/flu/keyfacts.htm) [Accessed October 4, 2007].
2. Centers for Disease Control and Prevention. Prevention and control of influenza: Recommendations of the Advisory Committee on Immunization Practices. *MMWR Morb Mortal Wkly Rep* 2007;56:1–60.
3. Neuzil KM, Reed GW, Mitchel EF, Simonsen L, Griffen MR. Impact of influenza on acute cardiopulmonary hospitalizations in pregnant women. *Am J Epidemiol* 1998;148:1094–102.
4. Mullooly JP, Barker WH, Nolan TF. Risk of acute respiratory disease among pregnant women during influenza A epidemics. *Public Health Rep* 1986;101:205–11.
5. Cox S, Posner SF, McPheeters M, Jamieson DJ, Kourtis AP, Meikle S. Influenza and pregnant women: Hospitalization burden, United States, 1998–2002. *J Womens Health* 2006;15:891–3.
6. Irving WL, James DK, Stephenson T, Laing P, Jameson C, Oxford JS, et al. Influenza virus infection in the second and third trimesters of pregnancy: A clinical and seroepidemiological study. *Br J Obstet Gynaecol* 2000;107:1282–9.
7. Edwards MJ. Hyperthermia in utero due to maternal influenza is an environmental risk for schizophrenia. *Congenit Anom (Kyoto)* 2007;47:84–9.
8. Shi L, Tu N, Patterson PH. Maternal influenza infection is

likely to alter fetal brain development indirectly: The virus is not detected in the fetus. *Int J Dev Neurosci* 2005;23:299–305.

9. Tellier R. Review of aerosol transmission of influenza A virus. *Emerg Infect Dis* 2006;12:1657–62.
10. World Health Organization Writing Group. Nonpharmaceutical interventions for pandemic influenza, international measures. *Emerg Infect Dis* 2006;12:81–7.
11. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 305. Influenza vaccination and treatment in pregnancy. *Obstet Gynecol* 2004;104:1125–6.
12. Centers for Disease Control and Prevention. Expansion of use of Live Attenuated Influenza Vaccine (FluMist) to children aged 2-4 years and other FluMist changes for the 2007-2008 influenza season. *MMWR Morb Mortal Wkly Rep* 2007;56:1217–9.
13. Centers for Disease Control and Prevention. Using live, attenuated influenza vaccine for prevention and control of influenza: Supplemental recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 2003;52:1–8.
14. Gonik B, Jones T, Contreras D, Fasano N, Roberts C. The obstetrician-gynecologist’s role in vaccine-preventable diseases and immunization. *Obstet Gynecol* 2000;96:81–4.
15. Schrag SJ, Fiore AE, Gonik B, Malik T, Reef S, Singleton JA, et al. Vaccination and perinatal infection prevention practices among obstetrician-gynecologists. *Obstet Gynecol* 2003;101:704–10.
16. Yeager DP, Toy EC, Baker B III. Influenza vaccination in pregnancy. *Am J Perinatol* 1999;16:283–6.
17. Naleway AL, Smith WJ, Mullooly JP. Delivering influenza vaccine to pregnant women. *Epidemiol Rev* 2006;28:47–53.
18. Rastogi D, Wang C, Mao X, Lendor C, Rothman PB, Miller RL. Antigen-specific immune responses to influenza vaccine in utero. *J Clin Invest* 2007;117:1637–46.
19. Monoz FM, Greisinger AJ, Wehmanen OA, Mouzoon ME, Hovle JC, Smith FA, et al. Safety of influenza vaccination during pregnancy. *Am J Obstet Gynecol* 2006;194:1098–106.
20. Englund JA. Maternal immunization with inactivated influenza vaccine: Rationale and experience. *Vaccine* 2003;21:3420–64.
21. Thompson WW, Price C, Goodson B, Shay DK, Benson P, Hinrichsen VL, et al, for the Vaccine Safety Datalink Team. Early thimerosal exposure and neuropsychological outcomes at 7 to 10 years. *New Engl J Med* 2007;357:1281–92.
22. Verstraeten T, Davis RL, DeStefano F, Lieu TA, Rhodes PA, Black SB, et al. Safety of thimerosal-containing vaccines: A two-phased study of computerized health maintenance organization databases. *Pediatrics* 2003;112:1039–48.
23. Andrews N, Miller E, Grant A, Stowe J, Osborne V, Taylor B. Thimerosal exposure in infants and developmental disorders: A retrospective cohort study in the United Kingdom does not support a causal association. *Pediatrics* 2004;114:584–91.
24. Heron J, Golding J. Thimerosal exposure in infants and developmental disorders: A prospective cohort study in the United Kingdom does not support a causal association. *Pediatrics* 2004;114:577–83.

25. US Environmental Protection Agency. 2002. EIMS meta-data report reference dose for methylmercury. Available from: <http://oaspub.epa.gov/eims/eimsapi.dispdetail?deid=20873> [Accessed October 3, 2007].

26. US Food and Drug Administration. 2007 thimerosal in vaccines. Available from: [www.fda.gov/cber/vaccine/thimerosal.htm](http://www.fda.gov/cber/vaccine/thimerosal.htm) [Accessed October 3, 2007].

27. Centers for Disease Control and Prevention. Vaccine management: Recommendations for storage and handling of selected biologicals 2007. Available from: [www.cdc.gov/vaccines/pubs/downloads/bk\\_vac\\_mgt.pdf](http://www.cdc.gov/vaccines/pubs/downloads/bk_vac_mgt.pdf) [Accessed October 3, 2007].

28. Immunization Action Coalition. Vaccinate women. July 2007. Available from: [www.immunize.org/vw/](http://www.immunize.org/vw/) [Accessed October 3, 2007].

## Appendix A. Resources for Clinicians Providing Influenza Vaccination

Source	Description
Influenza Information	
Centers for Disease Control and Prevention (CDC) <a href="http://www.cdc.gov/flu/">www.cdc.gov/flu/</a>	Provides information for professionals and the general public.
Centers for Disease Control and Prevention (CDC) <a href="http://www.cdc.gov/flu/keyfacts.htm">www.cdc.gov/flu/keyfacts.htm</a>	Provides information about influenza and the vaccine.
Immunization Action Coalition <a href="http://www.immunize.org/vw/">www.immunize.org/vw/</a>	A private non-profit that provides vaccine resources to health professionals and the general public.
Sources of Influenza Vaccine	
Flu Vaccine Business Practices Initiative <a href="http://www.flusupplynews.com/resources.cfm">www.flusupplynews.com/resources.cfm</a>	A voluntary group of flu vaccine distributors who work with the CDC to list all sources of the influenza vaccine.
Health Industry Distributors Association <a href="http://www.hida.org/document.asp?document_id=10082">www.hida.org/document.asp?document_id=10082</a>	A medical products distributor working with CDC to list all sources of the influenza vaccine.
Management of Vaccination Services	
CDC Vaccine Management: Recommendations for Storage and Handling of Selected Biologicals 2007 <a href="http://www.cdc.gov/vaccines/pubs/downloads/bk_vac_mgt.pdf">www.cdc.gov/vaccines/pubs/downloads/bk_vac_mgt.pdf</a>	A document that gives detailed information about storing and handling vaccines.
Reporting Adverse Events	
US Health and Human Services Vaccine Adverse Event Reporting System (VAERS) <a href="http://vaers.hhs.gov/">http://vaers.hhs.gov/</a>	Health care professionals can use this site to report an adverse event to a vaccine. VAERS is a cooperative program between the CDC and the US Food and Drug Administration. It is a post-marketing safety surveillance program, collecting information about adverse events (possible side effects) that occur after the administration of US-licensed vaccines.