ORIGINAL ARTICLES

Improving Influenza Vaccination Rates in Pregnant Women

Melissa J. Sherman, M.D., Christina A. Raker, Sc.D., and Maureen G. Phipps, M.D., M.P.H.

OBJECTIVE: To determine whether a provider-focused reminder improved vaccination rates as compared with no reminder.

STUDY DESIGN: This was a retrospective cohort study comparing vaccination rates among pregnant patients seen in October and November 2003 (no reminder) and October and November 2005 (provider-focused reminder). Charts of all patients presenting for prenatal care during those months were reviewed for vaccination order. Vaccination rates were calculated and compared by year, provider, age, race, education, primary language, insurance type, and presence or absence of medical risk factors.

RESULTS: A total of 1,367 records were reviewed: 504 from 2003 and 863 from 2005. Overall vaccination rate increased from 15–52% with a provider-focused reminder in place. In our study population medical risk factors were identified in 396 patients (29%). Vaccination rates for patients with medical risk factors increased from 18–47%. All provider groups demonstrated significant increases in the rates of vaccination with a reminder, however, there were no differences in age, race, education, primary language, or insurance.

CONCLUSION: Although a low-cost, provider-focused reminder improved vaccination rates to 52%, additional measures including patient and provider education, dedicated vaccination clinics, and standing orders will be needed to achieve the ACOG goal of 100% vaccination. (J Reprod Med 2012;57:371–376)

…providers themselves may have the most potential to influence vaccination rates in our prenatal clinics.

Keywords: influenza, pregnancy, vaccination.

Influenza vaccination is recommended for all women who will be pregnant during influenza season. Although the ideal time for vaccination is October-November, pregnant patients may receive the vaccine throughout the influenza season.[1,2] Despite both Centers for Disease Control and Prevention (CDC) and American Congress of Obstetricians and Gynecologists (ACOG) recommendations for universal vaccination for pregnant women, the vaccination rate remained < 15% until the H1N1 pandemic of 2009; subsequent survey data showed an increase to 51%, but still less than the Healthy People 2020 goal of 80% vaccination and the ACOG goal of 100%.[2]

The advent of antibiotics and increased access to

From the Department of Obstetrics and Gynecology, Women & Infants Hospital, and the Department of Community Health, Warren Alpert Medical School of Brown University, Providence, Rhode Island.

Presented at American Congress of Obstetricians and Gynecologists District I Meeting, Brewster, Massachusetts, September 6, 2008.

Address correspondence to: Maureen G. Phipps, M.D., M.P.H., Department of Obstetrics and Gynecology, Women & Infants Hospital, 101 Dudley Street, Providence, RI 02905 (mphipps@wihri.org).

Financial Disclosure: The authors have no connection to any companies or products mentioned in this article.

0024-7758/12/5709-10–0371/$18.00/0 © Journal of Reproductive Medicine®, Inc.

supportive care have dramatically decreased the influenza-related mortality rate in pregnancy from 30–50% to <1%; however, influenza continues to cause significant morbidity. Pregnant women with influenza use outpatient and inpatient health care services at a much higher rate than their nonpregnant counterparts,[3] and women in their third trimester are 3–4 times more likely to be hospitalized than their nonpregnant counterparts for influenza-related complications.[4] In women with medical complications such as asthma, the rates of hospitalization for influenza-like illness increase up to tenfold.[5] With the advent of the H1N1 virus there is increased concern for severe morbidity and mortality related to influenza infection.[6]

Many types of interventions to increase influenza vaccination have been evaluated in nonpregnant populations.[7] Reminders, educational initiatives, and standing orders have all demonstrated modest success in improving vaccination rates.[7,8] In pregnancy, although many studies have evaluated patient and provider behavior,[9-13] there are few data on the effectiveness of interventions to increase vaccination. One study evaluated a comprehensive plan including provider education, protocols for screening, and standing orders but did not evaluate the components individually.[14] Another study has shown that patient education with an information pamphlet can increase vaccination rates.[15]

To evaluate whether a single low-cost intervention would have an impact on the rates of influenza vaccination, we evaluated a provider-focused reminder that was instituted in 2005 in a large tertiary care clinic. The purpose of this study was to determine whether the provider reminder increased the rate of influenza vaccination during October and November, the ideal time for vaccination, compared with a prior influenza season. Our hypothesis was that a reminder would increase the overall rate of vaccination for all patients, and that women with chronic disease would be vaccinated at a higher rate than the general obstetric population.

Materials and Methods

We conducted a retrospective cohort study to evaluate the rate of vaccination in 2003, when no reminder was present, and in 2005, when a reminder was placed on each patient's chart. The year 2004 was excluded due to vaccine shortage. All women who presented for prenatal care at the Women and Infants Hospital Women's Primary Care Center in October or November of 2003 and in October or November of 2005 were eligible for vaccination. Exclusion criteria were egg allergy and vaccine allergy. For 2005, outpatient medical records were readily available for review in the clinic; for 2003, however, they had to be retrieved from storage and a total of 132 medical outpatient charts were not available for review. Medical records were reviewed for nursing or provider documentation of vaccination. We also reviewed prenatal intake notes to record demographic information (age, race, language spoken, insurance, level of education), provider type (nurse practitioner, resident, or high-risk clinic), and presence of chronic medical illness. Chronic illness was defined as any illness that would lead to increased morbidity from influenza, such as asthma, diabetes, or immunosuppressive disease. This study was approved by the Women and Infants Hospital Institutional Review Board (IRB # 06-0075).

Assuming $\alpha = 0.05$, $\beta = 0.20$, and a baseline vaccination rate of 15%, the power analysis demonstrated that we would require at least 134 patients per cohort to demonstrate a twofold increase in vaccination rates. Categorical variables were compared by Fisher's exact test. Continuous variables were compared by Student's *t* test or the Wilcoxon rank-sum test as appropriate. The proportions vaccinated in each cohort were compared by the relative risk (RR), risk difference (RD), and their corresponding 95% confidence intervals (95% CIs). The change in vaccination rates between cohorts was also examined separately by provider type, trimester of pregnancy, presence or absence of chronic medical illness, age, race, language spoken, insurance type, and level of education. Data analysis was conducted with SAS 9.2 (SAS Institute, Cary, North Carolina).

Results

A total of 1,367 prenatal patient medical records were reviewed: 504 from 2003 and 863 from 2005. No egg or vaccine allergies were identified. No significant difference was noted between cohorts in terms of age, race, language, insurance, education, or presence of chronic illness (Table I). Median age was 24 years, the majority of patients spoke English, and the majority received public insurance. Approximately one-third of patients were identified as having a chronic medical illness.

Overall vaccination rates improved from 15% in 2003 to 52% in 2005, an absolute increase of 37% ($p < 0.0001$, RR 3.51) (Table II). In 2003 a patient was

Table I *Demographic Characteristics of Study Cohorts*

Characteristic	2003 Cohort No. (%)	2005 Cohort No. (%)	p Value*
Total patients	504	863	
Age (yrs): median (range)	24 (14–44)	24 (13–45)	0.2*
Race/ethnicity			
Hispanic	168 (33)	314 (36)	0.2
White	162 (32)	288 (33)	
Black	127 (25)	192 (22)	
Asian	35 (7)	39 (5)	
Other	11 (2)	25 (3)	
Unknown	1	5	
Primary language			
English	450 (89)	744 (86)	0.3
Spanish	38 (8)	84 (10)	
Other	16 (3)	32 (4)	
Unknown	0	3	
Insurance			
Public	432 (86)	807 (93)	<0.0001
Private	53 (11)	24 (3)	
Other	17 (3)	32 (4)	
Unknown	2	0	
Education			
Junior high school or less	20 (5)	40 (6)	0.05
Some high school	114 (29)	183 (27)	
High school/GED	160 (40)	257 (39)	
College 1–3 yrs	80 (15)	111 (13)	
4–Yr college graduate or more	24 (5)	74 (9)	
Unknown	106	198	
Chronic illness			
Yes	158 (31)	238 (28)	0.2
No	346 (69)	621 (72)	
Unknown	0	4	

*p Value by Wilcoxon rank-sum test. Otherwise, by χ^2 test for categorical data.

less likely to be vaccinated if she was of Hispanic or Asian ethnicity or did not speak English. After introduction of the reminder, vaccination rates improved significantly in all categories (Table III). Vaccination for those of Hispanic ethnicity increased from 12–51% and for Asian ethnicity increased from 9–72%. In Spanish-speaking patients vaccination increased from 3–45% and for other non-English speakers increased from 12–59%. Vaccination rates in 2005 also improved across all education categories. No significant differences in vaccination rates were noted based on insurance type in either cohort.

For patients with chronic illness, vaccination rates did not differ significantly from the rest of the cohort. Vaccination rates increased from 18–48% with a reminder present (Table IV). Asthma and diabetes were the most common identified chronic illnesses. Vaccination increased by 37% in patients with asthma and by 32% in patients with diabetes. Patients with renal disease, chronic anemia, cardiac disease, malignancy, and other pulmonary disease were identified during data collection, but there were not enough patients in these categories for meaningful statistical analysis.

When we reviewed provider data, we found that nurse practitioners had the highest vaccination rate in both cohort years, increasing from 16–56% with a reminder present (Table V). Obstetrics and gynecology residents improved from 13–52%. High-risk clinic providers had the lowest vaccination rates, vaccinating 13% of patients in 2003 and 33% of patients in 2005.

Women were primarily immunized during the second and third trimesters during both influenza seasons. The proportion of women vaccinated in the first trimester increased from 1% in 2003 to 20% in 2005 (Table VI). Of note, >80% of those who presented for their prenatal intake in October or November of 2005 received the vaccine at that first prenatal visit (data not shown).

Discussion

This evaluation demonstrates that a provider-oriented reminder placed directly on the patient chart is an effective intervention to improve vaccination rates in pregnancy. The reminder used in the Women and Infants Hospital Women's Primary Care Center focused on increasing provider awareness of vaccination guidelines and contained a simple outline of recommendations for vaccination in pregnancy, answers to common questions, and a list of high-risk groups. It is a simple, inexpensive intervention that was easily implemented.

It was encouraging to find that in 2005 there was little difference in vaccination rates based on age, race, insurance, or educational level. In Rhode Island most women qualify for state insurance in pregnancy, and all insurance providers reimburse

Table II *Vaccination Rate by Cohort*

Cohort	Total no.	Vaccinated No. (%)	p Value*	RR (95% CI)	RD (95% CI)
2003	504	74 (15)	<0.0001	Referent	Referent
2005	863	445 (52)		3.51 (2.82–4.37)	37.0 (32.5–41.6)

*p Value by χ^2 test.

Table III *Vaccination Rates by Socio-Demographic Characteristics*

Characteristic	2003 Cohort Total no.	2003 Cohort Vaccinated No. (%)	2005 Cohort Total no.	2005 Cohort Vaccinated No. (%)	p Value*	RR (95% CI) 2005 vs. 2003
Age (yrs)						
<20	98	12 (12)	170	97 (57)	<0.0001	4.66 (2.70–8.04)
20–24	171	29 (17)	309	160 (52)	<0.0001	3.05 (2.15–4.33)
25–29	96	14 (15)	205	107 (52)	<0.0001	3.58 (2.17–5.91)
≥30	134	18 (13)	176	81 (46)	<0.0001	3.43 (2.17–5.42)
Race						
Hispanic	168	2 (12)	312	159 (51)	<0.0001	4.08 (2.69–6.17)
White	161	29 (18)	288	142 (49)	<0.0001	2.74 (1.93–3.88)
Black	126	20 (16)	191	97 (51)	<0.0001	3.20 (2.09–4.90)
Asian	35	3 (9)	39	28 (72)	<0.0001	8.38 (2.79–25.16)
Other	11	1 (9)	25	18 (72)	0.001	7.92 (1.20–52.15)
Primary language						
English	448	71 (16)	742	386 (52)	<0.0001	3.28 (2.62–4.11)
Spanish	38	1 (3)	83	37 (45)	<0.0001	16.94 (2.41–118.92)
Other	16	2 (12)	32	19 (59)	0.002	4.75 (1.26–17.92)
Insurance						
Private	69	11 (16)	56	26 (46)	0.001	3.71 (1.67–8.24)
Public	431	62 (14)	804	419 (52)	<0.0001	3.62 (2.85–4.60)
Education						
≤Junior high school	20	4 (20)	40	17 (43)	0.2	2.13 (0.82–5.48)
Some high school	113	13 (11)	181	104 (57)	<0.0001	4.99 (2.95–8.46)
High school graduate/GED	159	21 (13)	256	130 (51)	<0.0001	3.84 (2.54–5.83)
College 1–3 yrs	80	17 (21)	111	59 (53)	<0.0001	2.50 (1.58–3.95)
≥4-Yr college graduate	24	4 (17)	74	32 (43)	0.03	2.59 (1.02–6.59)

RR = relative risk with 2003 as the reference cohort.
*p Value by Fisher's exact test.

for vaccination during pregnancy, so there are no direct patient costs for vaccination. There was a significant difference in 2003 vaccination rates between English- and Spanish-speaking patients; in 2005, however, that difference shrunk by 50% and the overall vaccination rate in Spanish-speaking patients improved by 42%.

In this study vaccination rates improved universally, suggesting that providers themselves may have the most potential to influence vaccination rates in our prenatal clinics. Although provider recommendation is a significant component of vaccination uptake in adults,[12,16] providers overestimate how often they recommend vaccination. In one study 75% of obstetric providers stated they offered vaccine, but only 22% of patients recalled being offered vaccine while pregnant.[17] Other provider barriers often exist to vaccination, including erro-

Table IV *Vaccination Rates by Medical Condition*

Chronic condition	2003 Cohort Total no.	2003 Cohort Vaccinated No. (%)	2005 Cohort Total no.	2005 Cohort Vaccinated No. (%)	p Value*	RR (95% CI) 2005 vs. 2003
Any	158	29 (18)	237	113 (48)	<0.0001	2.60 (1.82–3.70)
Specific disorders						
Asthma	73	14 (19)	141	79 (56)	<0.0001	2.92 (1.78–4.78)
Diabetes	36	4 (11)	35	15 (43)	0.003	3.86 (1.42–10.48)
HIV	0	0 (0)	4	2 (50)	—	—
Immunosuppressive disease	2	0 (0)	8	4 (50)	0.5	—

RR = relative risk with 2003 as the reference cohort.
*p Value by Fisher's exact test.

Table V *Vaccination by Provider Type*

Health care provider	2003 Cohort Total no.	2003 Cohort Vaccinated No. (%)	2005 Cohort Total no.	2005 Cohort Vaccinated No. (%)	p Value*	RR (95% CI) 2005 vs. 2003
Nurse practitioner	262	42 (16)	469	264 (56)	<0.0001	3.51 (2.63–4.69)
Resident	153	21 (13)	271	141 (52)	<0.0001	3.79 (2.51–5.73)
High-risk clinic	87	11 (13)	120	40 (33)	0.001	2.64 (1.44–4.84)

RR = relative risk with 2003 as the reference cohort.
*p Value by Fisher's exact test.

neous beliefs about the indications, safety, or efficacy of vaccine; not stocking vaccine in the practice; or believing that patients are being offered vaccine elsewhere.[13] In providing pertinent information on the reminder about vaccination recommendations, safety, side effects, and answers to common questions, we may have both improved our providers' knowledge base and facilitated their ability to address common patient concerns.

Few data exist regarding the efficacy of interventions to improve influenza vaccination in pregnancy. We demonstrated that even a single intervention can have a significant impact on vaccination rate. In addition to improving the overall rate of vaccination, the reminders dramatically improved vaccination rates for non–English-speaking patients.

A limitation of this study is that, as a retrospective review, we relied on documentation in the clinical record. Although vaccination was reliably documented, provider recommendation and vaccination refusal generally were not. We decided not to use consecutive years for comparison due to a vaccine shortage in 2004. Also in 2004, ACOG recommendations changed from recommending vaccination in the second and third trimesters to recommending universal vaccination in any trimester in pregnancy. Although it is possible that a rebound effect and ACOG changes led to increased vaccination with increased supply in 2005, the CDC data do not demonstrate a significant increase in vaccination (12.8% in 2003 and 15.6% in 2005).[18] In this study the proportion of those vaccinated in the first trimester increased in 2005; however, this increase alone does not account for the overall difference in vaccination, and the majority of vaccinations were in the second and third trimesters. Finally, high-risk patients may have been vaccinated prior to transfer to Maternal-Fetal Medicine by another provider, which was not recorded in the charts.

Although this study demonstrated that a passive intervention increased the rate of vaccination by 37%, total vaccination rate still fell short of ACOG recommendations for 100% vaccination. This study was completed prior to the H1N1 pandemic; although that event increased awareness of morbidity and mortality related to influenza and vaccination rates subsequently have risen, we still need further interventions to achieve universal vaccination. As prenatal care providers we have the unique advantage of regularly scheduled visits during influenza season and multiple opportunities for vaccination. Not only can we protect our patients but also the high-risk groups that often reside in their homes: children under the age of 2, adults older than 65, and people with chronic illness. Reminders are a good initial effort, but achieving universal vaccination will require a multifaceted approach, including reminders, patient and provider education, and standing orders.

Table VI *Gestational Age at Time of Vaccination of Study Cohort*

Gestational age (wks)	2003 Cohort No. (%)	2005 Cohort No. (%)	p Value*
Total vaccinated	74	445	
1–13	1 (1)	88 (20)	<0.0001
14–25	36 (49)	171 (38)	
26–42	37 (50)	186 (42)	

*p Value by Fisher's exact test for overall association.

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