

Influenza Vaccination of Healthcare Workers: Institutional Strategies for Improving Rates

Kristina Simeonsson, MD, MSPH, Chris Summers-Bean, MS, RN, and Allison Connolly, MA, MPH

Abstract

The nosocomial transmission of influenza has been well documented since the 1970s with both direct and indirect effects of outbreaks in healthcare settings. Outbreaks can directly increase morbidity among patients and residents of long-term care facilities. Indirect effects include disruption of normal operations of healthcare institutions, shortages of healthcare workers (HCWs), fewer elective admissions, and income loss due to absenteeism. Influenza vaccination of United States HCWs remains below 40% despite the availability of a safe, effective vaccine and a long-standing recommendation for vaccination of HCWs. New strategies to improve the rate of influenza vaccination among HCWs are needed as the percentage of those receiving yearly vaccination has changed little in the past 20 years. Increasing HCW influenza vaccination coverage calls for a paradigm shift; institutions should view vaccination of HCWs as a crucial part of a comprehensive infection control program designed to protect patients and staff. Administrators of hospitals, long-term care facilities, and other health agencies should respond to this challenge by developing programs to improve yearly influenza vaccination of their staff. Such efforts would put these employees into compliance with national recommendations and also benefit the institution by reducing absenteeism, nosocomial influenza transmission, and the associated economic losses and disruption of routine operations.

Introduction

Influenza epidemics occur each year in the United States; however, the impact of the disease on morbidity, mortality, and the economy is underestimated both by healthcare workers (HCWs) and the general public. An average of 200,000 people are hospitalized and 36,000 die due to influenza or its complications each year in the United States.^{1,2} The healthcare costs related to these episodes as well as the time lost from work and school have a significant economic impact. In the United States, it is estimated that the economic cost associated with influenza epidemics exceeds \$12 billion annually.³

Influenza is easily spread from person-to-person by respiratory droplets, particularly in enclosed areas. Infected adults can transmit influenza virus even in the absence of symptoms.⁴ Therefore, infected HCWs can unknowingly serve as vectors of the virus even if they avoid contact with patients after the onset of illness.

Vaccination is the most effective means of preventing influenza

illness. HCWs are among the target groups to receive influenza vaccine each year, yet their compliance with vaccination remains low. Institutions should promote influenza vaccination of HCWs as a necessary step to ensure the health of employees and patients.

Nosocomial Transmission of Influenza

Nosocomial transmission of influenza has been well documented since the 1970s. Outbreaks have been identified even during times when influenza activity was not documented in the surrounding community.^{5,6} The effects of these outbreaks can be far reaching. They can increase morbidity among hospitalized patients and residents of long-term care facilities, who are at risk for complications from influenza illness. Outbreaks of influenza can also have the indirect effects of disrupting the normal operations of healthcare settings (if there are shortages of staff), decreasing elective admissions, and loss of worker income due to absenteeism.

Numerous outbreaks of nosocomial influenza, with effects

Kristina Simeonsson, MD, MSPH, is a Medical Epidemiologist in the General Communicable Disease Control Branch in the Division of Public Health, NC Department of Health and Human Services. She can be reached at kristina.simeonsson@ncmail.net or 1902 Mail Service Center, Raleigh, NC 27699-1902. Telephone: (919)733-3419.

Chris Summers-Bean, MS, RN, is a CDC Public Health Advisor in the Immunization Branch in the Division of Public Health, NC Department of Health and Human Services.

Allison Connolly, MA, MPH, is an Epidemiologist in the General Communicable Disease Control Branch in the Division of Public Health, NC Department of Health and Human Services.

on staff, institutions, and patients, have been documented in the infection control literature. A descriptive example by Sartor of an outbreak on an internal medicine ward is illustrative: Five of the 22 staff members became ill with influenza.⁷ These five cases resulted in 14 person-days of sick leave during the two-week outbreak. Because of the staff shortage, eight scheduled admissions to this ward were postponed, and all admissions to the ward from the emergency department were suspended for 11 days. In this same study, nine of the 22 susceptible patients developed influenza illness, and three of the nine had prolonged hospitalizations.⁷

Outbreaks of influenza in high-risk settings like neonatal intensive care units, transplant units, and specialty care units, have resulted in increased morbidity or mortality for patients.^{5,6,8-10} For example, Munoz and colleagues describe an outbreak of influenza A in a 20-bed neonatal intensive care unit (NICU).⁸ This outbreak resulted in four infants developing influenza-like illness. Laboratory results confirmed influenza A in three of these infants. One of the infants subsequently died. Although no definite source for this outbreak was identified, four NICU staff members had been sick with influenza-like illness when the first infant manifested symptoms.

Cunney and colleagues describe an outbreak of influenza in a 34-bed NICU in which 19 infants became infected with influenza virus, six showed symptoms, and one died.⁹ In both of the outbreaks described (by Munoz and Cunney), a very low percentage of NICU staff had been vaccinated for influenza. In the first instance, 45% of NICU physicians and 5% of NICU nurses had been vaccinated; in the second instance, only 15% of the NICU staff were vaccinated.^{8,9}

The Effect of Vaccination

Research demonstrates that vaccination is effective in reducing morbidity and mortality due to influenza. In healthy persons under 65 years of age, the efficacy of influenza vaccination exceeds 80% when there is a good match between the vaccine strain and the circulating strain of influenza virus.^{11,12} While the vaccine is not as effective in preventing illness in those over 65, it has been shown to significantly reduce severe complications and deaths in this age group.^{13,14}

Further, vaccination has been shown to be effective in reducing absenteeism among healthy working adults.^{11,12,15} In the largest study of healthy working adults (randomized and placebo-controlled), influenza vaccination reduced absenteeism due to upper respiratory infections from any cause by 43%.¹⁵ In a study looking specifically at healthcare workers, influenza vaccination resulted in a 28% reduction of absenteeism due to respiratory infections during the influenza season.¹⁶

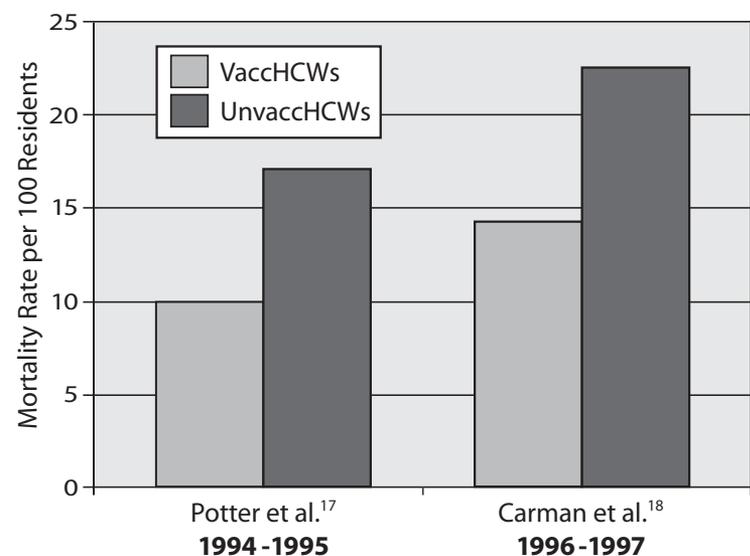
Vaccination of HCWs against influenza has also been associated with a reduction in patient mortality, as shown by two studies that examined

the effect of vaccination of HCWs on patient mortality rates in long-term care facilities.^{17,18} The first study, by Potter and colleagues, was conducted during the 1994-1995 influenza season in 12 long-term care facilities (LTCFs) in Scotland.¹⁷ The investigators stratified the LTCFs according to their policy regarding vaccination of patients for influenza. The study then randomized the LTCFs into two groups—those in which HCWs were routinely offered influenza vaccination and those in which HCWs were not offered vaccination. In the LTCFs in which influenza vaccination was routinely offered to the workers, 61% of HCWs received the vaccine. Although the authors did not determine how many HCWs may have received vaccine at the LTCFs that did not offer the vaccine, they believed that the percentage of vaccinated HCWs in these facilities would be negligible.

A follow-up study was conducted by Carman and colleagues during the 1996-1997 influenza season in 20 LTCFs in Scotland.¹⁸ LTCFs were again stratified according to their policy on influenza vaccination of patients and also by size of the facility. As in the study by Potter et al., the sites were then randomized into two groups. In one group, HCWs were routinely offered influenza vaccine, while in the other group of sites they were not. In those facilities where influenza vaccine was routinely offered to HCWs, 51% received the vaccine; in facilities where vaccine was not routinely offered, only 5% were vaccinated.

Both of these studies showed an association between vaccination of HCWs and decreased patient mortality (See Figure 1). In the study by Potter et al., patient mortality in facilities where HCWs were not routinely offered influenza vaccine was 17%, and in facilities where HCWs were offered the vaccine, patient mortality was 10%.¹⁷ (The difference in patient mortality remained statistically significant after controlling for patient characteristics such as age, sex, influenza vaccination status, and

Figure 1.
Association of Long-term Care Resident Mortality and Healthcare Worker (HCW) Vaccination



degree of disability). The study by Carman et al. showed an unadjusted rate of mortality of 14% for residents in facilities where vaccine was offered to HCWs, compared to 22% in the facilities where vaccine had not been offered. A significant difference was still observed after adjusting for patient characteristics.¹⁸

Influenza Immunization of Healthcare Workers

Every year the Advisory Committee for Immunization Practices (ACIP) issues recommendations regarding which population subgroups should be targeted to receive influenza vaccination; the most recent recommendations are summarized in Box 1.⁴ Although the ACIP has recommended for over 20 years that HCWs receive annual influenza vaccination, only 36% of HCWs (estimated) actually receive the vaccine each year.¹⁹ The HCWs who receive influenza vaccine tend to be older, more likely in their work to be caring for children or the elderly, more likely to have received influenza vaccine in the past, and more likely to be physicians.^{20,21}

Reasons for Acceptance

Compared to HCWs who are not vaccinated, those who are vaccinated are more likely to acknowledge the seriousness of influenza illness and its complications, recognize the efficacy of the vaccine, and understand their increased risk of contracting influenza.²⁰ In a study by Martinello et al., HCWs who responded correctly to a set of five basic knowledge questions pertaining to influenza vaccine were more likely to have been vaccinated compared to those who responded incorrectly to any one of the questions.²²

Self-protection and personal health are the most common reasons that HCWs give for why they accept the influenza vaccine.^{20,21,23-25} Beyond the wish to avoid illness, HCWs may accept vaccination in order to decrease the chance that they might miss work because of illness. In one survey of house staff physicians, one-third of the respondents said they got the vaccine to help avoid absenteeism.²⁶

The desire to protect patients from influenza is another reason why HCWs decide to receive influenza vaccine. In some studies over half of vaccinated HCWs listed protection of patients as a major reason to receive the vaccine.^{21,25}

Finally, the wish to serve as a role model may factor into a HCW's decision to receive influenza vaccine. Setting an example to other HCWs and patients was mentioned by 46% of hospital physicians surveyed in one study.²⁴ Twenty-four percent gave this as their most important reason for being vaccinated.

Reasons for Nonacceptance

Why are the majority of healthcare workers not receiving influenza vaccine? Surprisingly, the reasons are the same ones given by the general public. For instance, unvaccinated HCWs share the public's perceptions about the vaccine's side effects and its efficacy. The literature suggests that 20-44% of unvaccinated HCWs decline the influenza vaccine because they are concerned about side effects.²⁰⁻²⁵ The most frequently mentioned side effect is the possibility of getting influenza or an influenza-like illness from the vaccine itself.^{21,23,24,27} HCWs also fear allergic reactions or contracting Guillain-Barré syndrome following

Box 1: 2004 ACIP Recommendations: Target Groups for Annual Influenza Vaccination⁴

Persons at risk for complications

- persons aged ≥ 65 years;
- residents of nursing homes and other chronic-care facilities that house persons of any age who have chronic medical conditions;
- adults and children who have chronic disorders of the pulmonary or cardiovascular systems, including asthma;
- adults and children who have required regular medical follow-up or hospitalization during the preceding year because of chronic metabolic diseases (including diabetes mellitus), renal dysfunction, hemoglobinopathies, or immunosuppression (including immunosuppression caused by medications or by human immunodeficiency virus [HIV]);
- children and adolescents (aged six months-18 years) who are receiving long-term aspirin therapy and, therefore, might be at risk for experiencing Reye syndrome after influenza infection;
- women who will be pregnant during the influenza season; and
- children aged six-23 months.

Persons Aged 50-64 Years

- recommended because this age group has an increased prevalence of persons with high-risk medical conditions

Persons Who Can Transmit Influenza to Those at High Risk

- physicians, nurses, and other personnel in both hospital and outpatient-care settings, including medical emergency response workers (e.g., paramedics and emergency medical technicians);
- employees of nursing homes and chronic-care facilities who have contact with patients or residents;
- employees of assisted living and other residences for persons in groups at high risk;
- persons who provide home care to persons in groups at high risk; and
- household contacts (including children) of persons in groups at high risk.

influenza vaccination, although these side effects are mentioned less often.^{20,25} Unvaccinated HCWs may also have doubts about the efficacy of the influenza vaccine.^{23,24,28} A study of pediatricians in a Swiss hospital revealed that nearly half of those who remained unvaccinated gave doubt of the vaccine's efficacy as the primary reason.²⁴

Even though HCWs may know that they can transmit influenza to others and also recognize the potential severity of the influenza illness in their high-risk patients, they may still choose not to receive the vaccine. A study at one United States institution documented a vaccination rate among HCWs of only 16.2%, this despite the finding that over 90% of the physicians and nurses surveyed recognized that HCWs could transmit influenza to patients and that the patients could die from the illness.²⁹ Although knowledge of the severity of influenza illness and the efficacy and safety of the vaccine does not insure a HCW's acceptance of it, misperceptions about influenza illness and the vaccine can be significant barriers to being vaccinated.^{22,26,29}

Many HCWs are unaware of ACIP's recommendations regarding which population subgroups should be vaccinated for influenza.^{20-23,26,29} In some instances, this may influence their decision to be vaccinated. For example, Nichol and colleagues found that 8% of unvaccinated HCWs said that the most important reason for not being vaccinated against influenza was that they did not think they were in a target group for receiving it.²⁰ In addition, four studies discovered that between 2% and 15% of unvaccinated HCWs declined the vaccine because they were pregnant or breastfeeding,^{21-23,29} although neither pregnancy nor breastfeeding is a contraindication to influenza vaccination.⁴ In fact, the ACIP recommends that women who will be pregnant during the influenza season receive vaccine because they are at risk for complications from influenza illness.⁴

Finally, some unvaccinated HCWs simply believe that they are not at risk for influenza infection.^{21-23,28} Harbarth and colleagues found that over half of the unvaccinated HCWs cited either

their strong host defense or a low risk of getting sick from influenza as the primary reason not to be vaccinated.²⁸

The belief of some HCWs that they are not at risk may stem from confidence in their host defense mechanisms or an ability to avoid influenza through personal prevention strategies.^{21,28,30} For example, Manuel and colleagues found that the 81% of never-vaccinated HCWs believed that hand washing was more important for preventing illness from influenza than the vaccine.³⁰ In comparison, 67% of vaccinated HCWs held the same opinion. In the same study, 73% of never-vaccinated HCWs and 48% of vaccinated HCWs believed that a healthy diet and regular exercise were more important for preventing influenza than vaccination.

Improving HCW Immunization Rates

Influenza vaccination among HCWs in the United States remains below 40% despite continued nosocomial outbreaks of influenza, the availability of a safe and effective vaccine, and a long-standing recommendation by the nation's leading committee on vaccination guidelines that HCWs be vaccinated. Administrators of hospitals, long-term care facilities, and home-health agencies, among others, need to respond to this situation by developing programs to improve yearly influenza vaccination coverage among their staff. Such programs would not only put these employees into compliance with ACIP recommendations, it would also benefit the institutions by reducing absenteeism, nosocomial influenza transmission, and the associated economic losses and disruption of routine hospital operations.

Healthcare institutions should design their influenza immunization programs around the inactivated, injectable vaccine. Although an intranasally-administered influenza vaccine became available in 2003, it is a live, attenuated influenza vaccine (LAIV) with several limitations that make it impractical to use in an institution-wide campaign. For instance, it is only approved for young, healthy persons (between five and 49

Box 2: Keys to Increasing Healthcare Worker Vaccination Rates

1. Top management and administration need to become strong advocates to ensure healthcare workers get vaccinated to accomplish:
 - a. better infection control
 - b. reduced absenteeism
 - c. cost savings
2. Make vaccination convenient
3. Reduce or remove cost barriers
4. Remind healthcare workers that CDC recommends influenza vaccination annually
5. Educate healthcare workers that:
 - a. Injectable influenza vaccine cannot cause influenza
 - b. Influenza virus is easily transmitted between healthcare workers and patients, putting already ill patients at risk for influenza illness and its complications

From the National Foundation for Infectious Diseases. Call to action: influenza immunization among health-care workers 2003. Bethesda, MD: National Foundation for Infectious Diseases, 2003. Available at <http://www.nfid.org>

years);⁴ people with an array of chronic conditions, including diabetes and heart disease, should not receive LAIV. In addition, LAIV is not recommended for HCWs who care for severely immunosuppressed patients.⁴ Further, from an institutional perspective, the cost and the storage and handling procedures make LAIV undesirable compared to the injectable vaccine.

The National Foundation for Infectious Diseases (NFID) recently issued a call to action for employers to improve HCW influenza vaccination rates.³¹ The key elements of the NFID's action plan (See Box 2) provide a solid foundation from which to develop a comprehensive influenza vaccination program. NFID recommends that top management become strong advocates of HCW influenza vaccination and that cost and access barriers be removed. The Foundation also suggests educating healthcare workers about the ACIP's recommendations and about nosocomial transmission of influenza, as well as debunking the common myths and misperceptions regarding the virus and the vaccine itself.

The educational component of an immunization campaign will likely require the most extensive planning and implementation. According to the NFID, increasing awareness among healthcare workers of the ACIP recommendation regarding them as a target group to receive the vaccine should be directed at all healthcare workers—those who already know the ACIP recommendation and those who do not. Some who know the recommendation may disagree with it.²⁰ Therefore, the rationale behind the recommendation must be included in the educational messages. HCWs should be made to understand that they can spread influenza to their patients, even in the absence of symptoms. When it is appropriate, documentation of nosocomial outbreaks can be used to illustrate this point.

Knowledge of ACIP recommendations and the ramifications of nosocomial influenza will not be enough to convince some HCWs to participate in a vaccination program. As discussed in the previous section, the fear of side effects or doubts about efficacy are often the principal factors in the decision to not receive the influenza vaccine. Therefore, educational campaigns should also highlight the low risk of side effects from influenza vaccine as well as its proven efficacy.

Influenza Vaccination of Healthcare Workers Remains a Priority

Kristina Simeonsson, MD, MSPH

On October 5, 2004, one of the two manufacturers of inactivated influenza vaccine for the United States announced that it would be unable to deliver any of its vaccine because of contamination problems. This loss of more than 40 million doses of influenza vaccine has significantly reduced the projected supply for the United States, creating a severe shortage of vaccine for the current influenza season. In response, the Advisory Committee on Immunization Practices (ACIP) amended its list of recommendations for vaccination groups in an attempt to target the remaining supply to reduce the risk of influenza complications for those at highest risk.¹ These interim recommendations define eight groups of equal priority to receive influenza vaccine:

- all children aged six-23 months;
- adults aged 65 years and older;
- persons aged two-64 years with underlying chronic medical conditions;
- all women who will be pregnant during the influenza season;
- residents of nursing homes and long-term care facilities;
- children aged six months-18 years on chronic aspirin therapy;
- healthcare workers involved in direct patient care; and
- out-of-home caregivers and household contacts of children aged less than six months.

Individuals who are not in one of these priority groups have been asked to forego or defer vaccination for the 2004-2005 influenza season. These interim recommendations no longer include persons 50-64 years or household contacts of high-risk individuals as groups for which influenza vaccine is recommended.

Despite the change in vaccination recommendations due to this season's shortage, the ACIP still includes healthcare workers (HCWs) as a priority. The decision to include HCWs in the priority groups underscores that HCW-vaccination is essential to control the spread of influenza to high-risk patients.

Even for individuals in the eight priority groups, gaining access to vaccination this season may continue to pose significant challenges. HCWs who are not offered vaccination at their workplace should make every effort to get vaccinated on their own. Certain categories of HCWs have two options for influenza vaccination: (1) They can receive either the injectable influenza vaccine or (2) the intranasal, live attenuated form of influenza vaccine (FluMist). FluMist is indicated for healthy individuals five-49 years of age. According to the ACIP, HCWs who meet these criteria and do not care for severely immunosuppressed patients can receive the intranasal form of vaccine.² Healthcare facilities may choose to develop institutional policies pertaining to the use of FluMist for their HCWs. Regardless of whether HCWs are successful in finding influenza vaccination this year, the message about HCW vaccination is clear. Annual influenza vaccination of HCWs remains a top priority.

REFERENCES

- 1 Centers for Disease Control and Prevention. Interim influenza vaccination recommendations, 2004-05 influenza season. *MMWR* 2004;53(39):923-24.
- 2 Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2004;53(No. RR-6):1-40.

Access to influenza vaccination must also be ensured. Several studies document that the location and schedule of vaccination administration influence whether HCWs will participate.^{20,22,26,28} Access, however, includes not only logistical issues such as locations and times for vaccine administration, but also the cost to the worker of being vaccinated. One study found that one-third of vaccinated HCWs at one institution would not accept influenza vaccine if they had to pay for it themselves.²¹ A recent position statement of the Association for Professionals in Infection Control and Epidemiology urged institutions to provide their employees with influenza vaccination at no charge—just as these institutions provide masks, gloves, gowns, and hand-washing products to employees at no charge.³²

In short, the educational and access components of vaccine programs will likely be multi-faceted. Thus, assessing the employees' knowledge and concerns about the influenza vaccine, and therefore their willingness to be vaccinated, and removing the barriers to gaining access to vaccination, are both critical steps in planning a campaign. HCWs are a heterogeneous group who vary greatly in terms of their healthcare knowledge, educational level, and primary work environment, as well as race and culture. These variations may influence both the workers' educational needs and their ability to surmount the access barriers with respect to receiving influenza vaccination.^{22-26,28}

Begue and colleagues found that addressing all of the issues expressed by HCWs during the educational component of the campaign increased their vaccination rate by 50%.²³ Other

studies have demonstrated that some HCWs—attending and resident physicians, for example—are more likely than others to cite time and convenience as important reasons behind their failure to be vaccinated.^{22,25,26}

One successful strategy to improve access is linking the vaccination campaign to a required activity. At one institution, a HCW vaccination rate of 62% was achieved for the 1999-2000 influenza season when vaccine was offered to HCWs during their mandatory tuberculosis screening, which was scheduled for a one-week period in October.²¹ Offering the vaccine in a setting where employees are screened for other occupational health issues may also provide an opportunity to address individual concerns about the vaccine in a private manner. Other institutions have noted that offering the vaccine to the HCWs in the units where they work has proven to be an effective strategy.^{20,22,28}

The ACIP recommendation that HCWs receive influenza vaccination every year is not a new one. However, new strategies to improve vaccination coverage of HCWs are necessary because the rate of vaccination has not changed significantly in the past 20 years. The challenge of increasing HCW influenza vaccination calls for a paradigm shift. Institutions should view influenza vaccination of HCWs as an integral part of a comprehensive infection control program designed to protect both patients and staff.³³ Vaccination remains the most effective way to prevent influenza illness, and vaccination of HCWs is essential to preventing the spread of influenza in healthcare settings. **NCMJ**

REFERENCES

- 1 Thompson WW, Shay DK, Weintraub E, et al. Influenza-associated hospitalizations in the United States. *JAMA* 2004;292:1333-1340.
- 2 Thompson WW, Shay DK, Weintraub E, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. *JAMA* 2003;289:179-86.
- 3 Williams WW, Hickson MA, Kane MA, Kendal AP, Spika JS, Hinman AR. Immunization policies and vaccine coverage among adults: the risk for missed opportunities. *Ann Intern Med* 1988;108:616-625.
- 4 Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2004;53(No. RR-6):[1-40].
- 5 Berg HF, Van Gendt J, Rimmelzwaan GF, Peeters MF, Van Keulen P. Nosocomial influenza infection among post-influenza-vaccinated patients with severe pulmonary diseases. *J Infect* 2003;46(2):129-32.
- 6 Horcajada JP, Pumarola T, Martinez JA, et al. A nosocomial outbreak of influenza during a period without influenza epidemic activity. *Eur Respir J* 2003;21(2):303-7.
- 7 Sartor C, Zandotti C, Romain F, et al. Disruption of services in an internal medicine unit due to a nosocomial influenza outbreak. *Infect Control Hosp Epidemiol* 2002;23(10):615-9.
- 8 Munoz FM, Campbell JR, Atmar RL, et al. Influenza A virus outbreak in a neonatal intensive care unit. *Pediatr Infect Dis J* 1999;18(9):811-5.
- 9 Cunney RJ, Bialachowski A, Thornley D, Smaill FM, Pennie RA. An outbreak of influenza A in a neonatal intensive care unit. *Infect Control Hosp Epidemiol* 2000;21:449-54.
- 10 Weinstock DM, Eagan J, Malak SA, et al. Control of influenza A on a bone marrow transplant unit. *Infect Control Hosp Epidemiol* 2000;21(11):730-2.
- 11 Wilde JA, MacMillan JA, Serwint J, Butta J, O'Riordan MA, Steinhoff MC. Effectiveness of influenza vaccine in health care professionals: a randomized trial. *JAMA* 1999; 281:908-13.
- 12 Bridges CB, Thompson WW, Meltzer MI, et al. Effectiveness and cost-benefit of influenza vaccination of healthy working adults: a randomized controlled trial. *JAMA* 2000; 284:1655-63.
- 13 Gross PA, Hermogenes AW, Sacks HS, Lau J, Levandowski RA. Efficacy of influenza vaccine in elderly persons: a meta-analysis and review of the literature. *Ann Intern Med* 1995;123:518-27.
- 14 Monto AS, Hornbuckle K, Ohmit SE. Influenza vaccine effectiveness among elderly nursing home residents: a cohort study. *Am J Epidemiol* 2001;154:155-60.
- 15 Nichol KL, Lind A, Margolis KL, Murdoch M, McFadden R, Hauge M, Magnan S, Drake M. The effectiveness of vaccination against influenza in healthy, working adults. *N Engl J Med* 1995;333(14):889-93.
- 16 Saxen H, Virtanen M. Randomized, placebo-controlled double blind study on the efficacy of influenza immunization on absenteeism of health care workers. *Pediatr Infect Dis J* 1999;18(9):779-83.
- 17 Potter J, Stott DJ, Roberts MA, Elder AG, O'Donnell B, Knight PV, Carman WF. Influenza vaccination of health care workers in long-term-care facilities reduces the mortality of elderly patients. *Jour Infect Dis* 1997;175:1-6.

- 18 Carman WF, Elder AG, Wallace LA, et al. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: a randomised controlled trial. *Lancet* 2000;355(9198):93-7.
- 19 Walker FJ, Singleton JA, Lu PJ, Strikas RA. Influenza vaccination of healthcare workers in the United States, 1989-97. *Infect Control Hosp Epidemiol* 2000;21:113.
- 20 Nichol KL, Hauge M. Influenza vaccination of healthcare workers. *Infect Control Hosp Epidemiol* 1997;18:189-94.
- 21 Steiner MA, Vermeulen LC, Mullahy J, Hayney MS. Factors influencing decisions regarding influenza vaccination and treatment: a survey of healthcare workers. *Infect Control Hosp Epidemiol* 2002; 23:625-7.
- 22 Martinello RA, Jones L, Topal JE. Correlation between healthcare workers' knowledge of influenza vaccine and vaccine receipt. *Infect Control Hosp Epidemiol* 2003;24(11):845-7.
- 23 Begue RE, Gee SQ. Improving immunization among healthcare workers. *Infect Control Hosp Epidemiol* 1998;19:518-20.
- 24 Heininger U, Bachler M, Schaad UB. Attitudes of pediatricians regarding influenza self-immunization: a survey in a Swiss university children's hospital. *Pediatr Infect Dis J* 2003;22(5):391-4.
- 25 Lester RT, McGreer A, Tomlinson G, Detsky AS. Use of, effectiveness of, and attitudes regarding influenza vaccine among house staff. *Infect Control Hosp Epidemiol* 2003; 24:839-44.
- 26 Nafziger DA, Herwaldt LA. Attitudes of internal medicine residents regarding influenza vaccination. *Infect Control Hosp Epidemiol* 1994;15(1):32-5.
- 27 Weingarten S, Riedinger M, Bolton LB, Miles P, Ault M. Barriers to influenza vaccine acceptance. A survey of physicians and nurses. *Am J Infect Control* 1989;17(4):202-7.
- 28 Harbarth S, Siergrist C, Schira J, Wunderli W, Pittet D. Influenza immunization: improving compliance of healthcare workers. *Infect Control Hosp Epidemiol* 1998;19:337-342.
- 29 Heimberger T, Chang HG, Shaikh M, Crotty L, Morse D, Birkhead G. Knowledge and attitudes of healthcare workers about influenza: why are they not getting vaccinated? *Infect Control Hosp Epidemiol* 1995;16(7):412-5.
- 30 Manuel DG, Henry B, Hockin J, Naus M. Health behavior associated with influenza vaccination among healthcare workers in long-term-care facilities. *Infect Control Hosp Epidemiol* 2002;23(10):609-14.
- 31 National Foundation for Infectious Diseases. Call to action: influenza immunization among health-care workers 2003. Bethesda, MD: National Foundation for Infectious Diseases, 2003. Available at <http://www.nfid.org>
- 32 Dash GB, Fauerbach L, Pfeiffer J, Soule B, Bartley J, et al. APIC position paper: Improving health care worker influenza immunization rates. *Am J Infect Control* 2004; 32:123-5.
- 33 National Foundation for Infectious Diseases. Improving influenza vaccination rates in health care workers: strategies to increase protection for workers and patients. Bethesda, MD: National Foundation for Infectious Diseases, 2004. Available at <http://www.nfid.org>

FOLIC ACID.

IT'S NOT JUST FOR BABIES ANYMORE.



Taking a multivitamin with 400 mcg of folic acid every day before pregnancy can do more than prevent serious birth defects. It can help avert heart disease, stroke, even certain kinds of cancer. So even if you're not planning to become pregnant, get your daily dose of folic acid. To learn more, ask your health care provider or local health department, call 1-866-GET-FOLIC or go to www.getfolic.com.

FOLIC ACID



GET IT NOW