

# Improving Influenza Immunization in Pregnant Women and Healthcare Workers

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**T**he Advisory Committee on Immunization Practices (ACIP) and the Centers for Disease Control and Prevention (CDC) recommend that pregnant women receive influenza vaccination.<sup>1</sup> However, coverage in the United States in 2005-2006 was only 12.8% in this vulnerable population.<sup>1</sup> Influenza immunization is not routine in most obstetric practices, and immunization of pregnant women is routinely avoided by most nonobstetric immunization providers because of a lack of familiarity or comfort with vaccinations in pregnancy.<sup>2-5</sup> Immunization for influenza has also not been well accepted by obstetricians and pregnant women, despite ACIP recommendations, because of concerns about the lack of safety data on vaccination of pregnant women and the recommendation before 2004 to defer immunization until the second or third trimester.<sup>2,6-9</sup>

Healthcare workers are at high risk for acquiring and spreading influenza infection because of their exposure to ill patients and their exposure in the community. Research suggests that healthcare workers can be a key source of institutional outbreaks, which can contribute to increased morbidity and mortality among vulnerable patients.<sup>10</sup> Despite longstanding recommendations from the ACIP, CDC, and the Association for Professionals in Infection Control and Epidemiology,<sup>10</sup> less than 50% of healthcare workers who have direct contact with patients are immunized annually.<sup>11-13</sup>

Strategies are needed to increase immunization rates in pregnancy and among healthcare workers. This article describes strategies to increase influenza vaccination coverage among pregnant women and healthcare workers in a large multispecialty clinic setting in Houston, Texas.

## METHODS

### Study Setting

Founded in 1949, Kelsey-Seybold Clinic (KSC) is a large multispecialty medical organization with more than 300 physicians and approximately 2100 employees that provides care to a racially/ethnically diverse population of more than 350,000 patients at 19 clinics in Houston, Texas. The racial/ethnic diversity of KSC patients who have

been recruited for research studies is 64.7% non-Hispanic white, 22.5% non-Hispanic African American, 11.2% Hispanic, and 1.4% Asian. Regarding insurance, 24.3% of KSC

**Objective:** To evaluate the effect of several strategies to increase influenza immunization in a multispecialty clinic.

**Study Design:** Retrospective electronic database analysis of influenza vaccinations in a 6-year period at Kelsey-Seybold Clinic in Houston, Texas.

**Methods:** We evaluated immunization rates in pregnant women and healthcare workers during 6 influenza seasons (2003-2004 to 2008-2009) after implementing the following strategies for pregnant women: assessing baseline immunization rates for obstetric providers, followed by direct encouragement and behavior modeling; implementing standing orders for influenza vaccination in pregnancy; and offering vaccination training to obstetricians and nurses. Further strategies implemented for healthcare workers included the following: conducting an employee survey about influenza knowledge, providing employee education based on survey findings and Centers for Disease Control and Prevention recommendations, making employee vaccines readily available and free of charge, designating immunization nurses to serve as clinical champions, monitoring and reporting the employee influenza vaccination rate, and recognizing the clinic with the highest employee vaccination rate.

**Results:** Influenza vaccination coverage rates in pregnant women increased from 2.5% at baseline to 37.4% in 2008-2009. Employee influenza vaccination coverage rates increased from 36.0% in 2003-2004 to 64.0% in 2008-2009.

**Conclusion:** Low influenza vaccination rates in pregnant women and healthcare workers can be substantially improved using methods shown to be effective in other clinical settings.

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For author information and disclosures, see end of text.

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### Take-Away Points

Influenza vaccination rates in pregnant women and healthcare workers increased after the following:

- Assessing baseline immunization rates for obstetric providers, followed by direct encouragement and behavior modeling, standing orders for influenza vaccination in pregnancy, and vaccination training to obstetricians and nurses.
- Conducting an employee survey about influenza knowledge and providing employee education based on survey findings and Centers for Disease Control and Prevention recommendations.
- Making employee vaccines readily available and free of charge.
- Designating immunization nurses to serve as clinical champions and monitoring and reporting the employee influenza vaccination rate.

patients are enrolled in capitated healthcare plans, 65.3% in preferred provider plans, 5.1% in Medicare or Medicaid, and 4.8% in fee-for-service plans. Kelsey-Seybold Clinic offers physician services in 34 medical specialties and subspecialties and provides more than 1.2 million patient visits annually. The KSC obstetrics and gynecology department has 29 obstetricians, who deliver approximately 2500 infants annually at 5 Houston-area hospitals.

Kelsey-Seybold Clinic has developed a robust infrastructure for immunizations throughout the multispecialty clinic, with vaccines offered at most clinic locations, training programs for nurses on immunization issues, and annual promotion of influenza immunizations to employees and patients. Since 1993, a managing physician for immunization practices (MEM) has had primary responsibility for increasing immunization rates and formalizing policies in pediatrics and in 1998 assumed the responsibility for implementing immunization standing orders clinicwide, with the additional assignment to address immunization issues in adult medicine areas in 2001.

Founded in 1956, the Kelsey Research Foundation (KRF) develops and evaluates patient care and education programs and conducts health services research. The KRF maintains a database with obstetric information on more than 18,000 women and infants, enabling us to examine maternal and infant outcomes. The KSC obstetrical research committee, a joint collaboration between the KRF and The Woman's Hospital of Texas (Houston), conducts research to improve the quality of care for women and infants.

### Study Design

This study was a retrospective electronic database search of influenza vaccinations for pregnant women and healthcare workers during 6 consecutive influenza seasons (2003-2004 to 2008-2009) at KSC. A baseline immunization rate among pregnant women of 2.5% was determined through a review of billing data from 1998 to 2002. Pregnancy is a 9-month occurrence, and influenza immunization activities in gen-

eral last approximately 6 months, with the possibility of some pregnancies being immunized in the spring and the fall and other pregnancies missing immunization activities altogether as a result of late prenatal care and delivery before vaccine arrival in the fall. In addition, vaccination activities in the past 2 seasons have been encouraged to begin as soon as vaccine is available and to continue into the spring, whereas in prior years they were concentrated in the fall and early winter months.

Therefore, vaccination years were standardized for this study to coincide with an influenza vaccine expiration date of June 30. The database was searched for influenza vaccinations billed through the obstetrics and gynecology department and other departments at KSC for women who delivered a live-born infant between July 1 of one year and June 30 of the subsequent year. The database search did not capture immunizations provided outside of the KSC. In 2006, KSC developed a billing code to capture the history of outside immunizations; however, this code is not used with regularity by all providers.

The KSC administrative database was searched for vaccinations for healthcare workers from 2003-2004 to identify vaccination opportunities among them. The immunization rate for healthcare workers was 36.0% at baseline, equivalent to the national mean at the time.<sup>14</sup>

Inactivated influenza vaccine was offered to patients and healthcare workers from October through February in 2006-2007. It was offered as soon as it was available through April in 2007-2008 and 2008-2009.

### Study Population

The study population included all pregnant women under the care of a KSC physician during 6 influenza seasons from 2003-2004 to 2008-2009 (July 1 through June 30), a mean of 2081 per year. Data were also collected on KSC healthcare workers (approximately 2000 healthcare workers in each year of the study) through an employee influenza campaign.

### Interventions

**Influenza Vaccination Program for Pregnant Women.** Beginning with the 2004-2005 influenza season, KSC implemented 3 strategies (listed herein) to increase influenza immunization rates among pregnant women. Research has demonstrated that these strategies are effective in increasing immunization rates among pediatric populations, and their implementation among adult populations has been encouraged by the National Vaccine Advisory Committee.<sup>15</sup>

## Influenza Immunization in Pregnant Women and Healthcare Workers

First, baseline immunization rates for each obstetrician's pregnant population were assessed using the billing database. Information on individual and departmental rates was provided to each obstetrician. This assessment was followed by direct encouragement to immunize according to ACIP guidelines in any trimester of pregnancy. The chief of the obstetrics and gynecology department (FAS) served as an immunization champion, modeling behaviors such as encouraging nurse assessment and promotion of immunization and immunizing patients at every opportunity. Educational updates on influenza vaccination in pregnancy and regular rate assessments were provided to obstetricians, nurses, and staff during quarterly meetings.

Second, standing orders for influenza vaccine administration were revised to specifically encourage immunization in pregnancy by all immunization providers (primary care physicians and immunization nurses). Training on their use was provided to obstetricians, obstetric nurses, and immunization nurses.

Third, obstetric nurses were offered training on vaccinations and were encouraged to take the initiative in identifying and completing immunization for eligible patients. Strong departmental leadership and physician interest in best practices led to the routine practice of nurses' taking responsibility for immunization of pregnant patients under standing orders for most, but not all, providers.

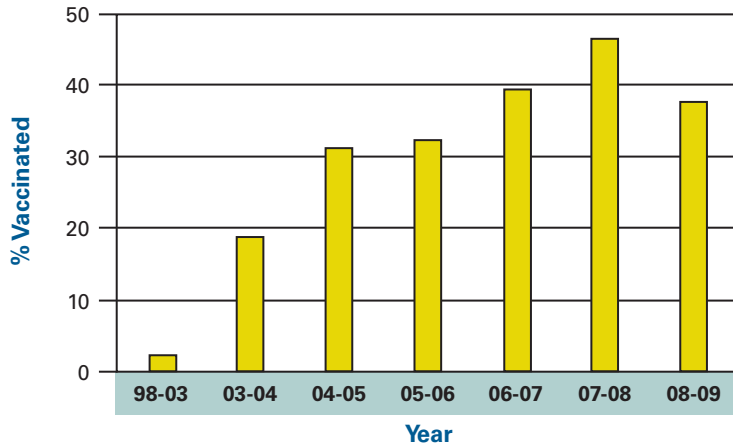
***Influenza Vaccination Program for Healthcare Workers.*** Beginning in 2004-2005, KSC designed and initiated an influenza vaccination program for healthcare workers to increase the low immunization rate (36.0%) among healthcare workers and staff in 2003. A multidisciplinary committee of physicians and staff from pharmacy, clinical education, nursing education, and environmental health was formed to develop a program to reduce barriers to immunization among healthcare workers. Before each influenza season, the committee meets to implement the employee influenza vaccination program by reviewing current CDC influenza information and the vaccination rates at KSC from previous years and by updating the promotional campaign and immunization goals. Standing orders for inactivated influenza vaccine and live attenuated intranasal influenza vaccine are reviewed and revised as needed each year. Standing orders facilitate vaccinating not only healthcare workers but also all persons who meet the criteria established by the ACIP and CDC. The influenza immunization program for healthcare workers is presented each September at a nurse practice council meeting at KSC, and then the program is disseminated to all healthcare workers. Program components include the following: (1) Conducting an annual survey of healthcare workers about their knowledge and perceptions of influenza immunizations. (2)

Providing various educational pieces directed to healthcare workers, addressing any knowledge deficits from the employee survey and new recommendations, the importance of influenza immunization for healthcare workers and patients, and the low risk of adverse events associated with immunization. (3) Making employee vaccines readily available and free of charge at all clinic locations and at employee benefits fairs. (4) Designating an immunization nurse at each clinic location to serve as a clinical champion to encourage staff to be vaccinated and to facilitate vaccination on-site. (5) Monitoring the employee influenza vaccination rate weekly by clinic location and sharing these rates with clinical champions. (6) Recognizing the clinic with the highest percentage of survey respondents in October with a lunch and recognizing the clinic with the highest percentage of influenza vaccination coverage for healthcare workers in December with a "Cage the Flu Bug" award and lunch.

Employee education about influenza immunization is promoted through an influenza Web site developed for the KSC intranet that includes a series of true-false questions distributed over a 5-week period beginning before immunization activities and continuing into October. Examples of true-false questions are "Influenza vaccine can give you the flu" and "Pregnant women can be immunized for influenza in any trimester of pregnancy." Healthcare workers can review and answer these questions in 2 ways, by accessing an interactive PowerPoint (Microsoft, Seattle, WA) presentation on the KSC intranet and through weekly e-mails that are sent to all healthcare workers. Information about influenza activity in the community, electronic copies of vaccine information statements, safety briefings on the vaccine, standing orders for the vaccine, and ACIP recommendations are among the other information available on the intranet influenza Web page. The annual employee influenza campaign was modified to stress the indication of vaccination for influenza in pregnancy, the ability to vaccinate in all trimesters of pregnancy, and the safety of inactivated vaccines during pregnancy. Educational materials distributed in all formats included information specific to pregnancy. At the end of the employee campaign, a flu quiz is posted on the KSC intranet, and healthcare workers who score 100% are entered into a random drawing, with 5 winners each receiving a \$50 gift card. In addition, safety briefings that include information about vaccine administration and current CDC recommendations, as well as CDC posters noting who should be vaccinated, are displayed at all clinic locations and pharmacies.

A major feature of the employee campaign is a friendly competition among clinic locations to achieve the highest percentage of immunized healthcare workers. A "tool kit" is

■ **Figure 1.** Influenza Vaccination Coverage in Pregnant Women



■ % Vaccinated	2.5	21.1	30.6	32.5	40.5	46.5	37.4
Women Vaccinated	222	427	579	633	603	949	760
Total Women	8813	2023	1893	1945	1488	2039	2032

distributed to clinical champions that includes competition guidelines, standing orders for influenza vaccination, information about current trivalent vaccine strains, a flu vaccination log, a vaccine information statement for inactivated influenza vaccine and for intranasal vaccine, a screening questionnaire for intranasal vaccination, a declination form for healthcare workers who chose not to be vaccinated (since 2007), and safety briefings. To encourage timely immunizations, the competition begins when vaccine first becomes available at the KSC and lasts until November 15, when the rate for healthcare workers is tabulated. Healthcare workers may continue to be vaccinated, free of charge, after the competition is closed.

### Measures

Measures of the effectiveness of the influenza vaccination program include the following: (1) the rates of vaccination coverage in pregnant women over consecutive influenza seasons, (2) the vaccination rates in healthy women and in those with underlying conditions, and (3) vaccination by trimester of gestation. We also examined which factors were predictors of receiving influenza immunization. Underlying conditions were assessed using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes for diabetes (code 250.x), heart disease (codes 401.x-429.00), and cancer (codes 140-429 and/or 230-234). Outcome measures for interventions targeted to the healthcare workers included the rate of vaccination by clinic location and the overall vaccination rate for healthcare workers.

### Statistical Analysis

The administrative database at KSC includes procedure and diagnostic information for all patients with clinic visits. A data programmer at the KRF accessed and organized the data using Microsoft Access 2003 and performed statistical analyses using SPSS (SPSS Inc, Chicago, IL) Statistics 17.0 (OAW).

$\chi^2$  Test was performed to determine whether the number of visits was correlated with the receipt of vaccination. Regression analyses were performed to examine the association between the vaccination rate and the number of visits and to examine trends in vaccination rates. *t* Test was performed to determine whether there was

a significant difference in the vaccination rate of pregnant women for obstetricians who were immunized versus for obstetricians who were not immunized.

## RESULTS

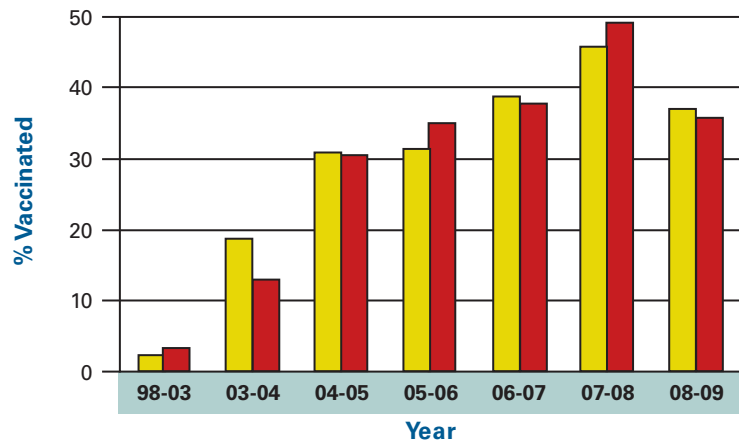
### Influenza Vaccination Program for Pregnant Women

Influenza vaccination coverage rates among eligible pregnant women increased from 2.5% at baseline to 21.1% (427 vaccinated of 2023 eligible) in 2003-2004, 30.6% (579 of 1893) in 2004-2005, 32.5% (633 of 1945) in 2005-2006, 40.5% (603 of 1488) in 2006-2007, and 46.5% (949 of 2039) in 2007-2008 and decreased to 37.4% (760 of 2032) in 2008-2009 (Figure 1). The lower rate in the 2008-2009 season is attributed to clinic closures because of Hurricane Ike. Several clinic locations were closed for as long as 3 weeks following the storm, resulting in missed appointments and fewer opportunities to vaccinate.

Vaccination rates were equally distributed among healthy pregnant women and those with underlying conditions such as diabetes, heart disease, and cancer (Figure 2). Less than 20% of vaccinations were completed during the first trimester (Figure 3).

The number of prenatal care visits was the most important predictor of receipt of influenza vaccination ( $P < .001$ ). Vaccination improved at a rate of approximately 5% per visit for 10 visits. Women with indications for vaccination other than pregnancy were not significantly more likely to be immunized than women without indications.

■ **Figure 2.** Vaccination Rates for Healthy Pregnant Women and Pregnant Women With Underlying Conditions



■ % Healthy	2.3	19.1	31.3	31.9	39.4	46.1	37.6
■ % Underlying Conditions	3.5	13.2	30.9	35.5	38.0	50.0	36.6
Total Women	8813	2231	2035	2040	2111	2039	2023

There was wide variability in immunization rates by provider, ranging from 2.1% to 72.4% in 2008-2009, indicating that physician education and feedback are crucial to increasing rates. Of 38 obstetricians in practice at the KSC during 2008-2009, 5 did not receive the influenza vaccination. For these 5 providers, 40.6% of their pregnant patients received influenza vaccination during the 2008-2009 season. Patients of providers who were immunized had an overall immunization rate of 36.7%, which was not a statistically significant difference.

Among women delivering before 37 weeks, 26.1% were vaccinated. Of women delivering on or after 37 weeks, 40.8% were vaccinated. Regression of the vaccination rate with the number of visits yields a result that is statistically indistinguishable from the total population rate already reported. Analysis of delivery type by vaccination status was not significant.

Immunization occurred throughout pregnancy but was more likely to occur in the second or third trimester. The median first prenatal visit in this population is at 56 days. Because pregnancy is generally not diagnosed until around the end of the first month of gestation, the fact that immunization is more likely to occur in the second or third trimester most likely reflects the initiation of care well into the first trimester together with the association of immunizations with increased number of visits. In addition, because immunizations take place during only 6 to 8 months of the year, only 50% to 60% of women will be in their first trimester during that period, while all women will be in the second

or third trimester of pregnancy for at least a part of the immunization period.

A regression analysis was performed to examine trends in vaccination rates over the study period. The results indicate that the improvement in immunization rates is significant ( $P < .01$ ).

### Influenza Vaccination Program for Healthcare Workers

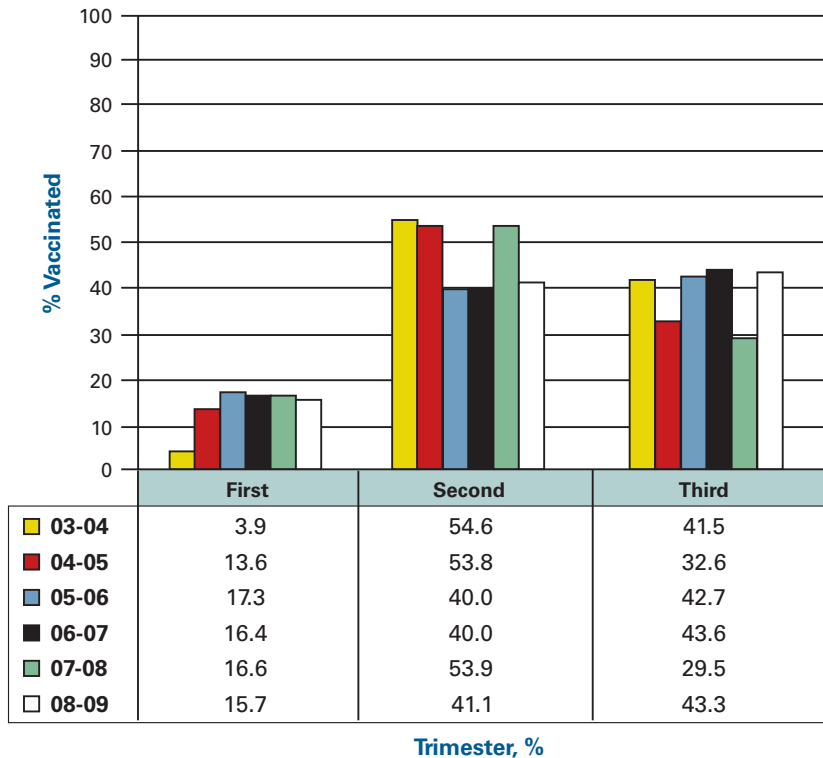
During the same period, influenza vaccination coverage for healthcare workers increased from 36.0% in 2003-2004 to 51.0% in 2004-2005, 56.0% in 2005-2006, 62.1% in 2006-2007, and 72.7% in 2007-2008 and decreased to 64.0% in 2008-2009 (Figure 4). The decrease in coverage in 2008-2009 was the result of interruption of medical services at KSC due to Hurricane Ike. We theorize that healthcare workers who receive influenza vaccination are more likely to recommend immunization to their patients and that increasing the acceptance of influenza immunization among healthcare workers has a role in increasing the number of pregnant women who are vaccinated.

## DISCUSSION

The emergence of the novel influenza A(H1N1) pandemic virus in the spring of 2009 reinforced the concern about the risk of influenza in pregnant women.<sup>16</sup> In the first month of activity in the United States, the CDC identified 34 cases in pregnant women, of whom 11 were hospitalized



■ **Figure 3.** Vaccination Rates by Trimester of Gestation



and 6 died.<sup>16</sup> A recent controlled vaccination trial showed significant protection for pregnant women and their infants younger than 6 months.<sup>8</sup> These studies justify the urgency to increase vaccination coverage during pregnancy.

Immunization in obstetrics poses particular problems because most private obstetricians do not stock vaccine in their offices (although that is changing with the advent of cervical cancer vaccines) and lack the basic infrastructure for providing them. They have refrigerators but not thermometers or protocols for following temperature logs.<sup>2,6,7</sup> They also have nurses but are unfamiliar with routine immunization protocols and vaccine information statements.<sup>2,17</sup>

Many obstetricians may recommend influenza immunization in pregnancy but refer their patients to receive vaccination at pharmacies and other clinics and from other physicians. Their patients may fail to be vaccinated because they do not comply with instructions to receive vaccination elsewhere and may be refused by the pharmacy, vaccination clinic, or physician they visit to get vaccinated because of false contraindications and fear of immunizing pregnant women. Some obstetricians overcome this barrier by writing prescriptions for vaccine to be obtained at a pharmacy and then administer it in their offices.

For many years, influenza vaccination was deferred until the second or third trimester because of a concern that spon-

aneous miscarriages would be attributed to vaccination, which might lead to potential lawsuits and an increased fear of immunization. There also was little documentation about the safety of vaccination in pregnancy at all, much less in the first trimester.<sup>2,6,7,17-19</sup> These concerns continue to inhibit active immunization programs for pregnant women, despite ACIP recommendations to immunize in any trimester.

A further issue that might affect the acceptance of immunization at KSC is the “bundling” of obstetric care. Because vaccination for influenza is not part of the covered bundled services for pregnancy, introducing vaccinations adds an additional cost to the patient’s obstetric care that is often not reimbursed by insurance. Patients who have paid out-of-pocket expenses for pregnancy care resist an additional payment for the immunization and separate copayments for immunization

visits when required by insurance, particularly if their copayment for obstetrics is at a higher “specialty service” level rather than at a primary care level.

Kelsey-Seybold Clinic has had a robust immunization infrastructure for many years, with equipment and protocols in place to safeguard supplies, easily ordered supplies through a central pharmacy, and billing and budgeting practices that already account for providing immunizations at each clinic location. Nurse training with continuing education units is offered on immunization through an active clinical education department at KSC. Standing orders are updated at least annually and have been in place for several years. There is also strong physician leadership, with a managing physician for immunization practices for KSC overall and in the obstetrics and gynecology department together with active participation in an ongoing obstetrical outcomes program and research committee. Collaboration with the KRF, which provides expertise in data collection and monitoring and analyses from the electronic medical record and billing systems at KSC, allows us to provide timely feedback on immunization rates to individual providers. In addition, the KRF was able to determine that using billing data for pregnancy without adjusting for delivery of live-born infants gave misleading information about actual immunization rates because it includes women who miscarry before seasonal vaccination efforts and for whom vaccination was not indicated.

## Influenza Immunization in Pregnant Women and Healthcare Workers

Even with this entire infrastructure in place, our baseline rate for influenza immunization in pregnancy was only 2.5%, significantly lower than published national rates.<sup>10</sup> As has been shown in pediatric practices, making physicians aware of their practice-specific rates is the first step in improving them.<sup>20,21</sup> This baseline rate captured immunizations given throughout our system, including family medicine, internal medicine, and immunization clinics, but was unable to capture immunizations administered outside of KSC because KSC does not bill for them. Since 2006, KSC has attempted to capture historical information through the use of a mock billing code. If a woman claims to have already been vaccinated for that influenza season (eg, a woman who becomes pregnant in February may have been vaccinated at a pharmacy in October), she would not be revaccinated until the following season. This code requires the physician to ask the question and to note the code on the service record but is not rigorously used by all obstetricians.

Influenza vaccination is now mandated in some settings, but incentives work to increase vaccination rates. An opportunity to vaccinate pregnant women during the influenza season occurs when the women have their first obstetric visit for prenatal laboratory testing. Receiving the vaccination at that visit would increase the rate of vaccination in the first trimester. This policy should be incorporated into standing orders.

In conclusion, low influenza vaccination rates among pregnant women and healthcare workers were increased with the use of standing orders, training of personnel, and active education and promotion activities by vaccination champions focusing on encouraging influenza immunization among patients and healthcare providers. Assessment of rates and feedback to providers are crucial to the effectiveness of influenza immunization programs.

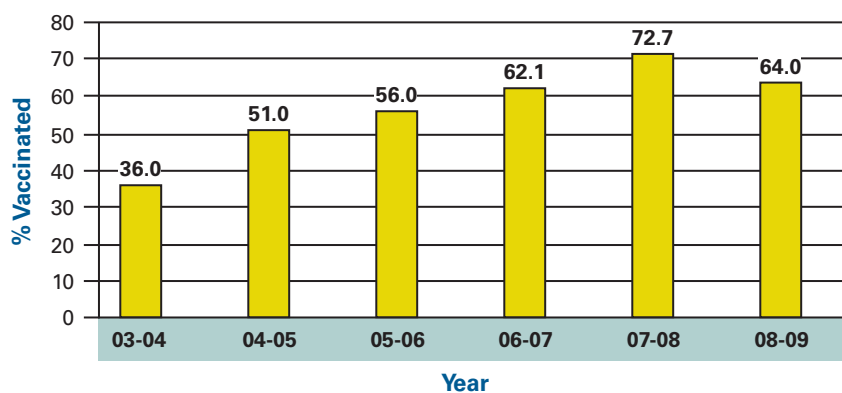
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**Authorship Information:** Concept and design (MEM, FMM, AJG, WPG); acquisition of data (MEM, AJG, OAW, FAS, JAM); analysis and interpreta-

■ **Figure 4.** Influenza Vaccination Coverage in KSC Employees



KSC indicates Kelsey-Seybold Clinic.

tion of data (MEM, FMM, AJG, BJB, JAM, WPG); drafting of the manuscript (MEM, FMM, AJG, BJB, WPG); critical revision of the manuscript for important intellectual content (MEM, FMM, AJG, FAS, JAM); statistical analysis (FMM, OAW); provision of study materials or patients (FMM, FAS); administrative, technical, or logistic support (AJG, JAM).

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