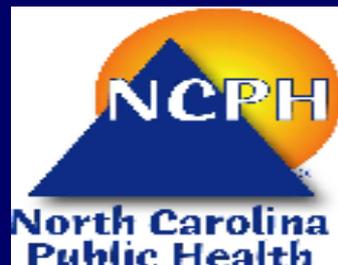


Pandemic Influenza H1N1: Clinical and Epidemiologic Features and Public Health Surveillance

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North Carolina Division of Public Health



How Flu Spreads



- Spread through coughing and sneezing
- Contact transmission also important
 - Hand to hand, contaminated surfaces
- Airborne transmission possible

Highly Efficient Transmission

- **March 28–30, 2009: Virus identified**
- **April 26, 2009: US declares Public Health Emergency**
- **June 11, 2009: WHO declares phase 6 pandemic**

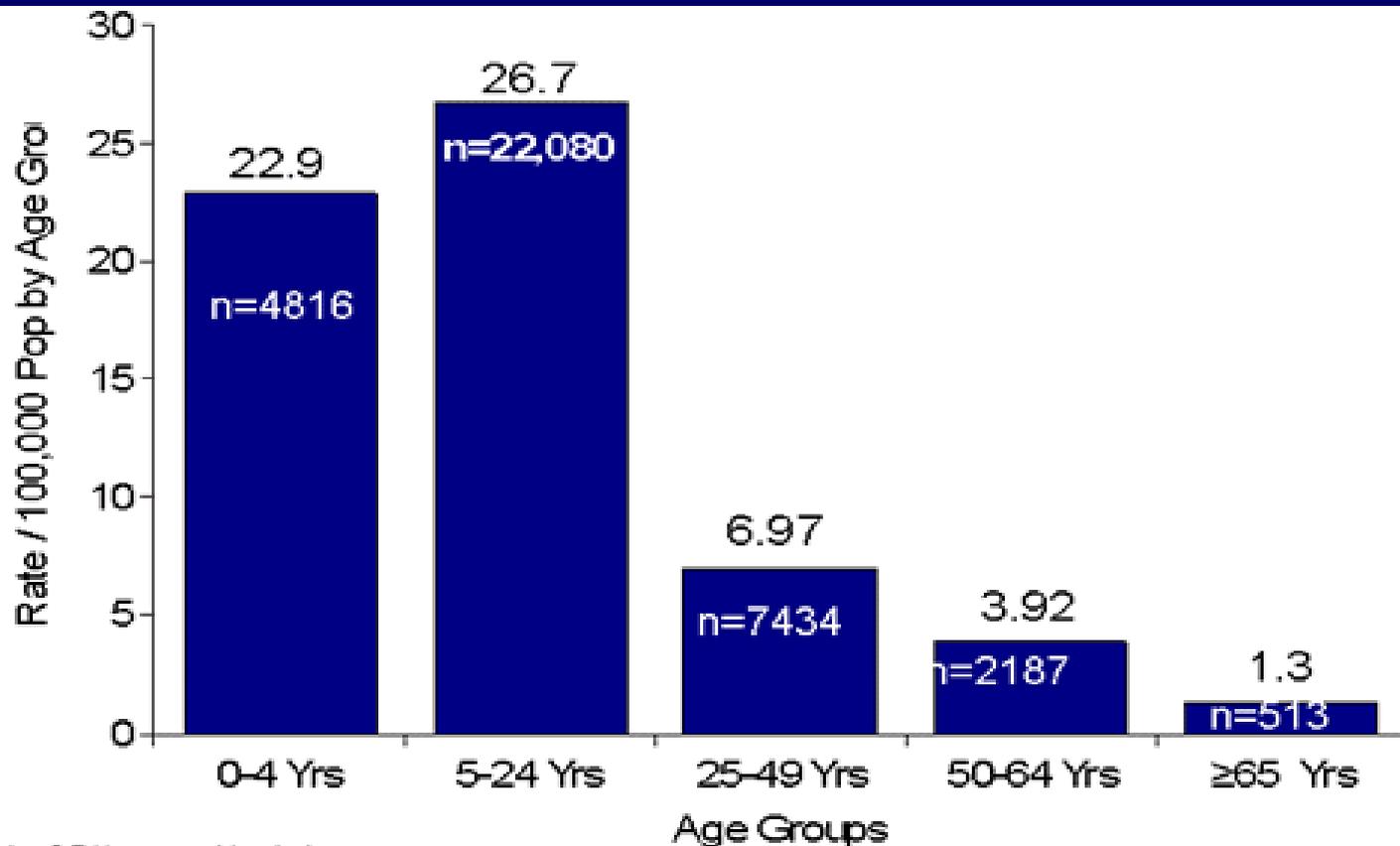
Seasonal Flu is a Big Deal

- **Affects 5–20% of US population each year**
- **200,000 hospitalizations each year**
- **36,000 deaths each year**
 - **More common in elderly**
 - **<100 pediatric deaths per year reported**

Pandemic H1N1 vs. Seasonal Flu

- **Similar transmissibility**
- **Affects younger populations**
- **Will infect more people than seasonal flu**
 - **More cases of severe illness**
 - **More deaths**

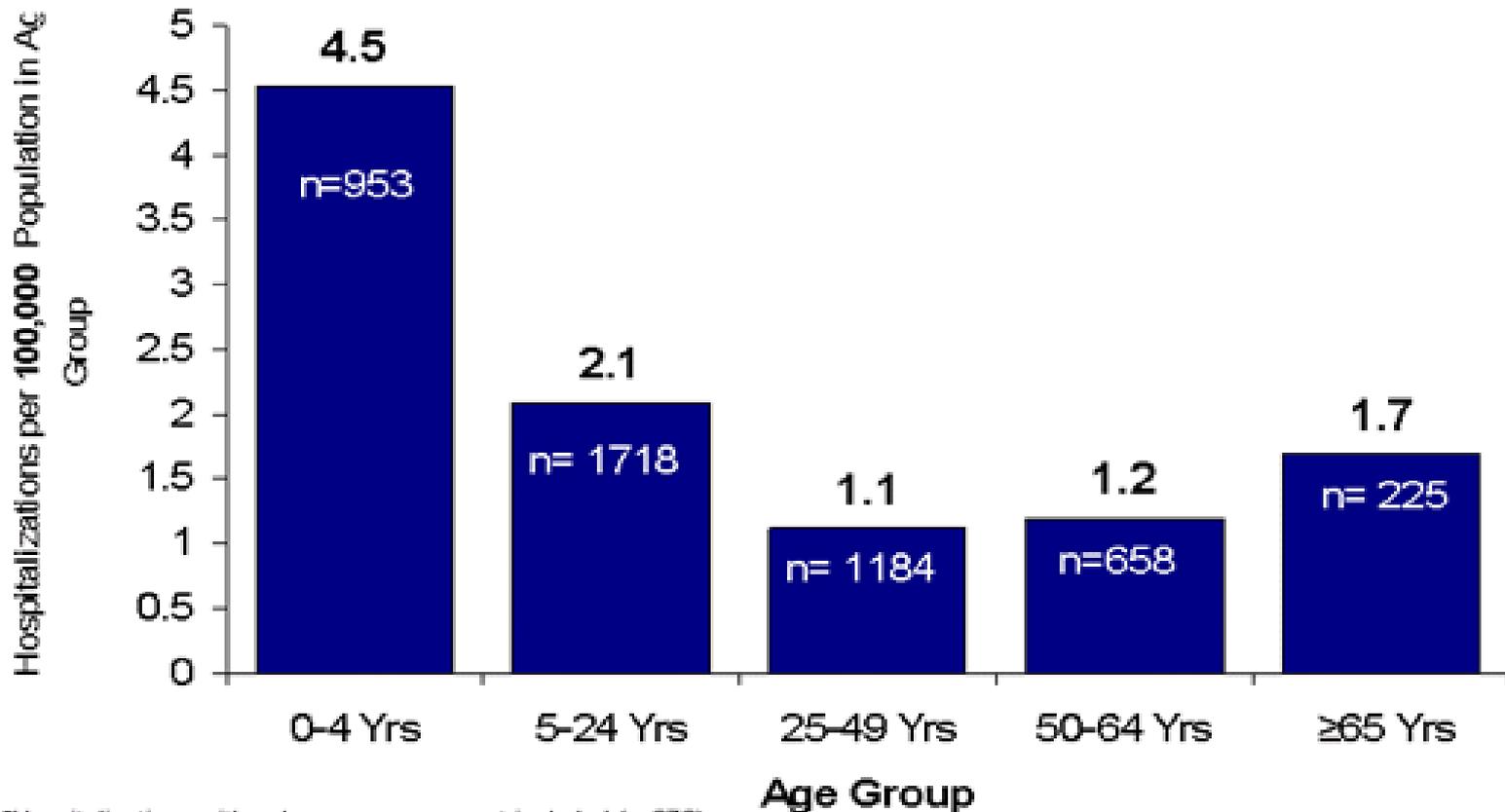
Pandemic H1N1 Confirmed and Probable Case Rates in the US, by Age Group



*Excludes 6,741 cases with missing ages.

Rate / 100,000 by Single Year Age Groups: Denominator source: 2008 Census Estimates, U.S. Census Bureau at: <http://www.census.gov/popest/national/asrh/files/NC-EST2007-ALLDATA-R-File24.csv>

Pandemic H1N1 U.S. Hospitalization Rate in the US, by Age Group



*Hospitalizations with unknown ages are not included (n=273)

*Rate / 100,000 by Single Year Age Groups: Denominator source: 2008 Census Estimates, U.S. Census Bureau at:

<http://www.census.gov/popest/national/asrh/files/NC-EST2007-ALLDATA-R-File24.csv>

Pandemic H1N1: Clinical Features

- **Similar severity to seasonal flu**
 - Not “mild”
- **Most cases uncomplicated, typical influenza-like illness (ILI)**
- **Diarrhea and vomiting more prominent than with seasonal flu**
- **Hospitalization and death rates difficult to assess**
 - More total cases = more severe cases

Clinical Features among NC Cases

Fever **570/584 (98%)**

Cough **506/551 (92%)**

Myalgias **243/391 (62%)**

Sore Throat **237/394 (60%)**

Coryza **195/392 (50%)**

Vomiting **114/493 (26%)**

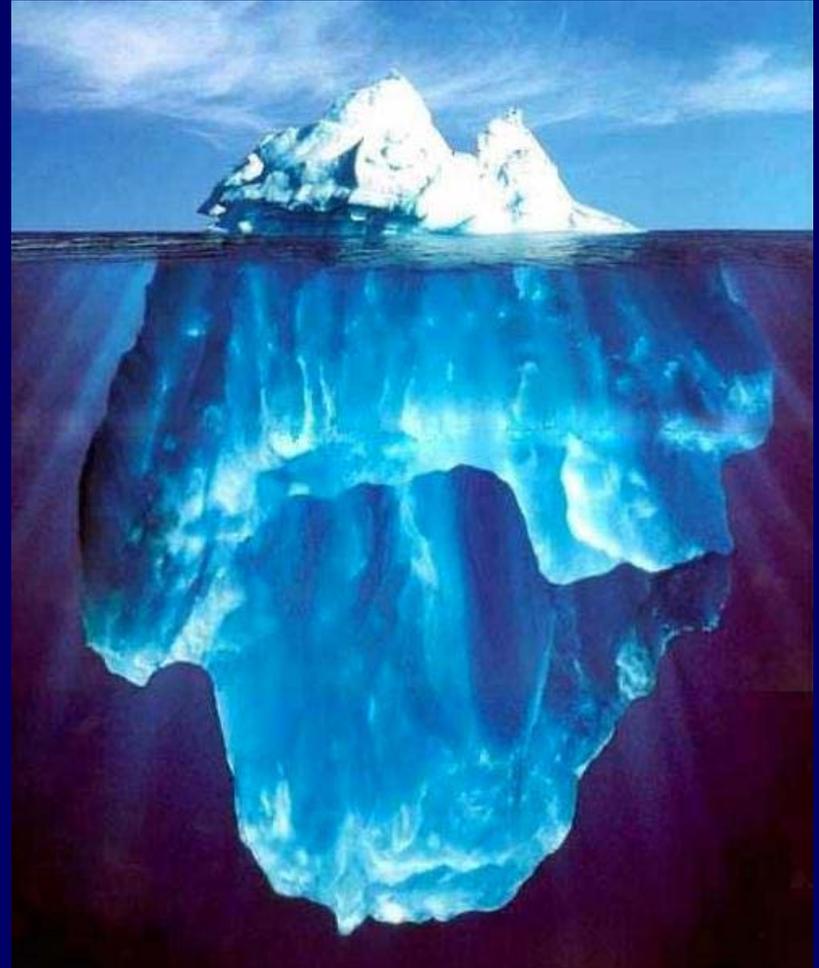
Diarrhea **75/419 (18%)**

Severe Illness

- **25% of admissions require ICU**
- **Lower respiratory illness**
 - Diffuse alveolar damage
 - Hemorrhagic interstitial pneumonitis
 - ARDS
- **Secondary bacterial pneumonia**
 - Strep and staph
- **High-risk conditions identified in >70% hospitalized cases, 80% deaths in US**

Influenza Surveillance

- **Not based on identifying every individual case**
 - High numbers affected each year; more during pandemic
 - Most won't seek care
 - Few will be tested





Influenza Surveillance

Relies on:

1. Tracking of influenza-like illness

- Influenza-like Illness Network (ILINet)
- Electronic emergency department surveillance

2. Systematic laboratory testing

3. Monitoring disease severity

- Hospitalizations
- Deaths
- Severe illness among pregnant women

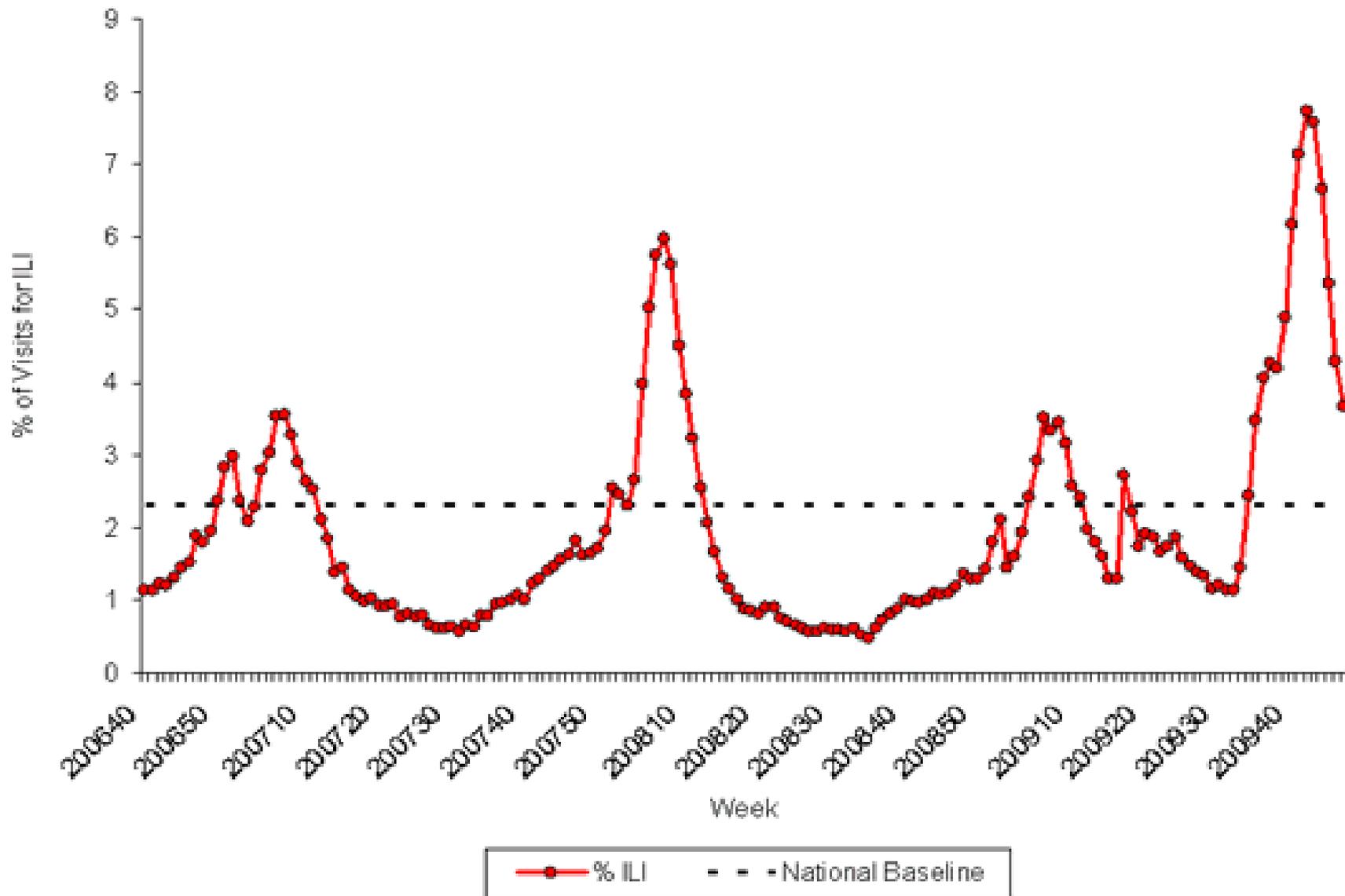
Flu Surveillance Goals

- 1. Identify and track mutations in viruses**
 - Novel strains, match to vaccine, antiviral resistance
 - 2. Detect the onset, duration and geographic spread of the epidemic/pandemic**
 - 3. Detect changes in severity**
 - 4. Identify severely affected populations**
-
- **Guide interventions**
 - **Provide information to partners**

Influenza-Like Illness Surveillance

- **Influenza-like Illness Network (ILINet)**
 - National program of volunteer providers
 - Report % of visits due to ILI
 - Submit specimens for testing
 - >95 volunteer providers across NC

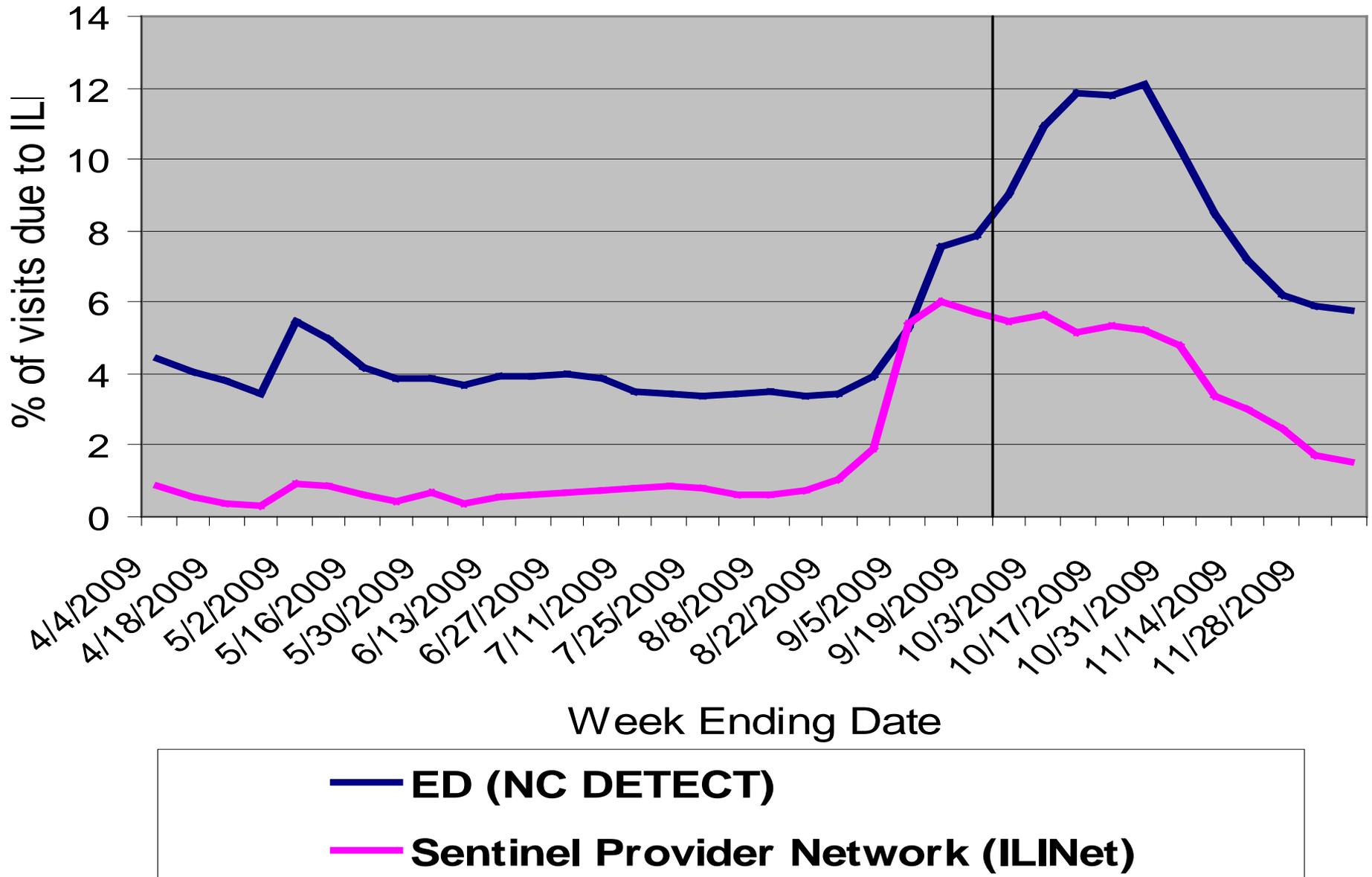
Percentage of Visits for Influenza-like Illness (ILI) Reported by the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Weekly National Summary, October 1, 2006 – November 28, 2009



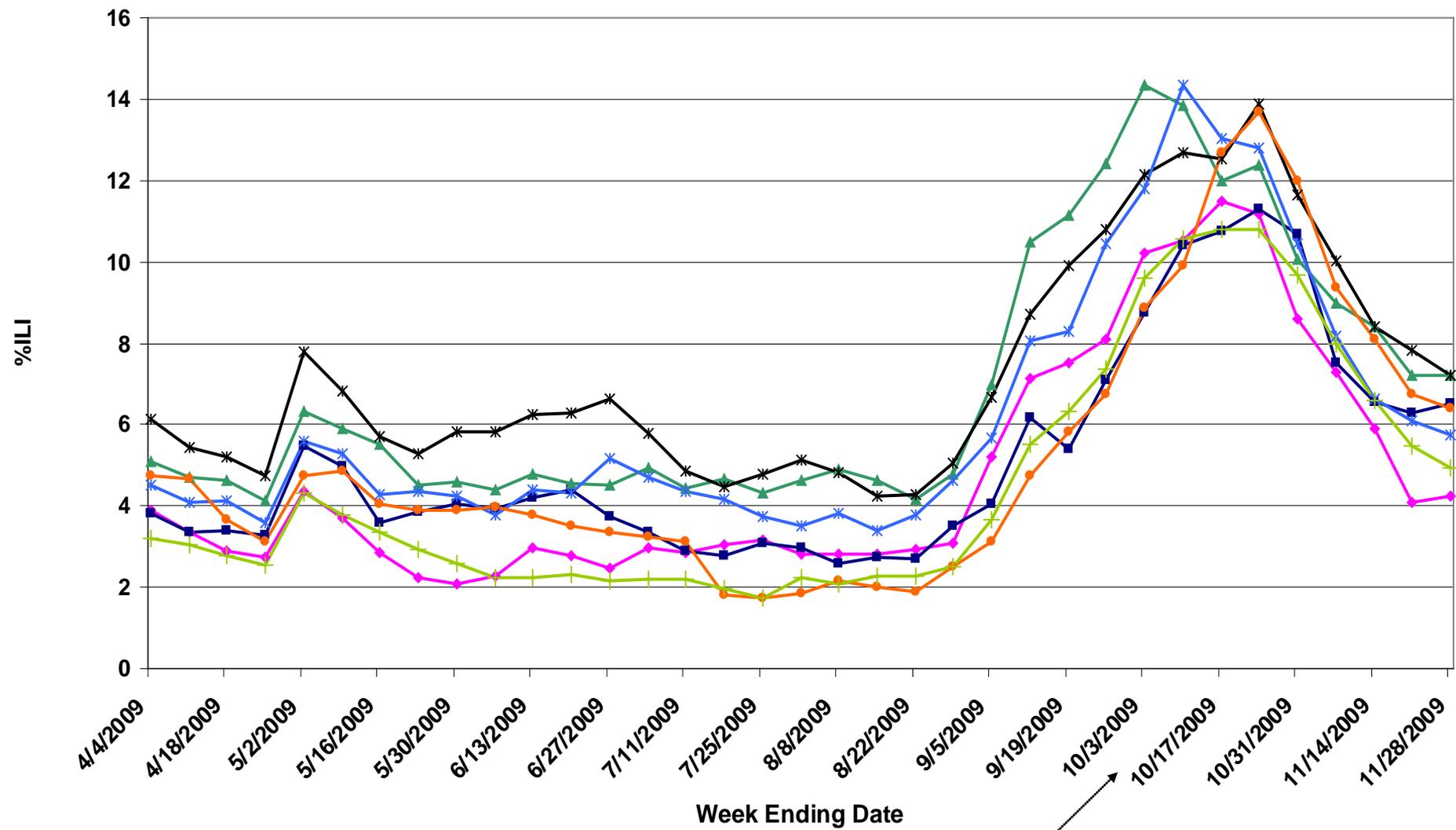
Flu Surveillance in NC

- **Influenza-like Illness Network (ILINet)**
 - National program
 - >95 volunteer providers across NC
 - Report % of visits due to ILI weekly
 - Submit specimens for testing
- **Emergency Department Surveillance:
NC DETECT**
 - Electronic surveillance of all ED visits
 - Tracks visits/admissions for flu-like illness

Influenza-Like Illness Surveillance in North Carolina, 2009-2010



ED ILI Cases As A Percentage Of All Visits Grouped By the PHRSTs Region 2009-2010 Flu Season



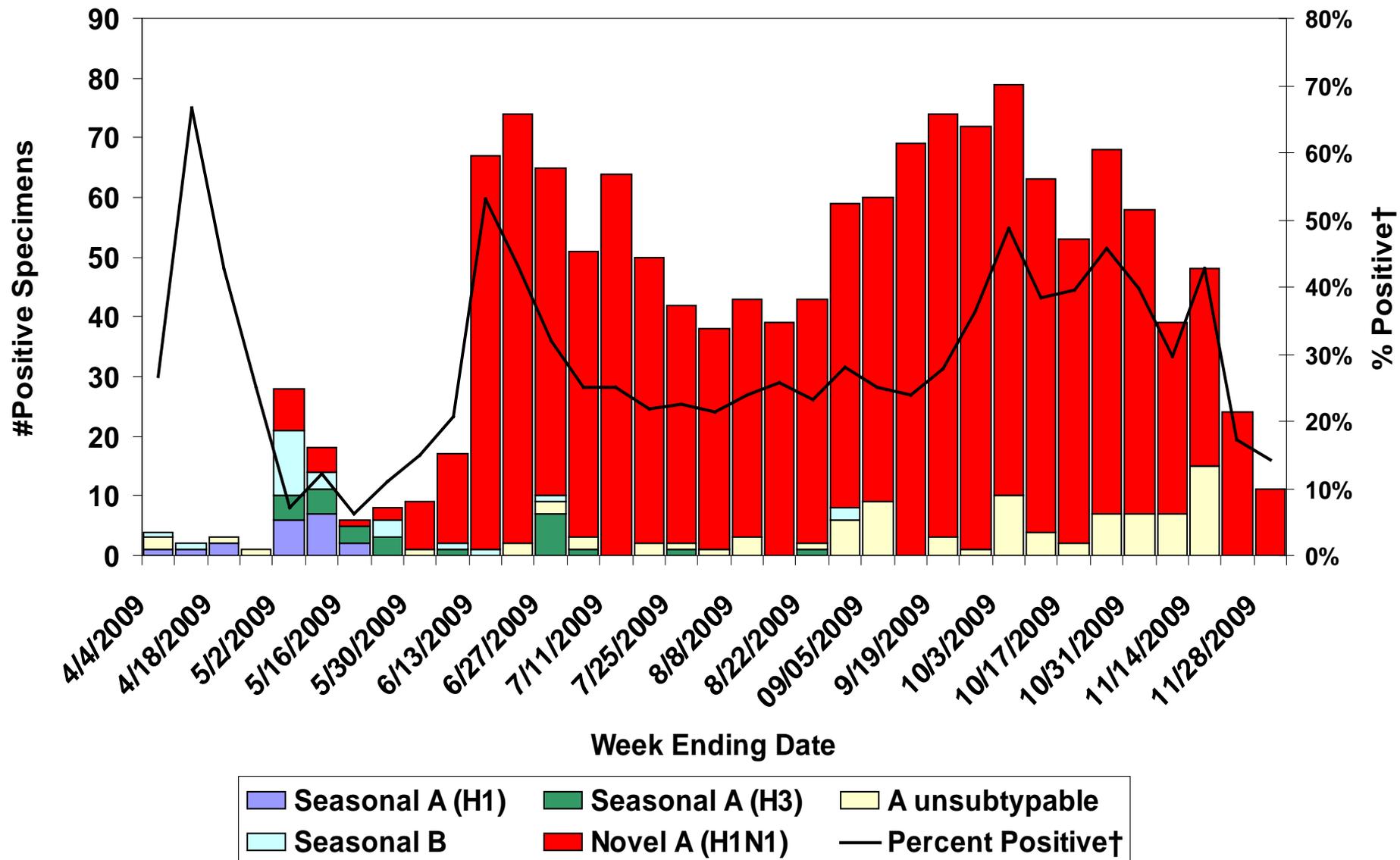
*Start of 09-10 Influeza Season Week
40 = Week Ending 10/10/2009



Laboratory Surveillance

- **NC State Laboratory of Public Health**
 - Sample of patients from ILINet
 - Patients requiring ICU care
 - Deaths suspicious for influenza
 - Situations of public health significance
 - More than 5,700 specimens tested since April (!)
- **Public Health Epidemiologist (PHE) Network**
 - 11 largest healthcare systems in NC
 - Report positive tests for flu, other viruses

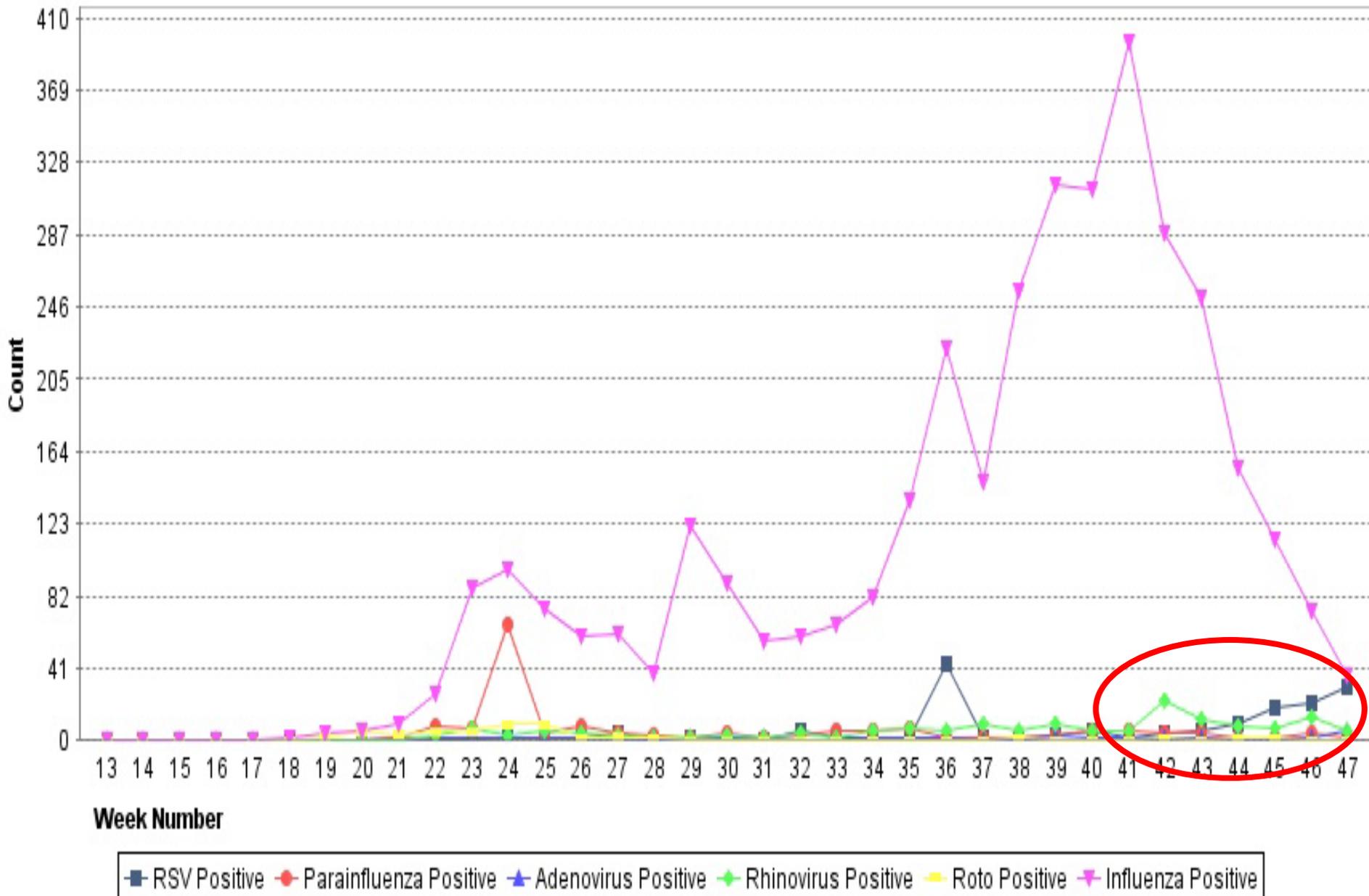
Influenza Positive Tests Reported by the N.C. State Laboratory of Public Health by Week



PHE Surveillance: Positive Respiratory Count by Week

Date Range: 03/29/2009 - 11/28/2009

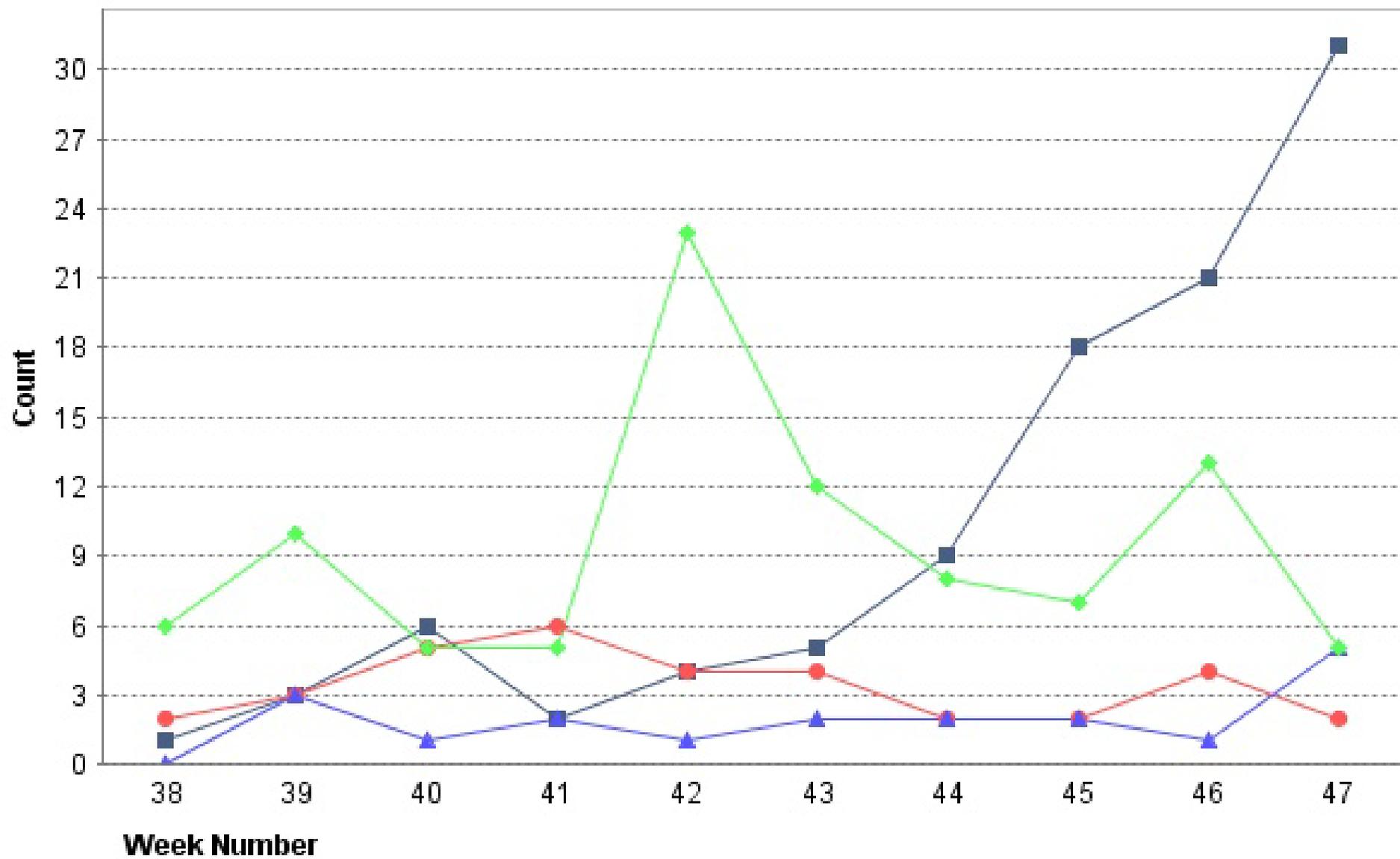
Hospital(s): PHE Network



PHE Surveillance: Positive Respiratory Count by Week

Date Range: 09/20/2009 - 11/28/2009

Hospital(s): PHE Network



■ RSV Positive ● Parainfluenza Positive ▲ Adenovirus Positive ◆ Rhinovirus Positive

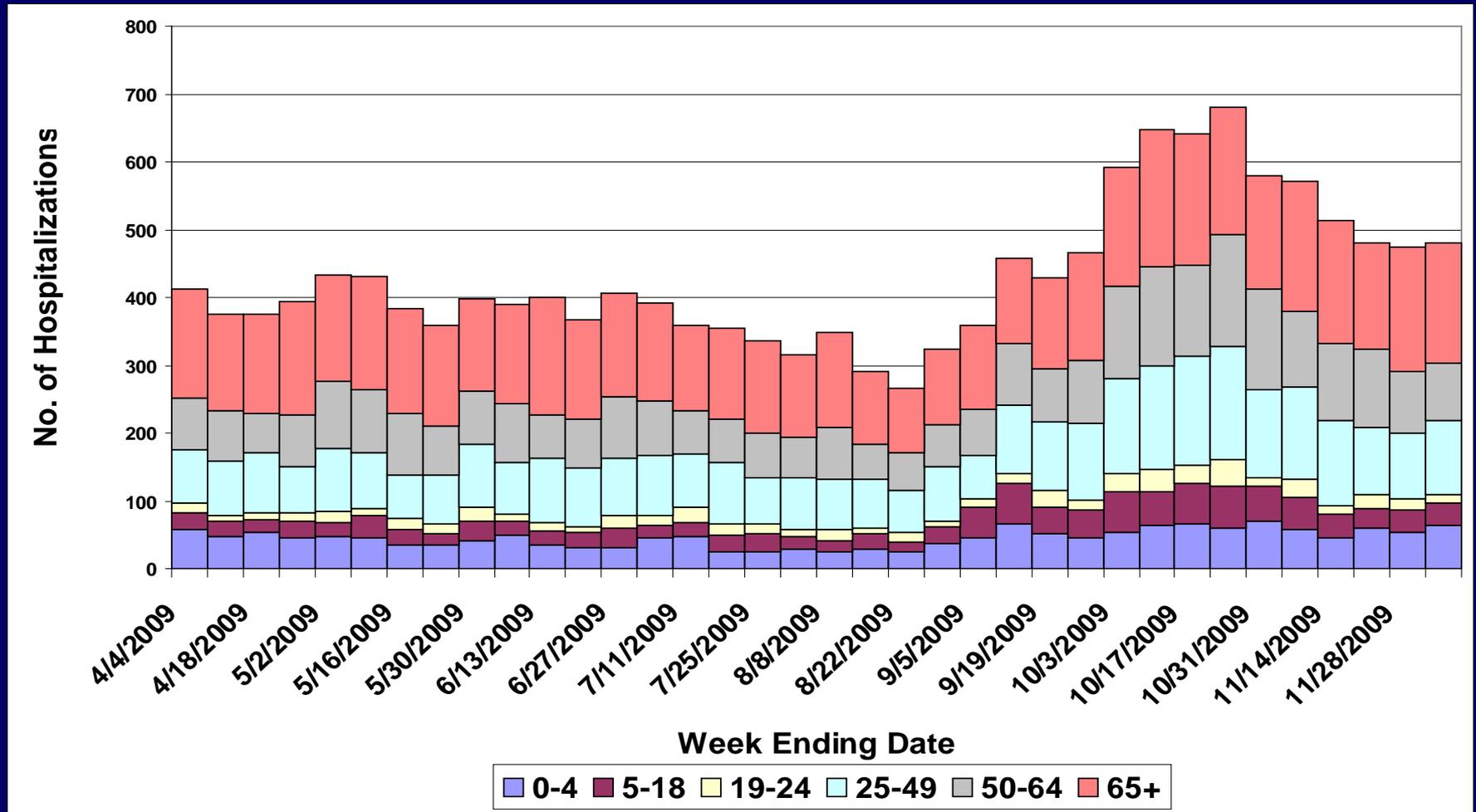
Laboratory Testing

- Negative rapid test does NOT rule out pandemic H1N1 infection
 - Sensitivity ranges 10–70% for novel H1N1
 - Negative rapid tests have led to treatment delay in fatal cases
- Treatment and control measures should be based on clinical and epidemiologic information; not on testing

Influenza-Associated Hospitalization Surveillance in NC

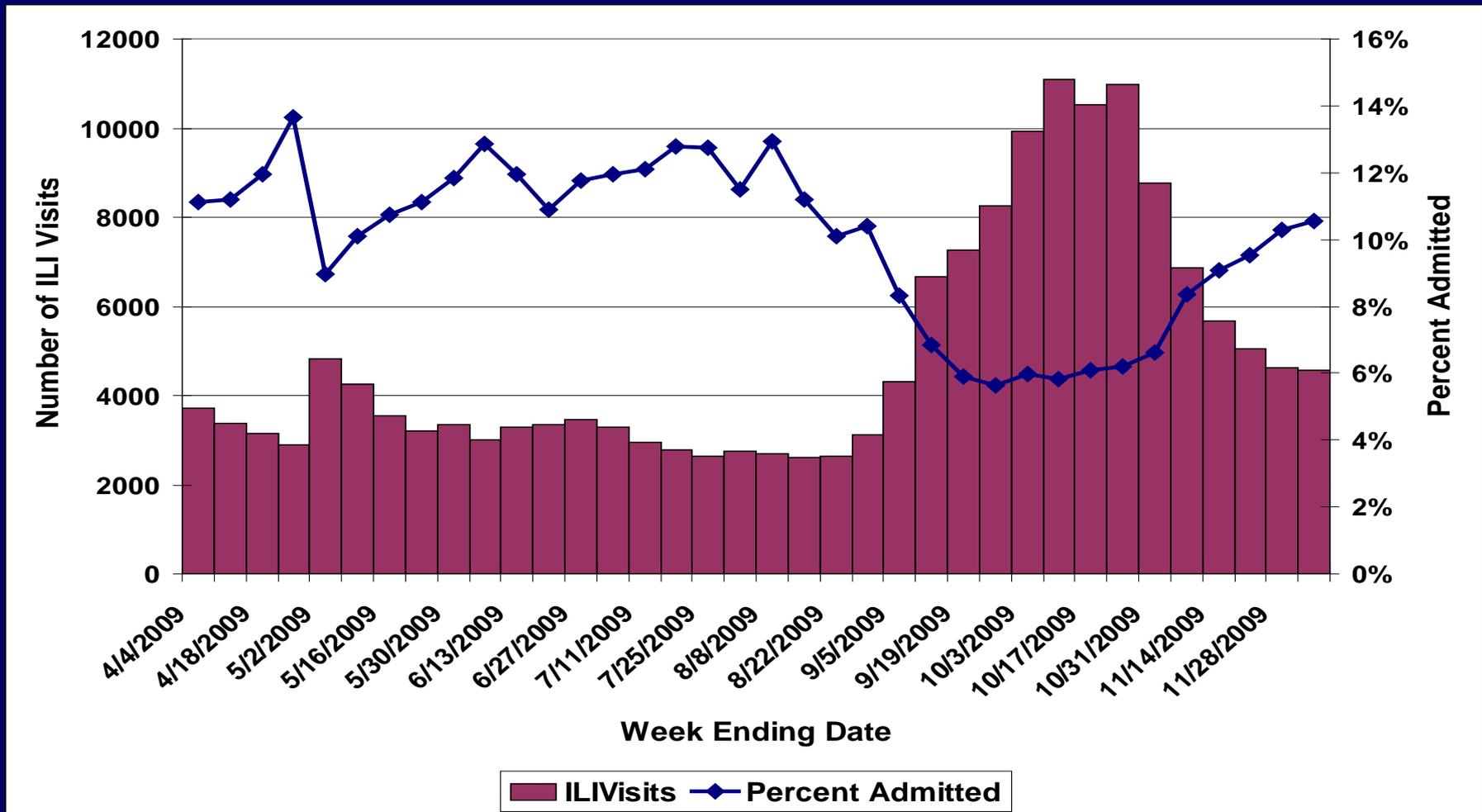
- **NC DETECT**
 - ED ILI visits resulting in admission
 - Does not include non-ED admissions
 - Includes ILI from any cause, not only influenza

ILI Admissions from Emergency Departments by Age Group



Source: NC DETECT

Number of ED Visits for ILI and Percent Admitted



Source: NC DETECT

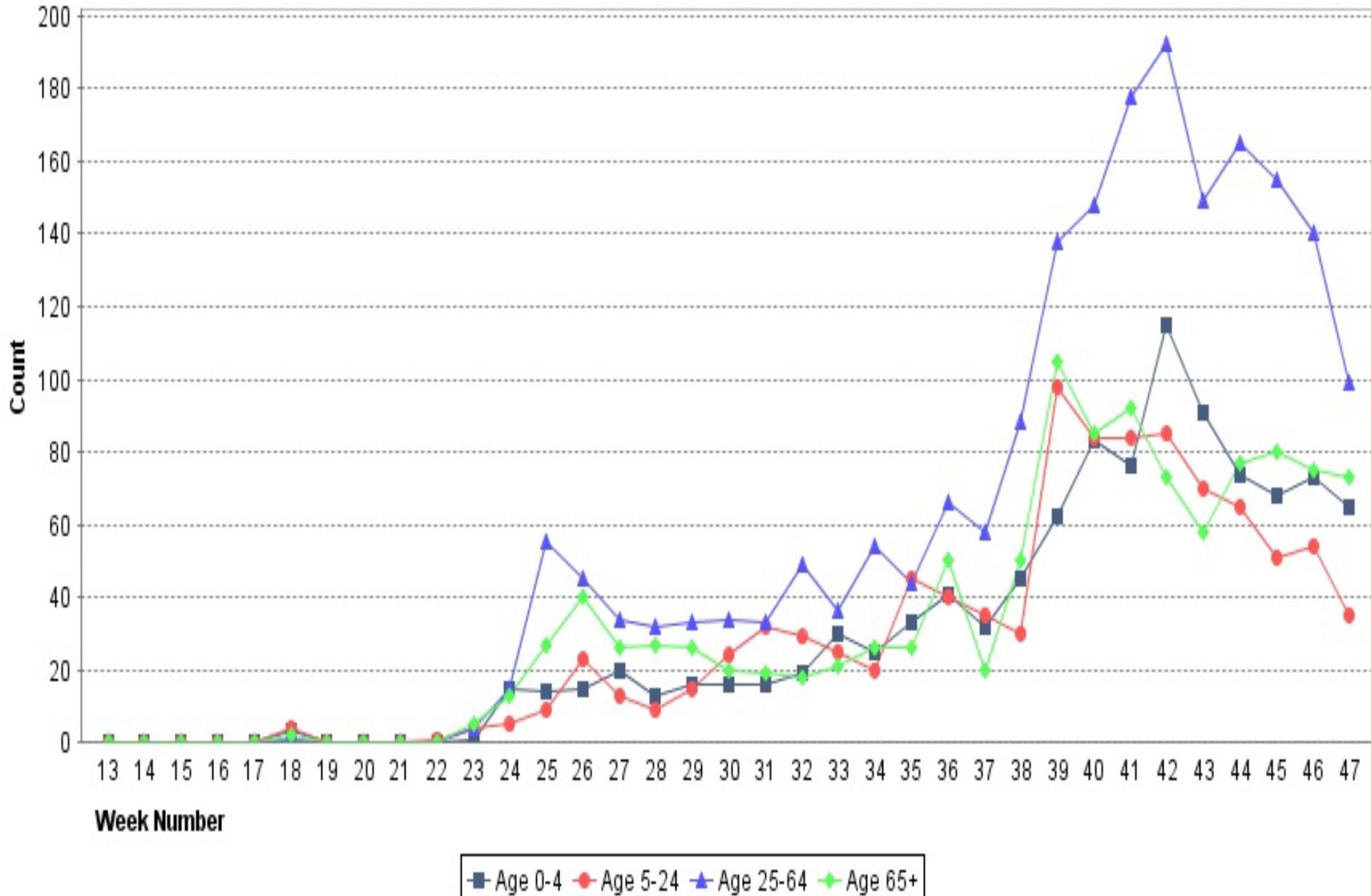
Influenza-Associated Hospitalization Surveillance in NC

- **NC DETECT**
 - ILI admissions from all EDs
 - Does not include non-ED admissions
 - Includes ILI from any cause, not only influenza
- **Public Health Epidemiologist (PHE) Network**
 - Admissions for febrile respiratory illness
 - Able to exclude those with “known cause other than influenza”

PHE Surveillance: Acute Respiratory Admits Count By Week

Date Range: 03/29/2009 - 11/28/2009

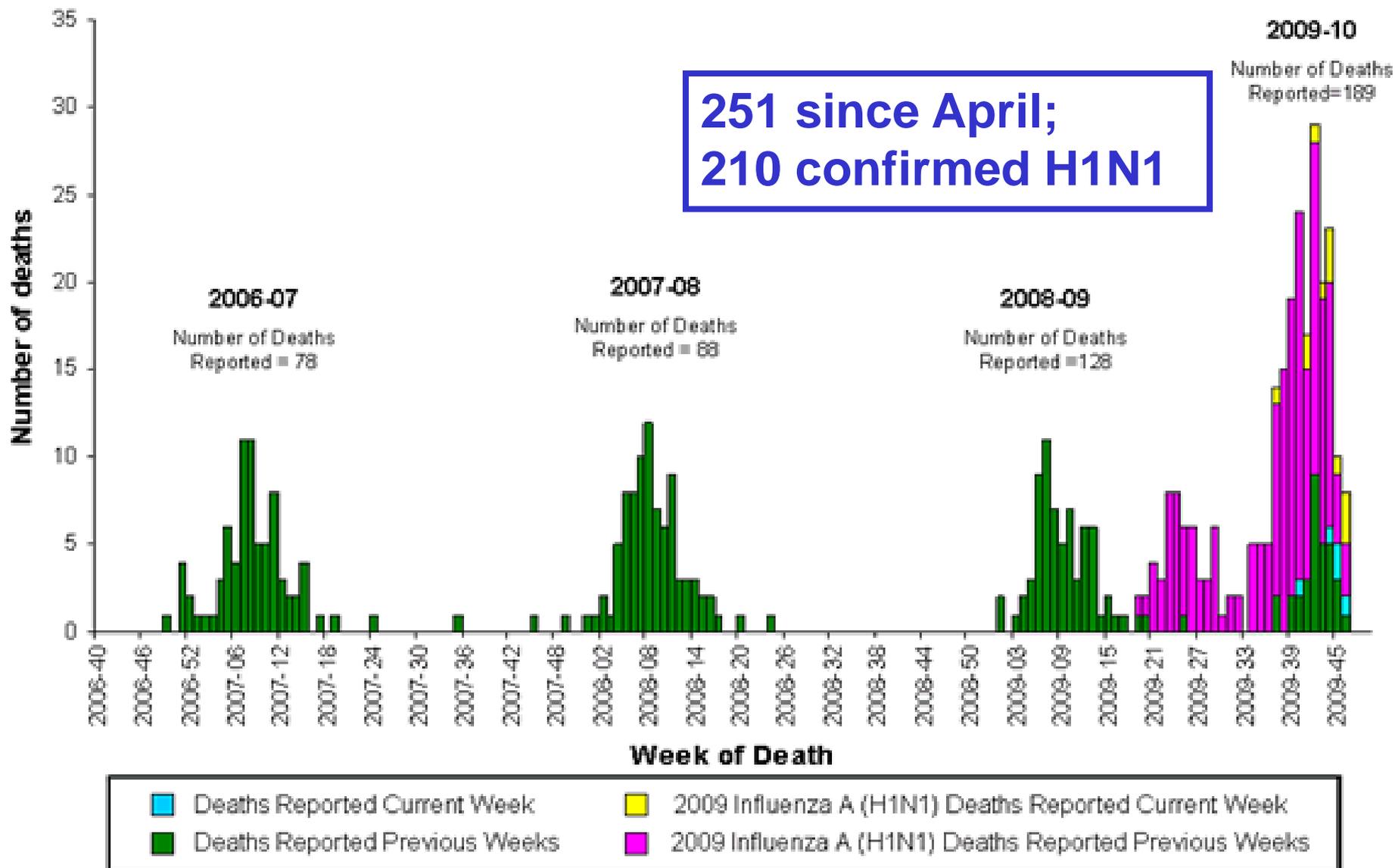
Hospital(s): PHE Network



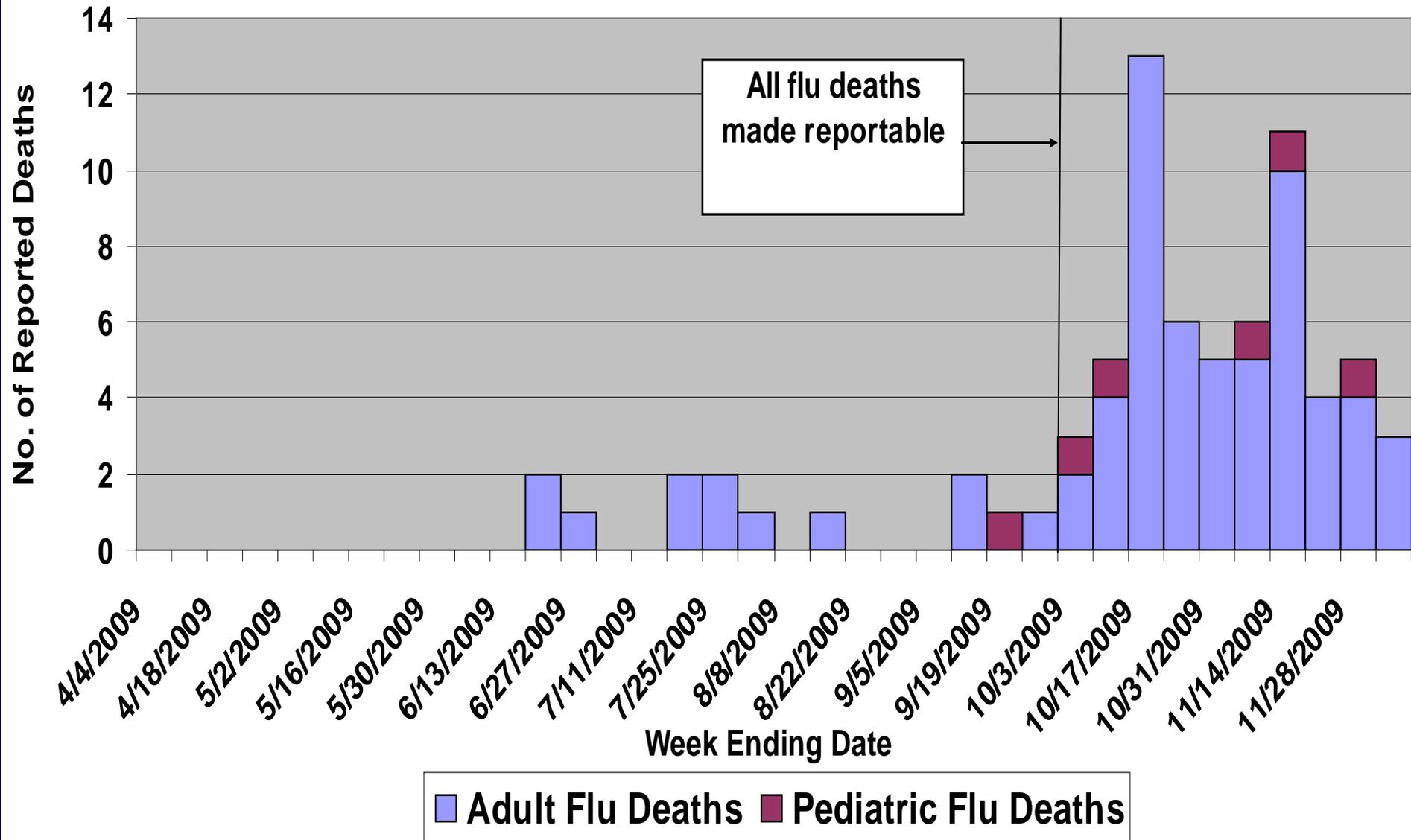
Influenza-Associated Death Surveillance

- **“Influenza-associated” defined as**
 - Clinically compatible illness
 - Influenza identified by laboratory or rapid test
- **Pediatric influenza-associated deaths reportable since 2004**
- **Beginning October 1, NC physicians also required to report deaths in adults**

Number of Influenza-Associated Pediatric Deaths by Week of Death: 2006-07 season to present



Influenza-Associated Deaths Reported in North Carolina, by Week of Death (n=74)



Influenza Associated Deaths by County of Residence



 Confirmed influenza-associated deaths (N=74)

Demographic Features

(n=74)

Age (yrs)

Median

50

Range

5–87

Male

40 / 74 (54%)

Hispanic

8 / 56 (14%)

Race (n=68)

African American

23 (34%)

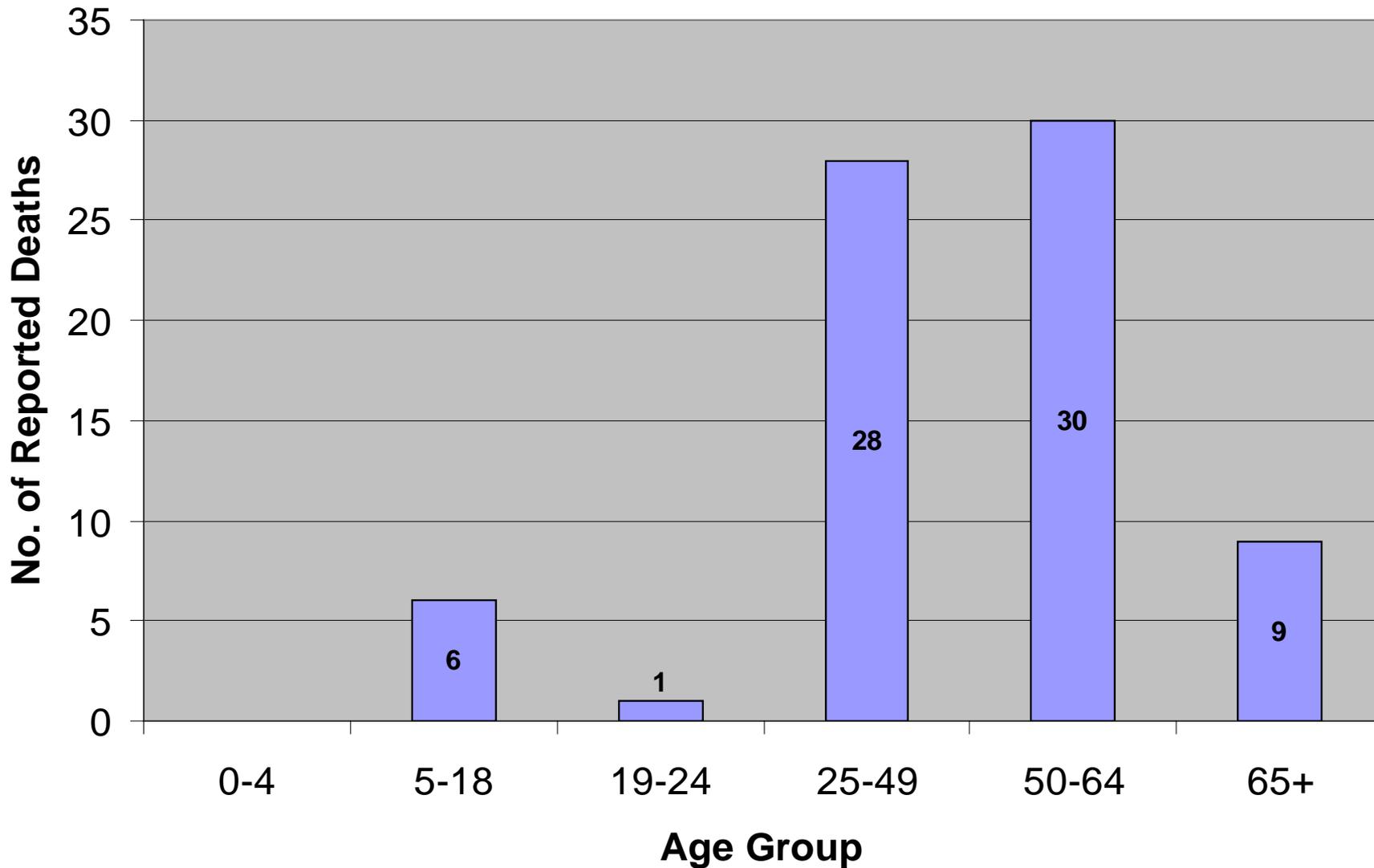
White

42 (62%)

Other

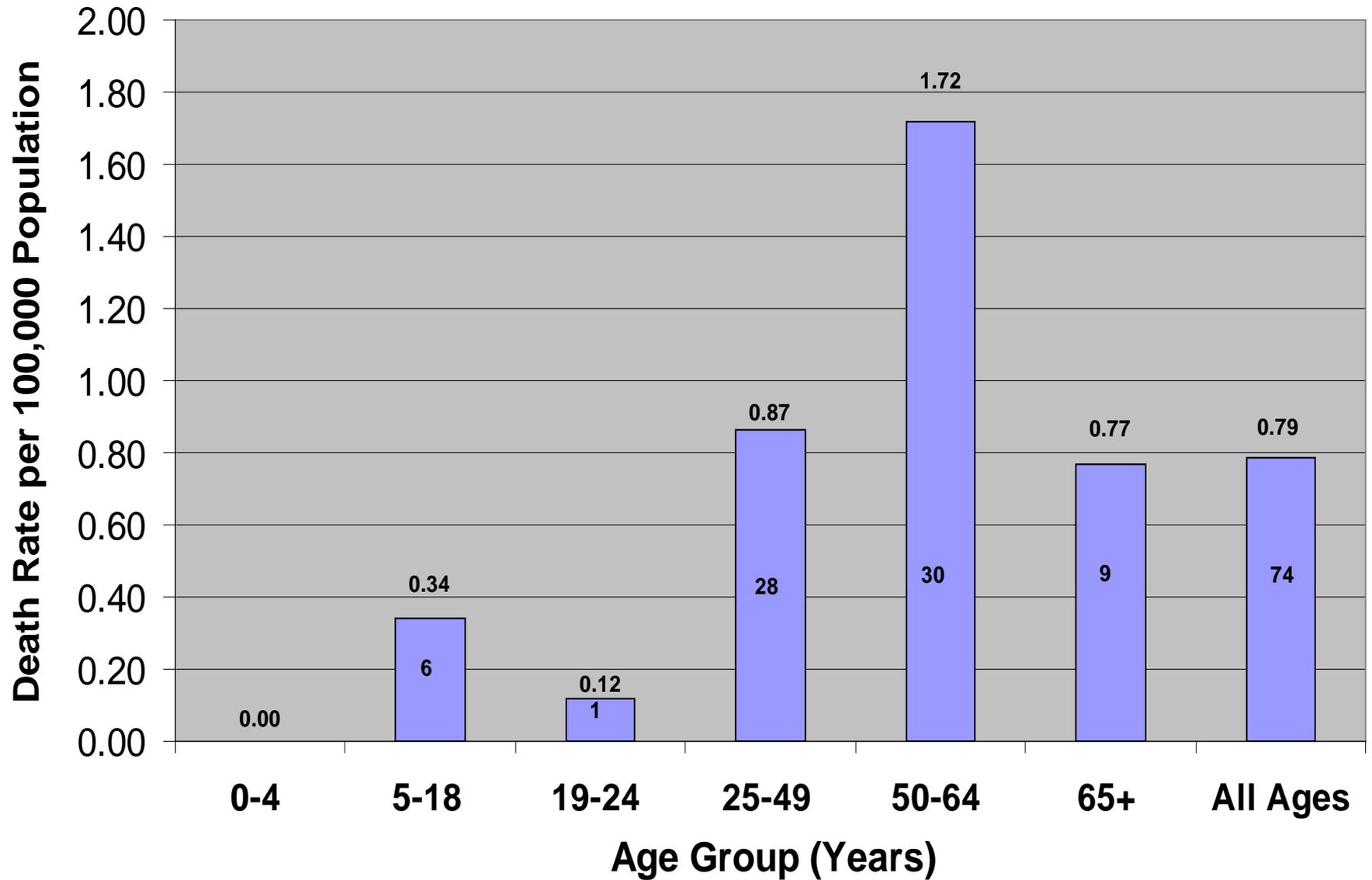
3 (4%)

Influenza-Associated Deaths Reported in North Carolina, by Age Group, April 1 - December 5, 2009 (n=74)



NC Influenza-Associated Death Rates

April 1, 2009 - December 5, 2009



Predisposing Conditions

Any	60/74 (81%)
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Chronic Lung Disease	28/50 (56%)
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COPD	16/28 (57%)
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Asthma	8/28 (29%)
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Heart Disease	23/47 (49%)
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Diabetes	20/50 (40%)
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Immunosuppressed	18/47 (38%)
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Complications

Pneumonia	53 / 60 (88%)
ARDS	38 / 55 (69%)
Sepsis	16 / 42 (38%)
Shock	13 / 45 (29%)
Encephalopathy	5 / 47 (11%)
Seizures	5 / 48 (10%)

Influenza-Associated Death Surveillance: Other Sources

- **Public Health Epidemiologist network**
 - Influenza deaths by age group
- **Medical Examiner surveillance**
 - Possible influenza deaths with no lab evidence
- **122 Cities Mortality Reporting System**
 - Pneumonia and Influenza deaths
 - Covers 1/4 of all US deaths

2009 H1N1 National Extrapolations, April 1 – October 17, 2009

	Point Estimate	(Range)
Cases	22 million	(14–34 million)
Hospitalizations	98,000	(63,000–153,000)
Deaths	3,900	(2,500–5,100)
Child Deaths	540	(300–800)

H1N1 Antiviral Resistance

- **Universal resistance to adamantanes**
- **Sporadic oseltamivir resistance**
 - 26 cases in US since April
 - 19 had exposure to oseltamivir
 - Majority immunosuppressed
- **No zanamivir resistance to date**

What's Next?

- **Continue enhanced surveillance, monitor for:**
 - Increased activity during “normal flu season”?
 - Emergence of seasonal flu strains?
 - Changes in antiviral resistance?
 - Other?
- **Stay tuned!**

Public Health Resources

- www.flu.nc.gov
- www.cdc.gov/h1n1flu

