Improving influenza vaccine uptake among patients at high-risk for influenza-related complications

Michael L. Jackson, Roy Pardee, Yates Coley, Emily Westbrook, Sharon Fuller, Tyler R. Ross, Sarita Hemmady, Paula Lozano, David Arterburn, David Rankey

KAISER PERMANENTE®
Kaiser Permanente Washington Health Research Institute

Kaiser Permanente Washington

Introduction

In theory, predictive risk stratification offers health systems the ability to target resources to individuals with highest need. In practice, identifying and executing effective, affordable, low-liability applications of predictive risk scores has been challenging. Influenza vaccination is one promising target for intervention.

Influenza vaccination is the best available tool for reducing hospitalizations and deaths due to influenza. However, influenza vaccine uptake remains sub-optimal, particularly among high-risk individuals. For example, seniors (adults aged ≥65 years) are at high risk of influenza-related complications, but only 60% of U.S. seniors were vaccinated against influenza during the 2017/18 influenza season.

Kaiser Permanente Washington (KPWA) is an integrated health care delivery system in Washington State. KPWA's 700,000 members receive most of their ambulatory health care, both primary and specialty, through KPWA's medical centers. Influenza vaccines are offered every year at no cost to members. **During the 2018/19 influenza season, the KPWA Learning Health System team implemented a phone-based outreach to improve influenza vaccine coverage among high-risk KPWA members.**

Identifying high-risk members

Adjusted Clinical Group (ACG) hospitalization risk scores are computed every month for all KPWA members based on medical encounters in the previous year. **We first evaluated whether the ACG hospitalization risk score predicts risk of influenza-related hospitalizations.** For this, we identified all KPWA members enrolled as of 1 August 2017.

Among these members we identified any hospitalizations for acute respiratory illness (ARI, a proxy for influenza) between 1 December 2017 and 30 April 2018. ARI hospitalizations were defined based on International Classification of Diseases, Version 10 (ICD-10) codes assigned to the principal diagnosis at hospital discharge.

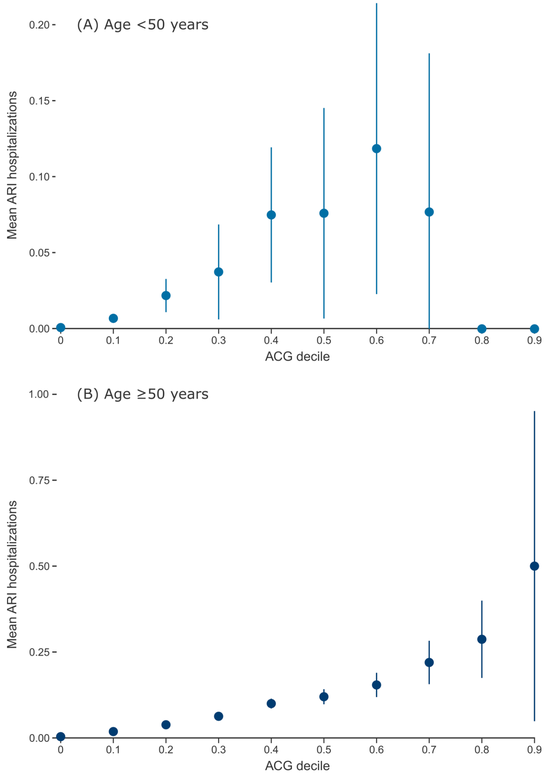
We evaluated ACG risk score as a predictor of ARI hospitalization risk in terms of calibration (the match between predicted risk and observed hospitalizations) and discrimination (the ability of ACG to separate those who do vs. do not get hospitalized for ARI). We assessed discrimination by computing c-statistics for predicted vs. observed risk, and calibration by comparing observed risk with deciles of predicted risk. We evaluated ACG stratified by age (<50 vs. ≥50 years) **(Table).**

Table: Characteristics of KPWA members used in evaluating Adjusted Clinical Group (ACG) risk score as a predictor of Acute Respiratory Illness (ARI) hospitalization

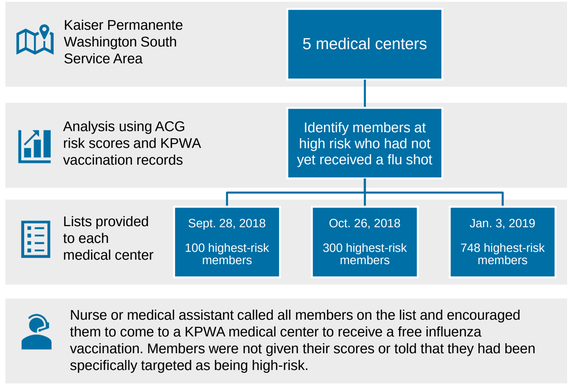
Age group	Number of members	Median ACG risk score (interquartile range)	Incidence of ARI hospitalization (per 1,000 persons)
<50 years	260,583	0.0096 (0.0063, 0.0173)	1.2
≥50 years	243,882	0.0509 (0.0294, 0.0993)	11.6

ACG risk score predicted ARI hospitalization risk in members aged ≥50 years. The ACG score showed very good discrimination (**c-statistic = 0.83**). ACG risk score was also well-calibrated to ARI risk, with hospitalization risk increasing with increasing ACG deciles (Figure 1). The ACG risk score was not as effective at predicting ARI hospitalization risk in members aged <50 years. While it showed good discrimination (c-statistic = 0.75), ARI hospitalizations were rare enough that ACG calibration was questionable **(Figure 1).**

Figure 1: Mean acute respiratory illness (ARI) hospitalizations by ACG risk decile, among KPWA members aged <50 years (A) and among members aged ≥50 years (B)



Influenza vaccination intervention



Effectiveness of the intervention

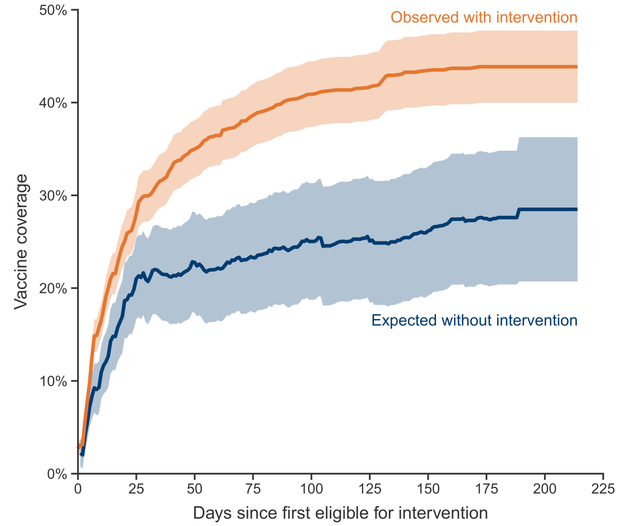
We used a "ratio-of-ratios" approach to evaluate the effectiveness of this intervention at improving influenza vaccine uptake among high-risk KPWA members. For this, we first estimated the hazard ratio for influenza vaccine uptake among the highest-risk KPWA members in the South Service Area between the 2017/18 (non-intervention) and the 2018/19 (intervention) influenza seasons. We then estimated the hazard ratio for influenza vaccine uptake among the highest-risk members in KPWA's North Service Area (which did not receive the intervention) between the 2017/18 and 2018/19 influenza seasons. Finally, we calculated the ratio of these two hazard ratios to estimate the impact of the intervention. Hazard ratios were adjusted for age, ACG risk score, and influenza vaccination history.

The adjusted "ratio-of-ratios" hazard ratio was 1.8 (95% confidence interval: 1.6 - 2.1) (Figure 2). In other words, on any given day, KPWA members in the intervention group were 1.8 times more likely to receive influenza vaccine than they would have been had the intervention not occurred. **The estimated number needed to treat (NNT) was 5.8**, meaning that one additional member was vaccinated for every 5.8 members contacted**.**

*This work was conducted as part of **Kaiser Permanente Washington's Learning Health System (LHS) Program**. The LHS Program brings research and care delivery together in partnerships that support effective implementation of evidence-based interventions*

Contact: Michael.L.Jackson@kp.org | https://www.kpwashingtonresearch.org/

Figure 2: Influenza vaccination coverage observed with intervention vs. expected in the absence of intervention, by days since first eligibility for intervention



Conclusions

Finding acceptable uses of predictive risk scores can prove challenging in health care systems. Communicating patients' predictive risk scores to providers may require a substantial investment in provider education/training in the proper interpretation and use of these scores. Communicating risk scores directly to patients requires educating them on interpreting risk and may create concerns about liability in the event that risk scores are perceived to be inaccurate.

In this intervention, we used predictive risk scores to identify KPWA members at high risk for influenza-related complications, followed by outreach to encourage influenza vaccination for these members. By generating lists of high-risk patients to contact without providing individual risk scores, care delivery staff were not required to interpret predictive risk scores or communicate these scores directly to patients. Patients were also not required to interpret risk scores but were simply encouraged to seek influenza vaccination. This brief, low-cost, targeted intervention was associated with increased influenza vaccine uptake among high-risk patients. **Based on these findings, KPWA has adopted this intervention across the entire health system.**