Cost-effectiveness of adult vaccinations: Results from two literature reviews

Andrew Leidner PhD
Economist
Berry Technology Solutions
Contractor for Immunization Services Division

National Adult and Influenza Immunization Summit

May 14, 2019

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Outline

- Background on cost-effectiveness
- Study 1: “Cost-effectiveness of adult vaccinations: A systematic review”
- Study 2: “A review of the cost-effectiveness of adult influenza vaccination and other preventive services” (with contractor Battelle)
Cost-effectiveness analysis

- **Purpose**
  - Evaluate two or more strategies (or interventions) designed to improve health
    - Vaccination vs. no vaccination
  - Estimate a cost per health outcome gained for an intervention

- **Important terminology**
  - Cost-effectiveness ratios
  - Quality-adjusted life-years

---

**Simple cost-effectiveness model**

- **No vaccine scenario:**
  - Susceptible: 1 billion
  - Infection: 4 million cases
  - Doctor visit: $200 / visit
  - Total: $800 million

- **Vaccination scenario:**
  - Susceptible: 1 billion
  - Infection: 2 million cases
  - Doctor visit: $200 / visit
  - Vaccinated: 500 million vaccinations
  - Vaccine: $1 / vaccine
  - Total: $900 million
Cost-effectiveness analysis

What is a cost-effectiveness ratio?
- An estimated cost per health outcome gained, comparing two strategies

$900M - $800M = $100M
2M averted cases - 0 averted cases = $50 / case averted

Common health outcomes

- Cases averted
- Deaths averted
  - Assumption: death of a 5 year old is equal to death of a 90 year old
- Life years
  - Based on life expectancy
- Quality-adjusted life-years (QALYs)
- Disability-adjusted life-years (DALYs)
Quality-adjusted life-years (QALYs)

- Accounts for length of life and quality of life
  - One year of perfect health = 1.0 QALY
  - One year of death = 0.0 QALY
  - One year of non-perfect health > 0.0 and < 1.0

Outline

- Background on cost-effectiveness analyses
  - Results presented as costs effectiveness ratios ($/QALY)
  - Study 1: “Cost-effectiveness of adult vaccinations: A systematic review”
  - Study 2: “A review of the cost-effectiveness of adult influenza vaccination and other preventive services”
Study 1

**Review**

**Cost-effectiveness of adult vaccinations: A systematic review**

Andrew J. Leidner \(^a\)*, Neil Murthy \(^b,c\)*, Harrell W. Cheson \(^d\)*, Matthew Biggerstaff \(^b\)*, Charles Stoecker \(^e\)*, Aaron M. Harris \(^d\)*, Anna Acosta \(^b\)*, Kathleen Dooling \(^b\)*, Carolyn B. Bridges \(^a\)*

\(^a\) Berry Technology Solutions, USA
\(^b\) National Center for Immunization and Respiratory Diseases, CDC, USA
\(^c\) Epidemic Intelligence Service, CDC, USA
\(^d\) National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC, USA
\(^e\) School of Public Health and Tropical Medicine, Tulane University, USA

Objectives

Cost-effectiveness of adult vaccinations: A systematic review (Study 1)

- Assess the research literature since 1980 to summarize economic evidence for vaccinations included on the recommended adult schedule
  - Vaccination groups: Influenza, pneumococcal, human papillomavirus (18-26 year olds only), herpes zoster, hepatitis B, Td/Tdap
Methods

Cost-effectiveness of adult vaccinations: A systematic review (Study 1)

- Searched PubMed, EMBASE, EconLit, and Cochrane Library from 1980 to 2016 for cost-effectiveness analyses on vaccinations of persons 18 years or older in the US or Canada
- Excluded publications based on reviews of title/abstract, and full text reviews conducted by two independent reviewers
- Final set of publications compared vaccination to “no vaccination” scenarios
- Identified multiple cost-effectiveness estimates or ranges of estimates from each study, depending on how results were presented
Results

Cost-effectiveness of adult vaccinations: A systematic review (Study 1)

- Vaccinations recommended based on age

Summary

Cost-effectiveness of adult vaccinations: A systematic review (Study 1)

- Some vaccinations had estimates that were cost-saving
  - 56% of influenza
  - 31% of pneumococcal
  - 23% of Td/Tdap
- Many estimates cost less than $100,000 per QALY
  - 100% of influenza and pneumococcal
  - 69% of human papillomavirus
  - 71% of herpes zoster
  - 50% of Td/Tdap
Outline

- Background on cost-effectiveness analyses
  - Results presented as costs effectiveness ratios ($/QALY)
- Study 1: “Cost-effectiveness of adult vaccinations: A systematic review”
- Study 2: “A review of the cost-effectiveness of adult influenza vaccination and other preventive services”

Study 2

A Review of the Cost-Effectiveness of Adult Influenza Vaccination and Other Preventive Services

Nazila M Dabestani, MPH, MBA, Andrew J Leidner, PhD, Eric E Seiber, PhD, Hyoshin Kim, PhD, Samuel B Graiter, MD, Ivo M Foppa, MD, Carolyn B Bridges, MD

1Battelle Memorial Institute, Advanced Analytics & Health Research, Seattle, Washington, USA
2Berry Technology Solutions, Atlanta, Georgia, USA
3Centers for Disease Control and Prevention, Immunization Services Division, Atlanta, Georgia, USA
Background

A Review of the Cost-effectiveness of Adult Influenza Vaccination and Other Preventive Services (Study 2)

- Influenza vaccination
  - 43.3% of adults ≥18 years old were vaccinated in the U.S. in the 2016-17 influenza season
- Other preventive services
  - 71.5% of women aged 50-74 undergoing mammography
  - 62.4% of adults aged ≥50 undergoing colorectal cancer screening
  - 82.8% of adults aged ≥18 screened for high blood pressure

Objectives

A Review of the Cost-effectiveness of Adult Influenza Vaccination and Other Preventive Services (Study 2)

- Objectives: Summarize the research on the cost-effectiveness of adult influenza vaccinations as well as other preventive services relevant to adults
  - Other preventive services included: breast cancer screening, colorectal cancer screening, and hypertension screening and treatment
Methods

A Review of the Cost-effectiveness of Adult Influenza Vaccination and Other Preventive Services (Study 2)

- Searched for cost-effectiveness research on adult influenza vaccines, colorectal cancer screening, mammography, hypertension screening and treatment
  - 12 medical and public health research literature databases
  - 1996 to 2016
Results

A Review of the Cost-effectiveness of Adult Influenza Vaccination and Other Preventive Services (Study 2)

Summary

A Review of the Cost-effectiveness of Adult Influenza Vaccination and Other Preventive Services (Study 2)

- Influenza vaccination in adults appears to have a similar cost-effectiveness profile as other commonly utilized preventive services for adults

- Adult-patient providers, healthcare systems and payers may want to implement measures to improve influenza vaccination of adult patients
Overall summary

- Study 1 looked at all adult vaccinations and found generally favorable cost-effectiveness estimates, including some estimates of cost-savings.
- Study 2 found cost-effectiveness of adult influenza vaccinations was generally comparable to other common preventive services for adults.
- Adult vaccinations were associated with cost-effectiveness values that would be generally considered to be a good value.

Thanks and acknowledgements

- Study 1 coauthors
  - Neil Murthy, Harrell Chesson, Matthew Biggerstaff, Charles Stoecker, Aaron Harris, Anna Acosta, Kathleen Dooling, Carolyn Bridges
- Study 2 coauthors
  - Nazila Debastani (Battelle), Eric Seiber, Hyoshin Kim (Battelle), Sam Graitcer, Ivo Foppa (Battelle), Carolyn Bridges
- Colleagues from CDC/NCIRD/Immunization Services Division
  - Bo-Hyun Cho, Zana Somda, Jamie Pike, Fangjun Zhou, Yuping Tsai, Cindy Weinbaum, Ram Koppaka
- Most of the photos in this presentation were taken from the Public Health Image Library: https://phil.cdc.gov/phil/home.asp

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.
Results

Cost-effectiveness of adult vaccinations: A systematic review (Study 1)

- Vaccinations recommended based on indications

![Diagram showing cost-effectiveness of adult vaccinations](image)