INFLUENZA: MORE SERIOUS THAN YOU MAY THINK

U.S. INFLUENZA DISEASE BURDEN AND PREVENTION PROFILE

INFLUENZA AS A DISEASE BURDEN

In the 2003-2004 influenza season in the United States, influenza was the leading cause of vaccine-preventable death in children in the United States and continues to place a significant burden on society every year.[1,2] To help reduce influenza-related morbidity and mortality, greater efforts are needed to enhance vaccination rates.

Each year, influenza is responsible for up to 60 million infections (estimated attack rates range from 5% to 20%) in the United States,[3] resulting in approximately 25 million visits to doctors' offices and hospital stays.[4]

It is evident that many individuals who should be immunized are not vaccinated. New vaccination strategies need to be implemented to help improve vaccination rates and help better protect children, their families, and the community from influenza.

Vaccine-preventable Disease and Deaths in the United States

Diseases	Annual Cases (Year)	Annual Deaths (Year)
Influenza[a,b]	31,000,000*	36,000 per year ('90-'99)
Pneumococcal disease, invasive (bacteremia & meningitis)[c]	40,000 ('02)	5,500 ('02)
HPV[d] (Cervical cancer)	10,520 ('04)	3,900 ('04)
Hepatitis-B[c]	6,741 ('04)	685 ('03)
Meningococcal disease[c]	2,500 per year (1970-2004)†	125 ('04)
Hepatitis-A[c]	20,000 ('04)	54 ('03)
Varicella[c] (chicken pox)	20,948 ('03)	16 ('03)
Pertussis[c]	25,827 ('04)	11 ('03)

*Stochastic simulation epidemic model of influenza transmission, which translates into an average annual influenza attack rate of ≈11%.
†Estimated annual rate.
[a]Weycker D, et al. *Vaccine*. 2005;23:1284-1293.
[b]Thompson W, et al. *JAMA*. 2003;289:179-186.
[c]CDC. *Pink Book*. 9th Edition. Available at: http://www.cdc.gov/nip/publications/pink/2006.
[d]American Cancer Society. *Cancer Facts and Figures 2004*. Available at: http://www.cancer.org/downloads/STT/SH_0.asp

INFLUENZA MORBIDITY AND MORTALITY

(Not limited to high-risk children, but also includes healthy children.)

- Influenza continues to be a significant cause of vaccine-preventable death in children[2]

During the 2003-2004 influenza season[2]

- 153 children died from influenza-related causes
- 47% of these children were previously healthy
- 37% of influenza mortality cases occurred in children aged 5 to 17 years

Influenza Mortality in Children: 2003-2004

153 children aged <18 years reportedly died of influenza-related causes*

By Age	
<6 months	12%
6-11 months	8%
1 year	20%
2-4 years	23%
5-10 years	17%
11-17 years	20%

By Health Status	
ACIP high-risk condition	33%
Other underlying medical condition	20%
Previously healthy	47%

*16% of children aged 6 months received 1 dose of the influenza vaccine.
26% of ACIP-defined high-risk children received 1 dose of of the influenza vaccine.

Bhat N, et al. *N Engl J Med*. 2005;353:2559-2567.

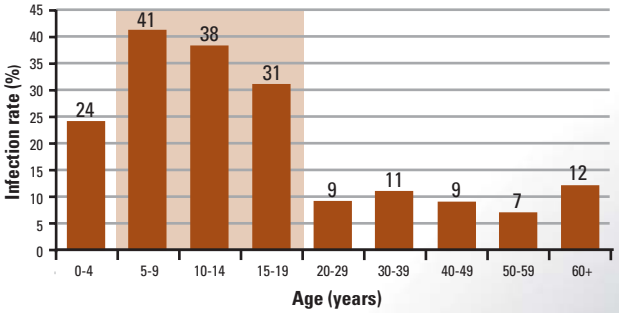
CHILDREN PLAY A SIGNIFICANT ROLE IN TRANSMITTING INFLUENZA

- By spreading the virus to their family members and classmates at day care or school[5]
- A school-aged child is often the way most flu epidemics are spread[5]

SCHOOL-AGED CHILDREN ARE THE AGE GROUP MOST LIKELY TO CONTRACT AND SPREAD INFLUENZA[6]

- The CDC/ACIP recommends that children who are household contacts of high-risk children or adults be vaccinated[1]
- Children 5 to 14 years of age were approximately 4 times more likely to be infected with influenza than adults[6]

Average Annual Age-specific Influenza Rates*



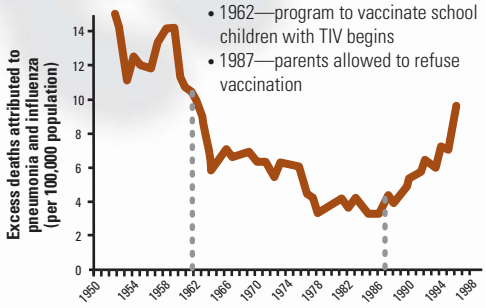
*Derived combined rates for influenza types A (H1N1 and H3N2) and B over the course of 7 outbreaks during the years between 1976 and 1981 in Tecumseh, Michigan.

Monto AS, Sullivan KM. *Epidemiol Infect*. 1993;110:145-160.

VACCINATION OF SCHOOL-AGED CHILDREN MAY HAVE SIGNIFICANT DIRECT AND INDIRECT BENEFITS[7]

- Obligatory vaccination during the Japanese school influenza vaccination program provided evidence that mass vaccination of school-aged children may benefit the community at large
  —Mortality attributable to pneumonia and influenza decreased by 37,000 to 49,000 deaths per year

Japanese School Vaccination Program



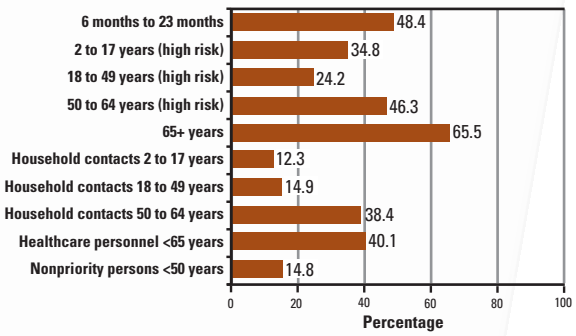
Reichert TA, et al. *N Engl J Med.* 2001;344:889-896.

WHY IS INFLUENZA STILL THE LEADING CAUSE OF VACCINE-PREVENTABLE DEATH IN CHILDREN IN THE U.S.?[2]

Vaccination Rates Are Still Low

- 80 million or more influenza vaccine doses may be available in a given season
  — ACIP recommends influenza vaccination for approximately 200 million people
- 48% of children aged 6 months to 23 months received ≥1 dose of influenza vaccination[8]
- Reports for fully vaccinated children (2 doses) in this age group indicate significantly lower immunization rates[8]

Influenza Vaccination Rates



Centers for Disease Control and Prevention. Interim estimates of populations targeted for influenza vaccination from 2003 National Health Interview Survey Data and estimates for 2004 based on influenza vaccine shortage priority groups. Available at: http://www.cdc.gov/flu/professionals/vaccination/pdf/targetpopchart.pdf. Accessed June 14, 2006.

Vaccine mismatch is a potentially serious problem

- Vaccine mismatch is a result of antigenic drift
- Antigenic drift is a continuous process of genetic change among flu strains

CDC Data Shows Vaccine Mismatch Occurred in 5 of the Last 10 Years

Season	Vaccine Strain	Drifted Strain	Drifted in Mismatched Type
2005-2006[a]	B/Shanghai	B/Victoria	78%
2004-2005[b]	A(H3N2)/Wyoming	A(H3N2)/California	78%
2003-2004[c]	A(H3N2)/Panama	A(H3N2)/Fujian	89%
2000-2001[d]	B/Beijing	B/Sichuan	89%
1997-1998[e]	A(H3N2)/Wuhan	A(H3N2)/Sydney	81%

[a]www.cdc.gov/flu/weekly (2005-2006 final report). Accessed June 20, 2006. [b]CDC. *MMWR.* 2005;54(25):631-634. [c]CDC. *MMWR.* 2004;53:284-287. [d]CDC. *MMWR.* 2001;50(22):466-470. [e]CDC. *MMWR.* 1998;47:280-284.

Immunization Outcomes Are Strongly Influenced by Physicians' Recommendations

- Immunization outcomes showed that 70% of children were vaccinated if the parents recalled a physician's recommendation versus only 3% if they did not[17]
- For both healthy and high-risk children, influenza vaccination rates are strongly influenced by the parents' recollection of a physician's recommendation

PREPARING FOR THE 2006-2007 INFLUENZA SEASON

Children Aged 2 to 5 Years and Their Close Contacts[18]

During its February meeting, the ACIP expanded the original recommendation for vaccinating children aged 6 to 23 months to also include children aged 24 to 59 months, beginning with the 2006-2007 season. The ACIP also recommends expanding routine vaccination for household contacts and out-of-home caregivers of children aged 24 to 59 months. Approximately 5.3 million children and their 11.4 million healthy close contacts will be covered by the new recommendation.

SUMMARY

Each year, influenza continues to cause significant morbidity and mortality across all age groups. In fact, the May 20, 2006 CDC surveillance reports for the 2005-2006 influenza season, which many view as a mild season, showed 35 reported influenza deaths in children.[19]

Recent CDC/ACIP recommendations include children aged 2 to 5 years, and a continued focus on immunizing all children aged 6 to 59 months and their close contacts will likely reduce the disease burden of influenza; however, effective vaccination strategies must be implemented to raise immunization rates in these groups. Future strategies also may include universal vaccination of children to significantly reduce influenza morbidity and mortality.

References: 1. Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices. *MMWR.* 2005;54(RR08):1-40. **2.** Bhat N, Wright J, Broder K, et al. Influenza-associated deaths among children in the United States, 2003-2004. *N Engl J Med.* 2005;353:2559-2567. **3.** Centers for Disease Control and Prevention. Influenza (flu) fact sheet: key facts about influenza and the influenza vaccine. Available at: http://www.cdc.gov/flu/pdf/keyfacts.pdf. Accessed June 7, 2006. **4.** Couch RB. Influenza: prospects for control. *Ann Intern Med.* 2000;133:992-998. **5.** Elveback LR, Fox JP, Ackerman E, et al. An influenza simulation model for immunization studies. *Am J Epidemiol.* 1976;103:152-165. **6.** Monto AS, Sullivan KM. Acute respiratory illness in the community. Frequency of illness and the agents involved. *Epidemiol Infect.* 1993;110:145-160. **7.** Reichert TA, Sugaya N, Fedson DS, Glezen WP, Simonsen L, Tashiro M. The Japanese experience with vaccinating schoolchildren against influenza. *N Engl J Med.* 2001;344:889-896. **8.** Centers for Disease Control and Prevention. Estimated influenza vaccination coverage among adults and children—United States, September 1, 2004–January 31, 2005. *MMWR.* 2005;54(12):304-307. **9.** Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR.* 1998;47(10): 196-200. **10.** Centers for Disease Control and Prevention. Update: influenza activity—United States and worldwide, 2000–01 season, and composition of the 2001–02 influenza vaccine. *MMWR.* 2001;50(22):466-470. **11.** Gaglani MJ, Piedra PA, Herschler GB, et al. Direct and total effectiveness of the intranasal, live-attenuated, trivalent cold-adapted influenza virus vaccine against the 2000-2001 influenza A (H1N1) and B epidemic in healthy children. *Arch Pediatr Adolesc Med.* 2004;158:65-73. **12.** Piedra P, Gaglani M, Kozinetz C, et al. Protection of live attenuated intranasal influenza vaccine-trivalent (FluMist®) against pneumonia and influenza (P-I) in school-aged children in the 2003-2004 influenza type A (H3N2) outbreak. Presented at the 2005 Annual Meeting of the Pediatric Academic Societies, Washington, DC. (abstract 201.0010). **13.** Centers for Disease Control and Prevention. Weekly report: influenza summary update: Week ending April 30, 2005. Available at: http://www.cdc.gov/flu.weekly. Accessed May 13, 2005. **14.** Centers for Disease Control and Prevention. Update: influenza activity: United States, 2003-04 season. *MMWR.* 2004;53:284-287. **15.** Centers for Disease Control and Prevention. Update: influenza activity: United States, 2000-01 season, and composition of the 2001-02 influenza vaccine. *MMWR.* 2001;50:466-470. **16.** Belshe RB, Gruber WC, Mendelman PM, et al. Efficacy of vaccination with live attenuated cold-adapted, trivalent, intranasal influenza virus vaccine against a variant (A/Sydney) not contained in the vaccine. *J Pediatr.* 2001;136;168-175. **17.** Poehling KA, Speroff T, Dittus RS, et al. Predictors of influenza virus vaccination status in hospitalized children. *Pediatrics.* 2001;108:E99. **18.** Centers for Disease Control and Prevention. CDC's advisory committee recommends expanded influenza vaccinations for children (press release). Available at: http://www.cdc.gov/od/oc/media/pressrel/r060223.htm. Accessed June 16, 2006. **19.** Centers for Disease Control and Prevention. Weekly report: influenza summary update week ending May 6, 2006: Week 18. Available at: http://www.cdc.gov/flu/weekly/. Accessed May 16, 2006.