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Session: 278: Vaccines: Influenza
Saturday, October 5, 2019: 12:15 PM

Background: Influenza vaccination has been shown to reduce influenza risk in pregnant women and their infants who are not yet age-eligible for vaccine. Ascertainment of vaccination history is important for vaccine safety and effectiveness evaluations. Our goals were to (a) determine coverage, location, and timing of influenza vaccination and (b) compare a subset of self-reported influenza vaccinations with documented vaccine records.

Methods: We enrolled children < 18 years with acute respiratory illness in 7 pediatric hospitals and emergency departments in the New Vaccine Surveillance Network from December 1, 2016 to October 31, 2018. We interviewed all mothers of enrolled infants < 1 year, and obtained mother’s influenza vaccine information while pregnant. As an option, sites obtained maternal influenza vaccine records from reported sources (e.g., registries, provider records, pharmacies).

Results: Among 5,458 mothers, 2,944 (54%) self-reported receiving influenza vaccine during pregnancy (57% in 2016–2017; 51% in 2017–2018), varying from 49% to 74% by site. Among self-reported vaccinees, 17%, 36%, and 47% received vaccine during the first, second, and third trimester, respectively. Most women (76%) were vaccinated at their OB/GYN or midwife office, 7% at their primary care provider, 7% at their workplace, and 5% at a retail pharmacy. Among 1,338 infants < 6 months, during early influenza season (i.e., born from June to August) and thus ineligible for vaccination, only 46% of mothers reported receiving vaccine during pregnancy (42% reported not receiving it, 12% were unsure). Of 2,242 women for whom vaccine verification was attempted, 1,491 (67%) self-reported receiving influenza vaccine during pregnancy; of those, documentation of vaccine receipt was found for 901 (60%).

Conclusion: Influenza vaccination coverage among women was sub-optimal, potentially increasing the risk of influenza in uncomplicated pregnant women. Infants born to uncomplicated vaccinated women, particularly those born from June to August, may also be at higher risk since they are not age-eligible to receive vaccine before influenza season. The optimal approach to ascertainment of maternal vaccination history with accuracy and completeness merits further investigation.

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2741. Seasonal Influenza Vaccine Timing in Children and Adults Hospitalized with Influenza in the United States, FluSurv-NET, 2013–2017

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Session: 278. Vaccines: Influenza
Saturday, October 5, 2019: 12:15 PM

Background: Seasonal influenza vaccine may attenuate disease severity among people infected with influenza despite vaccination, but vaccine effectiveness may decrease with increasing time between vaccination and infection. Patient characteristics may play a role in the timing of vaccine receipt.

Methods: We used data from the Influenza Hospitalization Surveillance Network (FluSurv-NET) and included patients ≥9 years hospitalized with laboratory-confirmed influenza during October 1–April 30 of influenza seasons 2013–2014 through 2016-2017 who received seasonal influenza vaccine ≥14 days prior to admission. Vaccine history was obtained from vaccine registries, medical charts, and patient interviews. We defined "early vaccination" as vaccine receipt before October 15 and "late vaccination" as receipt after (date selected using typical seasonal onset and median vaccination dates). Early and late groups were compared using Chi-square or Fisher exact tests.

Results: Among 21,751 vaccinated patients, 61% received vaccine before October 15, and distribution of vaccination date was similar across seasons (figure). Vaccination occurred earlier with increasing age (45% were vaccinated early among those 9–17 years but 65% in those ≥80 years, P < 0.01). White non-Hispanic patients were more likely to receive vaccine early compared with black non-Hispanic and Hispanic patients (63% vs. 55% and 54%, P < 0.01). Those with metabolic disorders, cardiovascular disease, kidney disease, and cancer were vaccinated earlier whereas those with HIV and liver disease were vaccinated later. Vaccine timing also varied by state (P < 0.01) but not by sex.

Conclusion: Among influenza-vaccinated older children and adults hospitalized with influenza, older age, white race, and certain medical conditions were associated with early receipt of influenza vaccination in unadjusted analysis. This may be due to frequent healthcare encounters and targeted public health strategies in high-risk groups. Understanding how timing of vaccine receipt varies among populations can provide insights into variables that must be controlled for in studying possible vaccine effectiveness and attenuation of disease among those who are dually vaccinated despite vaccination.

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2742. The Impact of Influenza Vaccination on Antibiotic Use in the United States, 2010–2017

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Background: Antibiotic resistance is a cause of morbidity and mortality driven by inappropriate prescribing. In the United States, a third of all outpatient antibiotic prescriptions may be inappropriate. Seasonal influenza rates are significantly associated with antibiotic prescribing rates. The impact of influenza vaccination coverage on antibiotic prescribing is unknown.

Methods: We conducted a retrospective analysis of state-level vaccination coverage and antibiotic prescribing rates from 2010 to 2017. We used fixed effects regression to analyze the relationship between cumulative vaccine coverage rates for a season and the per capita number of prescriptions for systemic antibiotics for the corresponding season (January–March) controlling for temperature, poverty, healthcare infrastructure, population structure, and vaccine effectiveness.

Results: Rates of vaccination coverage ranged from 33% in Nevada to 52% in Rhode Island for the 2016–2017 season, while antibiotic use rates ranged from 25 prescriptions per 1,000 inhabitants in Alaska to 376 prescriptions per 1,000 inhabitants in West Virginia (Figure 1). Vaccination coverage rates were highly correlated with reduced prescribing rates, and controlling for other factors, we found that a one percent increase in the influenza vaccination rate was associated with -1.40 (95% CI: -2.22–-0.57, P < 0.01) fewer antibiotic prescriptions per 1,000 inhabitants (Table 1). Increases in the vaccination coverage rate in the pediatric population (aged 0–18) had the strongest effect, followed by the elderly (aged 65+).

Conclusion: Vaccination can reduce morbidity and mortality from seasonal influenza. Though coverage rates are far below levels necessary to generate herd immunity, we found that higher coverage rates in a state were associated with lower antibiotic prescribing rates. While the effectiveness of the vaccine varies from year to year and the factors that drive antibiotic prescribing rates are multi-factorial, these results suggest that increased vaccination coverage for influenza would have significant benefit in terms of reducing antibiotic overuse and correspondingly antibiotic resistance.

Table 1. Antibiotic prescriptions (per 1,000 inhabitants) in communities with at least 1,000 inhabitants, US 2010-2017

| State | All Ages | 0-18 yrs old | 19-64 yrs old | 65+ yrs old |
|-------|---------|-------------|-------------|------------|
| Coverage (percent) | 33% | 45% | 45% | 33% |
| Deaths due to influenza per 100,000 population | 0.12 | 0.10 | 0.10 | 0.12 |
| Offspring rate for 10-19 year old population forgotten | 0.05 (95% CI: 0.04–0.06) | 0.05 (95% CI: 0.04–0.06) | 0.05 (95% CI: 0.04–0.06) |
| Percentage of population with antibiotic resistance | 0.05 (95% CI: 0.04–0.06) | 0.05 (95% CI: 0.04–0.06) | 0.05 (95% CI: 0.04–0.06) |
| Prescription rate per 1,000 inhabitants | 376 | 376 | 376 | 376 |

Note: CI = confidence interval, *P < 0.05, **P < 0.01

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Figure 1: Antibiotic prescriptions and influenza vaccination coverage for each state, United States, 2016-2017

(A) Antibiotic prescribing rate of antibiotics from January 2017 to March 2017 by state; (B) Influenza vaccination coverage percent for populations 6 months to 16 years of age for 2016-2017 influenza season. Source: CDC FluView, IQVIA MIDAS, 2006-2015, IQVIA Inc. All rights reserved.

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