Influenza Disease Burden and Vaccine Impact Estimates, 2019-20 Season

Carrie Reed, DSc, MPH
Lead, Applied Research and Modeling Team
Influenza Division, CDC

October 28, 2020
U.S. National Influenza Surveillance System

Goals:

- Find out when and where influenza activity is occurring;
- Determine what influenza viruses are circulating;
- Detect changes in influenza viruses; and
- Measure the impact influenza is having on outpatient illness, hospitalizations and deaths.
2019-20 Influenza Season Summary

*Specimens tested for influenza, reported to CDC by Clinical Laboratories, National
2019-20 Influenza Season Summary

*Influenza positive tests reported to CDC by Public Health Laboratories, National

https://www.cdc.gov/flu/weekly/fluviewinteractive.htm
Extended uses of surveillance data

**Disease Burden:** Estimate national disease burden (numbers of illnesses, medically-attended illnesses, hospitalizations, deaths) annually using data available during a season.

**Averted Burden:** Combine data on disease burden, vaccine effectiveness, and vaccine coverage to estimate reductions in disease due to influenza vaccine use.
“How many people get the flu every year?”
Challenges to Measuring Disease Burden

- Many sick people do not seek medical attention
- Symptoms similar among respiratory pathogens
- Illnesses not often confirmed with laboratory testing
- Many adults no longer shedding virus when tested
- Complications can be broader than respiratory illness
- Influenza rarely recorded on death certificates
- Surveillance not conducted everywhere
Not all influenza cases are detected.

Influenza hospitalizations

- Not tested
- Tested for influenza
Not all influenza cases are detected

- Influenza hospitalizations
  - Not tested
  - Tested for influenza
    - PCR
      - Test -
      - Test +
    - Rapid
      - Test -
      - Test +
    - Other
      - Test -
      - Test +
Not all influenza cases are detected

Influenza hospitalizations

- Not tested
- Tested for influenza

Distribution of test types

% of patients tested for influenza

PCR
- Test -
- Test +

Rapid
- Test -
- Test +

Other
- Test -
- Test +

Test sensitivity
Using routine influenza surveillance to estimate disease burden

1. Correct for under-detection

2. Extrapolate to U.S. population

3. Calculate deaths = multiply by ratio deaths: hospitalizations

4. Calculate illnesses = multiply by ratio cases: hospitalization

Reported rate hospitalization → Adjusted rate hospitalization → SYMPTOMATIC ILLNESS → HOSPITALIZED → DIED

FluSurv-NET Surveillance

Reed et al. PLoS One. 2015
Rolfes et al. IoRV. 2018
Using routine influenza surveillance to estimate disease burden

1. Correct for under-detection
2. Extrapolate to U.S. population
3. Calculate deaths = multiply by ratio deaths: hospitalizations
4. Calculate illnesses = multiply by ratio cases: hospitalization

FluSurv-NET Surveillance

Influenza testing in hospitals

Risk of death in hospital & deaths outside a hospital

Previous flu studies

Reed et al. PLoS One. 2015
Rolfes et al. IoRV. 2018
Influenza Disease Burden Estimates

2019–20 season*

- 38.2 million illnesses
- 17.5 million medical visits
- 400,000 hospitalizations
- 22,000 deaths

Estimated by 5 age groups: 0-4, 5-17, 18-49, 50-64, 65+ years

For all seasons since 2010-11: https://www.cdc.gov/flu/about/burden/index.html

*Some data inputs are lagged and estimates are updated when more complete data are available
Disease Burden of Influenza

Each year CDC estimates the burden of influenza in the U.S. CDC uses modeling to estimate the number of influenza illnesses, medical visits, flu-associated hospitalizations, and flu-associated deaths that occur in the U.S. in a given season. The methods used to calculate these estimates are described on CDC’s webpage, [How CDC Estimates the Burden of Seasonal Influenza in the U.S.](https://www.cdc.gov/flu/about/burden/index.html).

CDC uses the estimates of the burden of influenza in the population and the impact of influenza vaccination to inform policy and communications related to influenza.
“What impact can our interventions have?”
Annual Influenza Vaccine Impact

- Influenza vaccination is the primary strategy to prevent influenza illness and its complications.

- Vaccine coverage, vaccine effectiveness, and rates of influenza can all vary between seasons, between age groups, and between different types and subtypes of influenza viruses.

- At the end of each flu season, CDC uses data available on those factors from that season to estimate the burden of flu prevented by vaccination to better describe the population impact of influenza vaccination.

Tokars et al. Vaccine. 2018
Rolfes et al. CID. 2019; Chung et al. CID. 2020
## 2019-2020 season

<table>
<thead>
<tr>
<th>Disease Burden</th>
<th>Vaccine Coverage</th>
<th>Vaccine Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 million illnesses</td>
<td>38–75% (Varies by age group)</td>
<td>22–57% (Varies by age group and flu type)</td>
</tr>
<tr>
<td>400,000 hospitalizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22,000 deaths</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimated, by age group and influenza type/subtype


From the US Flu VE Network
2019-20 Influenza Averted Burden

Nearly 52% of the U.S. population aged 6 months and older got a flu vaccine during the 2019-2020 flu season, and this prevented an estimated:

- 7.5 million flu illnesses
- 105,000 flu hospitalizations
- 6,300 flu deaths

More than the combined population of Kentucky and Kansas

Enough people to fill Michigan Stadium at the University of Michigan

Equivalent to saving about 17 lives per day over the course of a year

Get vaccinated

www.cdc.gov/flu
the benefits of flu vaccination 2019-2020

Nearly 52% of the U.S. population aged 6 months and older got a flu vaccine during the 2019-2020 flu season, and this prevented an estimated:

- **7.5 million** flu illnesses
- **105,000** flu hospitalizations
- **6,300** flu deaths

More than the combined population of Kentucky and Kansas

Enough people to fill Michigan Stadium at the University of Michigan

Equivalent to saving about 17 lives per day over the course of a year

- **21%** prevented fraction, all ages
- **28%** prevented fraction, ages 0-4 years

get vaccinated

www.cdc.gov/flu
Summary

- During the 2019–2020 season an estimated 38 million people were sick with flu, resulting in 18 million visits to a health care provider, 400,000 hospitalizations, and 22,000 deaths.

- The estimated influenza illnesses, hospitalizations, and deaths were lower than some recent seasons and similar to other seasons where influenza A(H1N1)pdm09 viruses dominated.

- Persons aged <50 years had rates of illnesses, hospitalizations, and deaths similar to or greater than during the 2017-18 season, a recent season with high severity.

- Vaccination prevented the greatest proportion of outcomes among children aged 6 months to 4 years, an age group with high vaccine uptake and the greatest vaccine effectiveness.
Thank you

For more information, contact CDC
1-800-CDC-INFO (232-4636)

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

Danielle Iuliano  
Melissa Rolfes  
Matt Biggerstaff  
Shikha Garg  
Alissa O’Halloran  
Lynnette Brammer  
Alicia Fry  
Brendan Flannery  
Manish Patel  
Jerry Tokars  
Erin Burns  
Kathleen LaPorte  
Dan Jernigan  
Jim Singleton  
FluSurv-NET sites  
VE Network sites