22. Description of Hospitalized Patients with Influenza Vaccine Failure

Joanna Kimball, MD; Yuwei Zhu, MS, MD, MD; Dayna Wyatt, Registered Nurse; Helen Talbot, MD, MPH; Vanderbilt University Medical Center, Westwood, Kansas; Vanderbilt University, Nashville, Tennessee; Vanderbilt University, Nashville, Tennessee

Session: P-2. Adult Vaccines

Background: Despite influenza vaccination, some patients develop illness and require hospitalization. Many factors contribute to vaccine failure, including mismatch of the vaccine and circulating strains, waning immunity, timing of influenza season, age and patient comorbidities such as immune function. This study compared vaccinated, hospitalized patients with and without influenza.

Methods: This study used 2015–2019 Tennessee data from the US Hospitalized Adult Influenza Vaccine Effectiveness Network database. Enrolled patients were ≥18 years vaccinated for the current influenza season and admitted with an acute respiratory illness. Patient or surrogate interviews and medical chart abstractions were performed, and influenza vaccinations were confirmed by vaccine providers. Influenza PCR testing was performed in a research lab. Statistical analyses were performed with STATA and R using Pearson’s chi-squared, Kruskal-Wallis and Wilcoxon rank-sum tests and multivariable logistic regression.

Results: 1236 patients met study criteria, and 235 (19%) tested positive for influenza. Demographics, vaccines and comorbidities were similar between the two groups (Table 1) except for morbid obesity, which was more common in influenza-negative patients (13% vs 8%, P = 0.04), and immunosuppression, which was more common in the influenza positive (63% vs 54%, P = 0.01). Logistic regression analysis demonstrated older patients (OR 1.47, 95% CI 1.03–2.10) and immunosuppressed patients (OR 1.25–2.75) were at increased risk for influenza (Table 2 and Figure 1). Immunosuppression also increased the risk for influenza A/H3N2 (OR 1.86, 95% CI 1.25–2.75). A sensitivity analysis was performed on patients who self-reported influenza. Results: 1236 patients met study criteria, and 235 (19%) tested positive for influenza. Demographics, vaccines and comorbidities were similar between the two groups (Table 1) except for morbid obesity, which was more common in influenza-negative patients (13% vs 8%, P = 0.04), and immunosuppression, which was more common in the influenza positive (63% vs 54%, P = 0.01). Logistic regression analysis demonstrated older patients (OR 1.47, 95% CI 1.03–2.10) and immunosuppressed patients (OR 1.56, 1.15–2.12) were at increased risk for influenza (Table 2 and Figure 1). Immunosuppression also increased the risk for influenza A/H3N2 (OR 1.86, 95% CI 1.25–2.75). A sensitivity analysis was performed on patients who self-reported influenza vaccination for the current season without vaccine verification and demonstrated older patients (OR 1.47, 95% CI 1.03–2.10) and immunosuppressed patients (OR 1.25–2.75) were at increased risk for influenza (Table 2 and Figure 1). Immunosuppression also increased the risk for influenza A/H3N2 (OR 1.86, 95% CI 1.25–2.75). A sensitivity analysis was performed on patients who self-reported influenza vaccination for the current season without vaccine verification and demonstrated older patients (OR 1.47, 95% CI 1.03–2.10) and immunosuppressed patients (OR 1.25–2.75) were at increased risk for influenza (Table 2 and Figure 1). Immunosuppression also increased the risk for influenza A/H3N2 (OR 1.86, 95% CI 1.25–2.75).

Table 1: Demographics of influenza positive versus influenza negative patients in influenza vaccinated, hospitalized patients.

| N = 1236 | Influenza positive (N=235) | Influenza negative (N=1001) | p-value |
|----------|---------------------------|-----------------------------|---------|
| Gender – no. (%) | Male 48 (20%) | 444 (44%) | 0.20 |
| Race – no. (%) | Female 137 (60%) | 537 (56%) |
| African-American | 57 (24%) | 278 (28%) | 0.43 |
| Asian | 0 | 7 (0.7%) |
| White | 182 (77%) | 767 (77%) |
| Other | 4 (2%) | 4 (0.4%) |
| Pregnant at time of enrollment | 0 | 9 (0.9%) | 0.15 |
| Self-reported being vaccinated for current influenza season – no. (%) | 144 (63%) | 576 (58%) | 0.19 |
| Vaccine type – no. (%) | Standard (inactivated, quadrivalent, recombinant, cell culture) 135 (59%) | 425 (43%) | 0.21 |
| High-dose and adjuvanted | 94 (41%) | 360 (36%) |
| Median time between vaccine and symptom onset date – days | 120 (95, 140) | 114 (77, 150) | 0.36 |
| Any immunosuppression | 147 (63%) | 537 (54%) | 0.01 |
| Smoking (including vaping) in past 6 mo | 58 (25%) | 261 (26%) | 0.72 |
| Home OS use prior to admission | 48 (44%) | 201 (19%) | 0.15 |
| Cancer (including hematology) | 53 (14%) | 130 (13%) | 0.46 |
| Heart disease | 133 (39%) | 564 (56%) | 0.97 |
| Lung disease | 121 (51%) | 595 (59%) | 0.07 |
| Kidney disease (including NS) | 94 (32%) | 210 (21%) | 0.03 |
| Diabetes mellitus | 80 (33%) | 374 (37%) | 0.83 |
| Liver disease | 15 (5%) | 87 (8%) | 0.79 |
| Metabolic | 17 (6%) | 131 (13%) | 0.04 |

Table 2: Logistic regression analyses of vaccinated, hospitalized influenza positive patients; vaccinated, hospitalized patients with influenza A subtypes and self-reported vaccinated, hospitalized influenza positive patients.

| Variable | Odds Ratio (95% CI) | p-value |
|----------|---------------------|---------|
| Age < 65 yrs | 1.00 (0.53–1.90) | 0.99 |
| Age ≥ 65 yrs | 1.00 (0.53–1.90) | 0.99 |
| Immunosuppression | 1.00 (0.53–1.90) | 0.99 |
| Smoking (including vaping) in past 6 mo | 1.00 (0.53–1.90) | 0.99 |
| High-dose and adjuvanted | 1.00 (0.53–1.90) | 0.99 |
| Median time between vaccine and symptom onset date – days | 1.00 (0.53–1.90) | 0.99 |
| Any immunosuppression | 1.00 (0.53–1.90) | 0.99 |
| Smoking (including vaping) in past 6 mo | 1.00 (0.53–1.90) | 0.99 |
| Home OS use prior to admission | 1.00 (0.53–1.90) | 0.99 |
| Cancer (including hematology) | 1.00 (0.53–1.90) | 0.99 |
| Heart disease | 1.00 (0.53–1.90) | 0.99 |
| Lung disease | 1.00 (0.53–1.90) | 0.99 |
| Kidney disease (including NS) | 1.00 (0.53–1.90) | 0.99 |
| Diabetes mellitus | 1.00 (0.53–1.90) | 0.99 |
| Liver disease | 1.00 (0.53–1.90) | 0.99 |
| Metabolic | 1.00 (0.53–1.90) | 0.99 |

Figure 1: Predicted Probability of Hospitalization with Influenza, Influenza A/H1N1 and Influenza A/H3N2 in Vaccinated Patients by Age.