SEASONAL DIFFERENCES IN MICHIGAN INFLUENZA HOSPITALIZATIONS

SUSAN PETERS, DVM, MPH
MAY 15, 2014
MICHIGAN COMMUNICABLE DISEASE CONFERENCE

BACKGROUND: INFLUENZA

- Type A - pandemics
- Type B
- Droplet spread: Person-to-person or contaminated environments
- Infectious period: 1 day prior to onset to 5 days after onset
  - Children / immunocompromised: much longer
- Incubation period: 1 to 4 days
- Clinical symptoms are non-specific("influenza-like illness")
  - Fever >100.4ºF
  - Cough/sore throat/upper respiratory symptoms
  - Muscle aches, fatigue
- Control measures: cough / hand hygiene, vaccine, antivirals

U.S. INFLUENZA SURVEILLANCE GOALS

- Find out when and where influenza activity is occurring
- Track influenza-related illness
- Determine what influenza viruses are circulating
- Detect changes in influenza viruses
- **Measure the impact influenza is having on hospitalizations and deaths in the United States**
  - Estimated 100,000–300,000 hospitalizations are attributable to influenza annually*
  - Estimated MI burden: 3200-9600 annually

*Zhou H, Thompson WW, Viboud CG, et al. Hospitalizations associated with influenza and respiratory syncytial virus in the United States, 1993-2008. Clin Infect Dis **2012**; 54(10):1427-36.

U.S. INFLUENZA SURVEILLANCE CATEGORIES

- Virologic
  - Antiviral resistance testing and antigenic characterization
  - MDCH Bureau of Laboratories
  - Sentinel Laboratory Network
- Outpatient Illness
  - CDC ILINet
  - MDSS individual and aggregate reports
  - Syndromic data
  - Facility outbreaks
- Mortality
  - Pediatric influenza deaths
  - 122 Cities Mortality System
- **Hospitalizations**
- Geographic Spread

MI HOSPITALIZATION SURVEILLANCE

- Influenza hospitalizations are not reportable as in some states
- Individual hospitalizations voluntarily entered into MDSS
  - Option available since 2007
  - Required during 2009 pandemic
- Influenza Sentinel Hospital Network (ISHN)
  - Started in 2011-12 season in response to pandemic
  - 12-14 hospitals in all 4 surveillance regions participate
  - Report number of hospitalizations in 5 age groups and total number of admissions weekly
- Influenza Hospitalization Surveillance Project (IHSP)

INFLUENZA HOSPITALIZATION SURVEILLANCE PROJECT (IHSP)

- Part of larger FluSurv-NET surveillance project
- 70 counties in 10 EIP states and 3 additional states
- Represent 9% of U.S. population (~28 million)

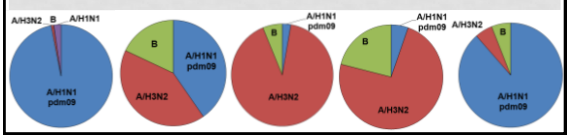
INFLUENZA HOSPITALIZATION SURVEILLANCE PROJECT (IHSP)

- EIP surveillance began in 2004 (children) and 2006 (adults)
- IHSP sites (including MI) added in 2009
  - Started with Clinton, Eaton and Ingham counties
  - Genesee added in 2012-13
  - 9% of MI population (~889,826)
- Cases
  - Population-based (can calculate rates)
  - Laboratory-confirmed
  - October 1 – April 30
  - Community-acquired or healthcare facility-associated
  - Chart reviews conducted – clinical and epidemiologic info
  - Influenza vaccination information obtained

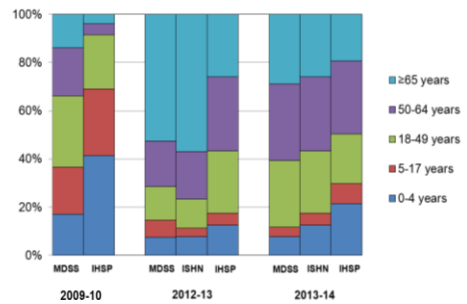
SETTING THE STAGE

- 4 seasonal influenza strains have circulated since 2009: A/H1N1pdm09, A/H3N2, and 2 B lineages

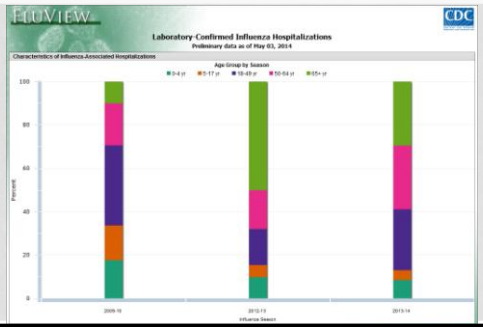
2009-10	2010-11	2011-12	2012-13	2013-14
Severe	Moderate	Mild	Moderately severe	Moderate
Late Oct.	Late Feb.	Mid-Mar.	Early Jan.	Early Jan.



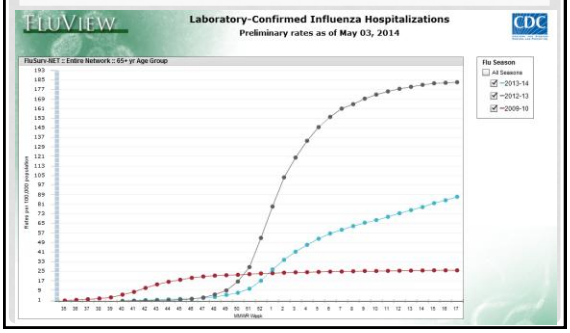
AGE DISTRIBUTION - MICHIGAN



AGE DISTRIBUTION - NATIONAL



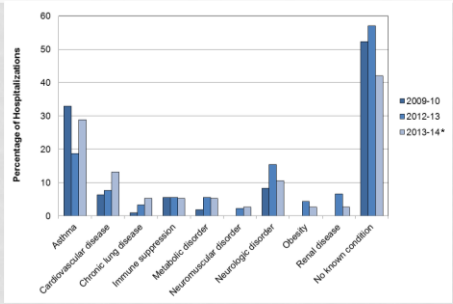
AGE DISTRIBUTION - NATIONAL



AGE DISTRIBUTION - CONCLUSIONS

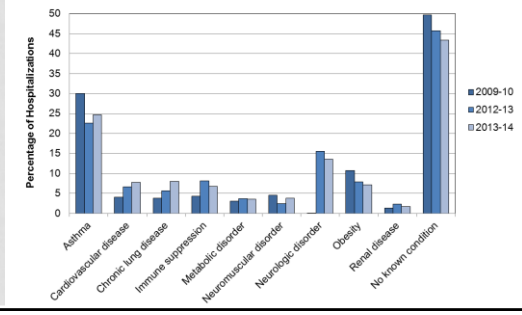
- 2009-10: In an A/H1N1pdm09 year, burden of disease fell on young (children and adults)
- 2012-13: In an A/H3 year, burden fell on elderly
- 2013-14: An A/H1N1pdm09 year, but some changes from 2009-10
  - Still affecting young adults
  - Decrease in pediatric cases
  - Increase in elderly cases
- With the exception of some variation during 2009-10, in general different Michigan surveillance systems showed a similar age distribution for influenza hospitalizations
- Michigan age distribution is similar to national

UNDERLYING MEDICAL CONDITIONS – CHILDREN, MI IHSP

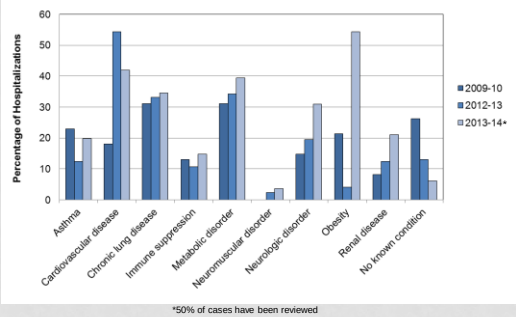


*55% of cases have been reviewed

UNDERLYING MEDICAL CONDITIONS – CHILDREN, FLUSURV-NET

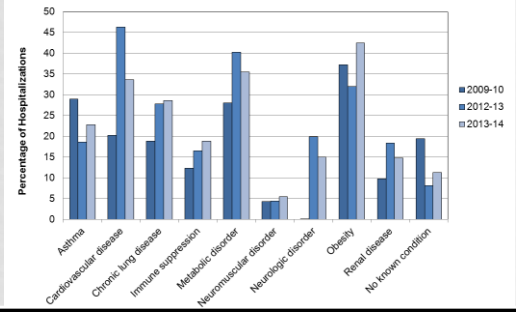


UNDERLYING MEDICAL CONDITIONS – ADULTS, MI IHSP



*50% of cases have been reviewed

UNDERLYING MEDICAL CONDITIONS – ADULTS, FLUSURV-NET



UNDERLYING MEDICAL CONDITIONS – CONCLUSIONS (1)

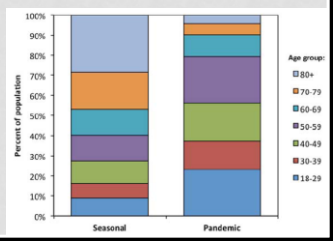
- In general, the proportion of MI cases with various underlying medical conditions is similar to national data
- Regardless of the season:
  - Higher proportion of children are previously healthy
  - Most common medical conditions:
    - Children: asthma
    - Adults: cardiovascular, metabolic, obesity
  - Areas of difference (MI compared to national):
    - Less asthma in adults
    - Slightly increased cardiovascular disease in adults
    - Increased chronic lung disease in adults

UNDERLYING MEDICAL CONDITIONS – CONCLUSIONS (2)

- Interseasonal differences:
  - Children
    - Higher proportion with asthma in 2009-10 and 2013-14 (A/H1N1pdm09) – both MI and national
    - Higher proportion previous healthy category in 2012-13 (A/H3N2)
      - Seen in MI but not in national data (more in 2009-10)
  - Adults
    - Higher proportion with asthma in 2009-10 and 2013-14 (A/H1N1pdm09) – both MI and national
    - Higher proportion with cardiovascular disease in 2012-13 (A/H3N2) – both MI and national
    - Higher proportion previously healthy in 2009-10 (A/H1N1pdm09) – both MI and national
- Obesity – some inconsistencies in how this data was collected between seasons and IHSP vs. EIP sites

PRE-PANDEMIC COMPARISON – AGE DISTRIBUTION

- Reed, C. et al. Complications among adults hospitalized with influenza: a comparison of seasonal influenza and the 2009 H1N1 pandemic. Clin Infect Dis. 2014 Apr 29. [Epub ahead of print]
- FluSurv-NET data
- Seasonal influenza cases from 2005 – early 2009
- Adults hospitalized with H1N1pdm09 were younger (median age 47 years) than those with seasonal influenza (median: 68 years, p<0.01)



PRE-PANDEMIC COMPARISON – UNDERLYING MEDICAL CONDITIONS

- Reed et al. study:
- Types of underlying medical conditions reported varied between the two groups
- H1N1pdm09 patients were more likely to have diseases associated with young age:
  - Asthma
  - Current pregnancy
- H1N1pdm09 patients substantially less likely to have diseases associated with older age:
  - COPD or other chronic lung diseases
  - Cardiovascular disease
  - Chronic metabolic diseases

PRE-PANDEMIC COMPARISON - OUTCOMES

- Reed et al. study:
- Similar risk for many influenza-associated complications
- When controlled for age and type of medical condition, H1N1pdm09 adult hospitalizations more likely to have:
  - Lower respiratory tract complications
  - Shock/sepsis
  - Organ failure
  - ICU admission
  - Mechanical ventilation
  - Death
- Young adults had 2-4 times the risk of severe outcomes from H1N1pdm09 compared to seasonal influenza outcomes

WHAT FACTORS ARE AT PLAY?

- Vaccine
  - Uptake
  - Match to circulating viruses
- Virus characteristics
  - Amount of circulation
  - Specific characteristics
    - Predilection of A/H1N1pdm09 to cause lower respiratory disease → more of an effect on asthmatics?
- Population characteristics
  - Strain-specific preexisting immunity
  - Proportion with various medical conditions → Is increase in cardiovascular disease in 2012-13 reflective of elderly population?
- Interaction between all of these factors is unknown and just starting to be explored

CONCLUSIONS

- Influenza hospitalizations in MI affect different age populations depending on the predominant influenza strain
  - In general, A/H3N2 tends to affect more elderly and A/H1N1pdm09 affects more younger children and adults
- Similar age distributions are seen both within the 3 MI surveillance systems and between MI and national data
- In general, the proportion of MI cases with various underlying medical conditions is similar to national data
  - Higher proportion of all ages with asthma in A/H1N1pdm09 seasons
  - Higher cardiovascular disease in adults during A/H3N2 season
  - Higher proportion previously healthy adults in 2009-10 (A/H1N1pdm09)
  - These trends may be correlated to age groups affected