Figure 1. Serum Neutralization Titers Post-Vaccination

Plaque reduction neutralization test (PRNT) antibody titers for Quad M2SR and QIV against matched Influenza B vaccine strain B/Colorado/06/2017 (Fig. 1A) and drifted strain B/Brisbane/60/2008 (Fig. 1B) on pre-study (Day -3), pre-vaccination (Day 28), and 3 weeks post vaccination (Day 51). The detection limit of the assay (horizontal dashed line) was 15 PRNT50.

Figure 2. Post-challenge body weight and temperature changes

Percent body weight changes (Fig. 2A) and average body temperatures changes (Fig. 2B) following challenge with drifted Influenza B strain B/Brisbane/60/2008 for ferrets vaccinated with Quad M2SR or QIV.

Viral titers in nasal washes (Fig. 3A) and nasal turbinates (Fig. 3B) collected post-challenge with Influenza B strain B/Brisbane/60/2008 in ferrets vaccinated with Quad M2SR or QIV. No virus was detected in the trachea or lungs. The detection limit of the assay (horizontal dashed line) was 1.5 log10 TCID50/mL and 20 FFU respectively. Virus titer between groups was significant on day 3 of the nasal washes: one-way analysis of variance (ANOVA) with Multiple t tests to compare between groups, #p<0.05, ××p<0.01, ×××p<0.001.

Conclusion. Despite eliciting similar Ab titers, the Quad M2SR demonstrated superior protection compared to QIV in a drifted influenza B challenge model in ferrets. These results suggest that the intranasal M2SR platform may confer additional advantages over currently available vaccines. Quad M2SR is in late-stage development for testing in a first-in-human clinical study.

Disclosures. Lindsay Hill-Batorski, PhD, FluGen (Employee); Yasuko Hatta, DVM, PhD, FluGen (Employee); Michael Moser, PhD, FluGen (Employee); David Marshall, BS, FluGen (Employee); Pamuk Bilsel, PhD, FluGen (Employee).

11. People Living with HIV During the COVID-19 Pandemic: Who Did (or Did Not) Receive Annual Influenza Vaccination?

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Session: P-02. Adult Vaccines

Background. Nationally, younger adults and racial minorities have lower levels of influenza vaccination (influenza vaccination = vaccine) than non-Hispanic White adults. During the 2015-16 season, most vaccine decliners in our program were male, black, and 45-66 years of age. As part of a quality improvement (QI) initiative to increase 2020-21 vaccine coverage amongst PLWH, we sought to compare patient characteristics between vaccine recipients and non-recipients.

Methods. Our program cares for 60% of Delawareans with HIV. The largest site in Wilmington was the QI site. IRB exemption was received, and pre-defined sociodemographic and HIV-specific variables were extracted from the EMR and CareWare from 1 Oct 2020 through 31 March 2021. Patient reports of external vaccine required confirmation. All PLWH ≥ 18 years of age, including those newly establishing care, met eligibility criteria. Comparisons between vaccinated and unvaccinated PLWH were performed using Wilcoxon rank sum tests for continuous variables and chi-squared tests for categorical variables. A multivariable logistic regression model, including age, sex, race, insurance, poverty level, HIV status, and virologic suppression, was used to predict vaccine.
Results. 780 patients met study inclusion criteria and 86% (667/780) received vaccine. Characteristics of PLWH with and without vaccine are presented in Table 1. Older age, lower HIV viral load, and virologic suppression had a statistically significant (p < 0.05) association with vaccine receipt in unadjusted analysis. Only older age (p = 0.01) was significantly associated with vaccine in logistic regression modeling (Table 2), however this relationship was non-linear. 

Table 1. Characteristics of patients living with HIV during the 2020-2021 Influenza vaccination season

| Characteristic | Vaccine Yes | Vaccine No | p-value |
|---------------|-------------|------------|---------|
| Age (y) | 49 (39.4%) | 28 (22.7%) | 0.032 |
| % Federal Poverty Level | 63 (55.6%) | 49 (42.9%) | 0.054 |
| Virologic Suppression | 61 (57.1%) | 34 (26.9%) | 0.002 |
| Sex | 14 (12.4%) | 7 (5.5%) | 0.001 |
| Race | 22 (20.0%) | 12 (9.6%) | 0.004 |
| Insurance | 22 (20.0%) | 12 (9.6%) | 0.004 |
| Medicare: Medicaid | 12 (10.7%) | 6 (4.8%) | 0.092 |
| Private: Medicaid | 36 (31.5%) | 26 (20.8%) | 0.002 |

Conclusion. A very high rate of PLWH received vaccine, far exceeding local and national benchmarks, with EMR data unlikely to have fully captured all vaccines. The role of the COVID-19 pandemic in vaccine amongst PLWH is not yet known. While older age was associated with vaccine in adjusted analysis, the number of unvaccinated PLWH was small, confidence intervals wide, and associations consequently weak. Larger studies are needed to further investigate factors associated with vaccine receipt amongst PLWH.

Disclosures. Deborah A. Kahal, MD, MPH, FACP, Gilead (Speaker’s Bureau) Viiv (Speaker’s Bureau)

12. Modeled Impact of the COVID-19 Pandemic and Associated Reduced Adult Vaccination on Herpes Zoster in the United States

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Background. During the COVID-19 pandemic, adult vaccination in the United States (US) decreased substantially in 2020. Unlike other vaccine-preventable diseases where individuals may have experienced reduced risk due to COVID-related mitigation efforts (e.g., lockdown restrictions, use of face masks), individuals remained at risk of herpes zoster (HZ). This study projects the impact of reduced recombinant zoster vaccine (RZV) use on HZ cases and complications in the US.

Methods. A multi-cohort Markov model estimated the impact of missed RZV vaccinations, by comparing scenarios with and without missed vaccinations between Apr-Dec 2020, on cases of HZ, postherpetic neuralgia (PHN), and quality-adjusted life years (QALYs) among US adults aged ≥ 50 years. Epidemiology, RZV efficacy, and utility inputs were obtained from standard US sources, clinical trial data, and published literature. Missed doses were estimated using data on RZV doses and an assumed 43% reduction in RZV vaccinations during the pandemic, based on publicly available data. Deterministic sensitivity and scenario analyses were conducted.

Results. In 2020, approximately 21 million (M) RZV distributed doses were expected, including an estimated 9.2M RZV series initiations in Apr-Dec. An estimated 3.9M RZV series initiations were missing, resulting in 31,945 projected HZ cases, 2,714 PHN cases, and 610 lost QALYs when compared over a 1-year follow up. If individuals with missed RZV initiations remain unvaccinated in 2021, avoidable HZ cases will increase to 63,117 over 2 years. Further, if the same number of RZV initiations are missed in 2021, 95,062 avoidable HZ cases are expected. In a sensitivity analysis assuming 30% RZV reduction, 18,920 avoidable HZ cases and 1,531 PHN cases were observed when individuals with missed RZV initiations remain unvaccinated in 2021.

Conclusion. Adding to the substantial COVID-19 infection-related morbidity and mortality, reduced RZV use during the pandemic resulted in further burden from avoidable HZ cases. Health care providers should continue to emphasize the importance of vaccination against HZ and other preventable diseases during the pandemic.

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13. The Efficacy and Effectiveness of Pneumococcal Vaccines against Pneumococcal Pneumonia among Adults: A Systematic Review and Meta-Analysis

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Session: P-02. Adult Vaccines

Background. Two pneumococcal vaccines are currently recommended for use in U.S. adults: 23-valent pneumococcal polysaccharide vaccine (PPSV23) and 13-valent pneumococcal conjugate vaccine (PCV13). Recommendations for adult PCV13 use were supported by a large randomized-controlled trial (RCT) demonstrating PCV13 efficacy against pneumococcal pneumonia (PPn) and vaccine-type (VT) PPn in older adults. New pneumococcal conjugate vaccines are expected to be licensed for adults in late 2021 and recommendations for use among adults will be reviewed and revised, as needed. We conducted a systematic review to summarize evidence on the vaccine efficacy and effectiveness (VE) of PPSV23 and PCV13 against PPn among adults.

Methods. We conducted a search of literature published from 1998 to February 2021 on PCV13 and PPSV23 VE studies using eight reference databases. Studies targeting adults with immunocompromising conditions were excluded. VE results with 95% confidence intervals (CI) were abstracted and stratified by vaccine product, outcome evaluated (PPn and VT PPn), study design, and effect measure. When applicable, random effects models were used to estimate pooled VE and I-squared statistic was reported to assess heterogeneity.

Results. Of 3,422 screened studies, we included 15 studies three on PCV13 and 12 on PPSV23 (Table 1). In addition to the RCT, we identified two observational studies for Table 1 (PCV13); however, pooled VE of the observational studies was not estimated due to differences in methods for reporting results. Pooled PPSV23 VE against PPn from two RCTs was 63% (95% CI: 31, 80 I-squared = 0%). Pooled VE of PCV13 against VT PPn from three observational studies was 18% (95% CI: 35, 35 I-squared = 38%). PPSV23 effectiveness against PPn was limited with a pooled VE of 25% (95% CI: 7, 39 I-squared = 78%) from nine observational studies.

Table 1. Vaccine efficacy and effectiveness of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine against pneumococcal pneumonia outcomes

| Author | Study Design | VE against PPn (95% CI) | VE against VT PPn (95% CI) |
|--------|-------------|-------------------------|---------------------------|
| PCV13 | RCT | 41 (14 to 61) | 29 (6 to 46) |
| PPSV23 | RCT | 32 (13 to 52) | 31 (13 to 52) |
| Allagan 2008 | RCT | 91 (85 to 95) | 95 (86 to 98) |
| Maryante 2010 | RCT | 60 (23 to 79) | 10 (5 to 15) |
| Kim 2019 | Case-control | 74 (54 to 89) | 99 (58 to 99) |
| Suzuki 2010 | Case-control | 77 (74 to 90) | 95 (80 to 99) |
| Vila-Corcoles 2009 | Case-control | 61 (47 to 75) | 85 (74 to 92) |
| Lawrence 2015 | RCT | 20 (13 to 40) | 20 (13 to 40) |
| Suzuki 2010 | RCT | 72 (59 to 86) | 72 (59 to 86) |
| Witterman 2012 | RCT | 31 (21 to 42) | 31 (21 to 42) |
| Elder 2000 | RCT | 35 (18 to 51) | 35 (18 to 51) |
| Ottovazzi 2004 | Cohort | 48 (35 to 61) | 48 (35 to 61) |
| Vila-Corcoles 2009 | Cohort | 39 (26 to 53) | 39 (26 to 53) |
| Vila-Corcoles 2007 | Cohort | 41 (35 to 48) | 41 (35 to 48) |

Abbreviations: CI, confidence interval; VT, non-bactericidal; PPn, pneumococcal pneumonia; RCT, randomized-controlled trial; VT, test negative design; VE, vaccine efficacy or effectiveness; PPn, pneumonia; VT PPn, vaccine-type pneumonia.

*This study reported vaccine efficacy or effectiveness for pneumococcal pneumonia, not specifically non-bactericidal vaccine-type pneumococcal pneumonia.

**This study reported vaccine efficacy or effectiveness for pneumococcal pneumonia, not specifically non-bactericidal vaccine-type pneumococcal pneumonia.