

Session: OS198 Changing landscape of community-acquired respiratory infections and treatment options

Category: 2c. Community-acquired respiratory infections

25 April 2017, 15:06 - 15:16
OS0996

Rethinking number-needed-to-vaccinate for adult pneumococcal conjugate vaccine in the United States: accounting for long-term public health impact against Community-Acquired Pneumonia

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Background: We compared methodologies for calculating the number-needed-to-vaccinate (NNV) with 13-valent pneumococcal conjugate vaccine (PCV13) to prevent one case of community-acquired pneumonia (CAP) among adults 65 and older. Specifically, we compared NNV estimates using annual absolute rate differences (as was originally used by CDC in 2014 to inform Advisory Committee on Immunization Practices deliberations regarding use of pneumococcal vaccines for adults 65 and older) to NNV estimates derived by calculating absolute risk reduction over a five-year period.

Material/methods: We constructed a basic hypothetical fixed cohort of 200,000 adults aged 65 and older equally separated into two groups: PCV13-vaccinated and PCV13-unvaccinated. We incorporated the same conservative assumptions used by CDC in 2014 regarding the annual incidence rate of hospitalized (1,375 per 100,000) and outpatient (2,010 per 100,000) CAP, the initial (2014) proportion of adult CAP that was PCV13-type (10.0%), and efficacy of PCV13 against vaccine-type CAP (45.0%). To model effects of PCV13 over time, we also assumed (i) an annual mortality rate of 5.0% for all persons, (ii) that the percentage of adult CAP that is caused by PCV13 serotypes declined over 5 years due to herd effects from the pediatric PCV13 program (starting at 10.0% in year 1 and declining linearly to a conservative 2.0% by year 5), and (iii) that PCV13 efficacy did not wane over 5 years.

Results: Among US adults 65 and older, the estimated NNV to prevent one hospitalized and one outpatient case of CAP with PCV13 as originally calculated by CDC in 2014 were 1,620 and 1,110, respectively. After accounting for five-year cumulative effects, however, the NNV with PCV13 to prevent one hospitalized case and one outpatient case of CAP over five years were estimated to be only 469 (Figure) and 321, respectively. NNV to prevent any CAP (inpatient or outpatient) over five years with a single administration of PCV13 was 190.

Conclusions: Given that PCV13 likely provides durable protection in adults 65 and older, it is particularly critical to account for the cumulative preventive effects of PCV13 vaccination over time. We demonstrated that failing to do so, even when using conservative disease burden parameters, can grossly underestimate the public health impact of adult PCV13 use.

Figure Number-Needed-to-Vaccinate with 13-valent Pneumococcal Conjugate Vaccine (PCV13) to Prevent One Case of Hospitalized Community-Acquired Pneumonia by Time Horizon

