The burden of paediatric influenza in the US: mortality, hospitalizations, outpatient visits and other outcomes

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Disclosures

• No financial conflicts to disclose

• Center for Disease Control (CDC) Advisory Committee on Immunization Practices (ACIP) Voting Member, First Nurse in the US 2004-2008

• ACIP Liaison Member 2008-present.

• Influenza workgroup member 2008 to present.

• Vice President, National Foundation for Infectious Diseases

• Mother of 2 daughters, one of whom had H1N1 in 2009
Objectives

At the completion of this presentation learners will:

• Review the burden of paediatric influenza in the US: mortality, hospitalizations, outpatient visits and other outcomes

• Discuss the history of pediatric influenza vaccine policy decisions in the US

• Describe the impact of influenza on a large US pediatric health system including vaccine implementation considerations
Tell real life stories: Seasonal influenza

• Television news airs photos a family has shared of their 8 year old son “Lucio” who died of Influenza A.

• His parents’ hope is to alert parents in order to prevent other children from dying.

• Droves of parents called providers concerned asking for influenza vaccine

• Telling the real stories makes a difference
2017-2018 US flu season was record-breaking
NFID and CDC press release 9.27.2018

- Deadliest, most severe season in 4 decades with VE at 40%

- Record-breaking 900,000 hospitalizations

- 80,000 deaths (90% in elderly, usually 12,000 to 56,000)

- Overall vaccine rates steady for children 6 mo to 17 yrs at 57.9%

- Highest vaccinated age group are children 6 mo to 4 yrs at 67.8%

- Lowest vaccinated age group are children 13 yrs to 17 yrs at 47.7%

- Pregnant women only vaccinated at 49.1%
Percentage of Visits for Influenza-like Illness (ILI) Reported by the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Weekly National Summary, 2017-2018 and Selected Previous Seasons
Burden of influenza disease on US Children-
outpatient

http://www.cdc.gov/flu/weekly/overview.htm
#Outpatient
Laboratory-Confirmed Influenza Hospitalizations

Preliminary cumulative rates as of Sep 15, 2018

FluSurv-NET :: Entire Network :: 2017-18 Season :: Cumulative Rate

Age Selection
- All Age Groups
- 0-4 yr
- 5-17 yr
- 18-49 yr
- 50-64 yr
- 65+ yr
Number of Influenza-Associated Pediatric Deaths by Week of Death: 2014-2015 season to present

- **2014-2015**: Number of Deaths Reported = 148
- **2015-2016**: Number of Deaths Reported = 94
- **2016-2017**: Number of Deaths Reported = 110
- **2017-2018**: Number of Deaths Reported = 180

**Week of Death**

- Green bars: Deaths Reported Previous Week
- Blue bars: Deaths Reported Current Week
Peds Influenza Deaths: 
Other Lessons From Prior Years

• Tracking since 2004 (low was 46 deaths in 2005, high was peak of novel H1N1 with 282)
• Last season (2017-2018) 180 deaths—80% unvaccinated
• In 2013-2014, 115 deaths, 94 died in the hospital and only half got Tamiflu.
• Of the 74 eligible to be vaccinated
  – < 25% were vaccinated
  – 46% were < 5 years old
  – 29% were < 2 years old
  – 50% had medical condition:
    ▪ Half had a neurological disorder
    ▪ 30% lung disorder
    ▪ 25% genetic disorder
    ▪ 19% CHD/CV problems
**History of Flu Vaccine Policy-United States**


<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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| 1930 | • Flu A Isolated  
      | • Flu B Isolated by 1936 |
| 1940 | • Mechanical Ventilators in Use |
| 1945 | • Inactivated flu vaccine licensed for US civilians |
| 1960 | • US Surgeon General recommends flu vaccine for 65 and over, chronic illness and pregnant women |
| 2003 | • First nasal influenza vaccine licensed |
| 2002 | • ACIP recommends flu vaccine for babies 6-23 months of age |
| 2006 | • ACIP recommends flu vaccine for health care professionals |
| 2008 | • ACIP expands recommendation to include children 5 years to 18 years |
| 2010 | • ACIP universal flu vaccine recommendation for all 6 months of age and over |
Evidence increases that flu vaccine reduces risk of severe flu in kids & adults
You may still get the flu, but you are less likely to die

- Pediatric patients who were fully vaccinated were 74% less likely to be admitted to an intensive care unit for influenza-related illness.
  - Ferdinand, Jill, Belongia, Ed, Pediatrics 2013

- Flu Vaccine reduced risk of flu-associated deaths by 51% in children with chronic conditions and by 65% in healthy kids
  - 2017 CDC study

- In adults, flu vaccine reduced severity, hospitalizations, ICU admission
  - August, 2018 CDC study
US Flu Vaccine Uptake

https://www.cdc.gov/flu/fluvaxview/nifs-estimates-nov2017.htm#all-ages

Early-season and end-of-season flu vaccination coverage estimates, National Immunization Survey-Flu and National Internet Flu Survey, United States, 2013–14 flu season to November, 2017

- Early Season

- End of Season
Influenza Vaccine Dosing

**Dosing**
- Infants younger than 6 months are too young to be immunized with influenza vaccine.
- Children 9 years of age and older need only 1 dose.
- Children 6 months through 8 years of age should receive 2 doses of vaccine if they did not previously receive any dose of vaccine.

**Adverse Events**
- Local site injection pain
- Fever within 24 hours (up to 1/3rd of younger kids)
- Mild systemic flu-like feeling
- Reports of febrile seizures when “Fluzone” given to 12-23 month olds who concurrently got 13-valent PCV13
- **Egg allergy no longer a contraindication**
Recommendations regarding influenza vaccination of persons who report allergy to eggs – Advisory Committee on Immunization Practices, United States, 2018–19 influenza season

After eating eggs or egg-containing foods, does the person experience ONLY hives?

YES

Administer any recommended, and age-appropriate IIV, RIV, or LAIV that is otherwise appropriate for the person’s health status.

NO

After eating eggs or egg-containing foods, does the person experience other symptoms such as
- Angioedema?
- Respiratory distress (e.g., wheezing)?
- Lightheadedness?
- Recurrent emesis (e.g., nausea/vomiting)?
- Reaction requiring epinephrine?
- Reaction requiring emergency medical attention?

YES

Administer any IIV, RIV, or LAIV that is otherwise appropriate for the person’s age and health status in a medical setting (e.g., health department, physician office). Vaccine administration should be supervised by a healthcare provider with experience in the recognition and management of severe allergic conditions.
Guide for Determining the Number of Doses of Influenza Vaccine to Give to Children Age 6 Months Through 8 Years

Did the child receive at least 2 doses of trivalent or quadrivalent influenza vaccine* before most recent July 1?  

**YES**

Give 1 dose of current season’s influenza vaccine.

**NO / DON’T KNOW**

Give 2 doses of current year’s influenza vaccine, spaced at least 4 weeks apart.

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* The two doses need not have been received during the same season or consecutive seasons.

**NOTE:** The two doses can both be inactivated influenza vaccine (IIV), or, for children age 2 through 8 years who have no contraindications to live attenuated influenza vaccine (LAIV), can both be LAIV, or alternatively, 1 dose of IIV and 1 dose of LAIV.

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**REFERENCE**

Adapted from CDC. “Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices – United States. . .” Access links to current ACIP recommendations at [www.cdc.gov/vaccines/hcp/aca-recs/vacc-specific/flu.html](http://www.cdc.gov/vaccines/hcp/aca-recs/vacc-specific/flu.html).
We are 2 hospitals, ~390 beds, 12 clinics, 100,000 clinic patients with 250,000 visits/year, 50 languages interpreted and 1 international airport.

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Background

• Severe influenza infection (SII) in children, although rare, can lead to poor health outcomes.

• A better understanding of risk factors associated with severity may assist in prevention and management strategies.

• This analysis was conducted to determine risk factors for SII among influenza-associated hospitalizations in children with laboratory-confirmed influenza across three seasons.

Methods

• We conducted a retrospective cohort study evaluating factors associated with SII across three influenza seasons (2013-2016) at a free-standing, urban, tertiary care children’s hospital.

• Included were children <19 years of age with laboratory-confirmed influenza who were hospitalized for ≥1 day. Data was extracted from electronic medical records using a standardized data collection form.

• To enhance reproducibility, our primary outcome severe influenza illness (SII) (defined as ≥2 days hospital stay) was compared to influenza illness (defined as hospital stay 1-2 days).

• Multivariable logistic regression was used to identify risk factors statistically significantly associated with SII, producing odds ratios (OR) and 95% confidence intervals (CI).

Results

Among 404 children hospitalized across three influenza seasons median age was 2.6 years (range: 1 day - 18.3 y) and 238 (59%) met the SII definition (Table 1). Among these children:

• Most children met the SII definition by having a medical unit stay >2 days, however, a notable proportion of surviving patients had more complicated encounters that included ICU stays (Figure 1).

• In univariate analysis significantly more children with SII had a chronic condition at admission (63% vs. 52%) (p=0.03), illness >3 days prior to admission (64% vs. 45%) (p=0.001) and had ≥1 missed influenza vaccination opportunity (56% vs. 24%, p=0.006).

• In the final multivariable model adjusted for calendar year and age, illness >3 days prior to admission (OR 2.1, 95% CI: 1.3, 3.3) and having ≥1 missed influenza vaccination opportunity (OR: 2.0, 95% CI: 1.1, 3.6) were statistically significantly associated with SII.

Table 1. Characteristics among children hospitalized for influenza by severity, 2013-2016 (404).

Presented at Pediatric Academic Societies meeting Nov, 2017

- Retrospective cohort study evaluating severity of influenza inpts
- Lab confirmed influenza, hospitalized >1 day, SII >2 days
- 404 children, all ages, median age 2.6 years, 59% met SII def
- 27% required ICU stay; 10% ventilated; 6 deaths
- 57% not vaccinated
- Characteristics of more severe influenza infection:
  - Ill >3 days prior to admission
  - 63% had underlying chronic illness
  - >1 missed opportunity to vaccinate
Disposition of surviving patients hospitalized with severe influenza illness (N=232).
Respiratory Viral Data – 2008-2018-Admissions
Respiratory Viral Data - 2017-2018 Season
Respiratory Viral Data-Admissions

Admitted Lab Confirmed Viral Pathogens
Children's Hospitals and Clinics of MN
By Week, 2017-2018 Season

Number of Admissions

RSV  Influenza  Adenovirus  Metapneumovirus  Rhinovirus  Rotavirus  Parainfluenza
Influenza - 2017-2018 Season

Lab Confirmed Influenza
Children's Hospitals and Clinics of MN
By Week, This Season vs Last Season Comparison

Number of Lab Confirmed Cases

Week

2016-2017 Season
2017-2018 Season
Lines for vaccines H1N1 2009 Pandemic
We are due for another one
Summary Thoughts

• Morbidity and mortality for children from influenza is significant
• Influenza vaccine options are available
• While flu vaccine effectiveness is lower than we want, it is still best tool to prevent severity, ICU hospitalization and death
• Implementation considerations are numerous but manageable
  − Is there a “too early to vaccinate date?”
  − Is there a “too late” to vaccinate message?
  − Is there a best location to vaccinate for most?
  − Are there children who should not get flu vaccine?
  − Are systems in place to make it easy to vaccinate children?
  − Communication of need and dangers of disease imperative
  − Remember: It’s not “just the flu”
Families Fighting Flu:
Working together to protect children against the flu
www.familiesfightingflu.org
Questions