Public Health Update for School Nurses

Jan 24, 2018

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CDC Grand Rounds Jan 16, 2018

Significant Annual Burden of Influenza

United States

12,000 – 56,000

140,000 – 710,000

9.2M – 35.6M

Global

291,000 – 646,000

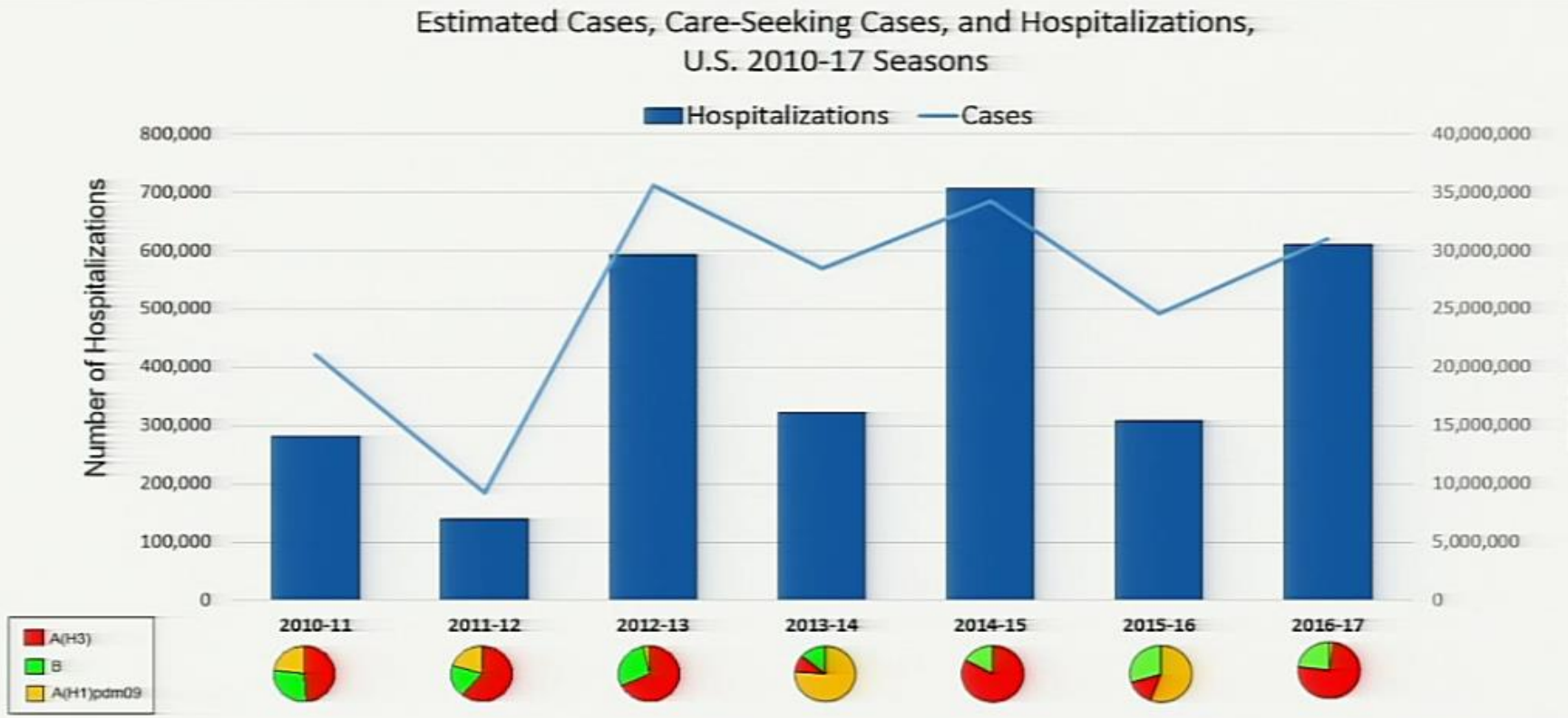
3M to 5M

1.0 B

Direct Medical Costs: $10.4 B per year
Indirect and Direct Costs: $87.1 B per year

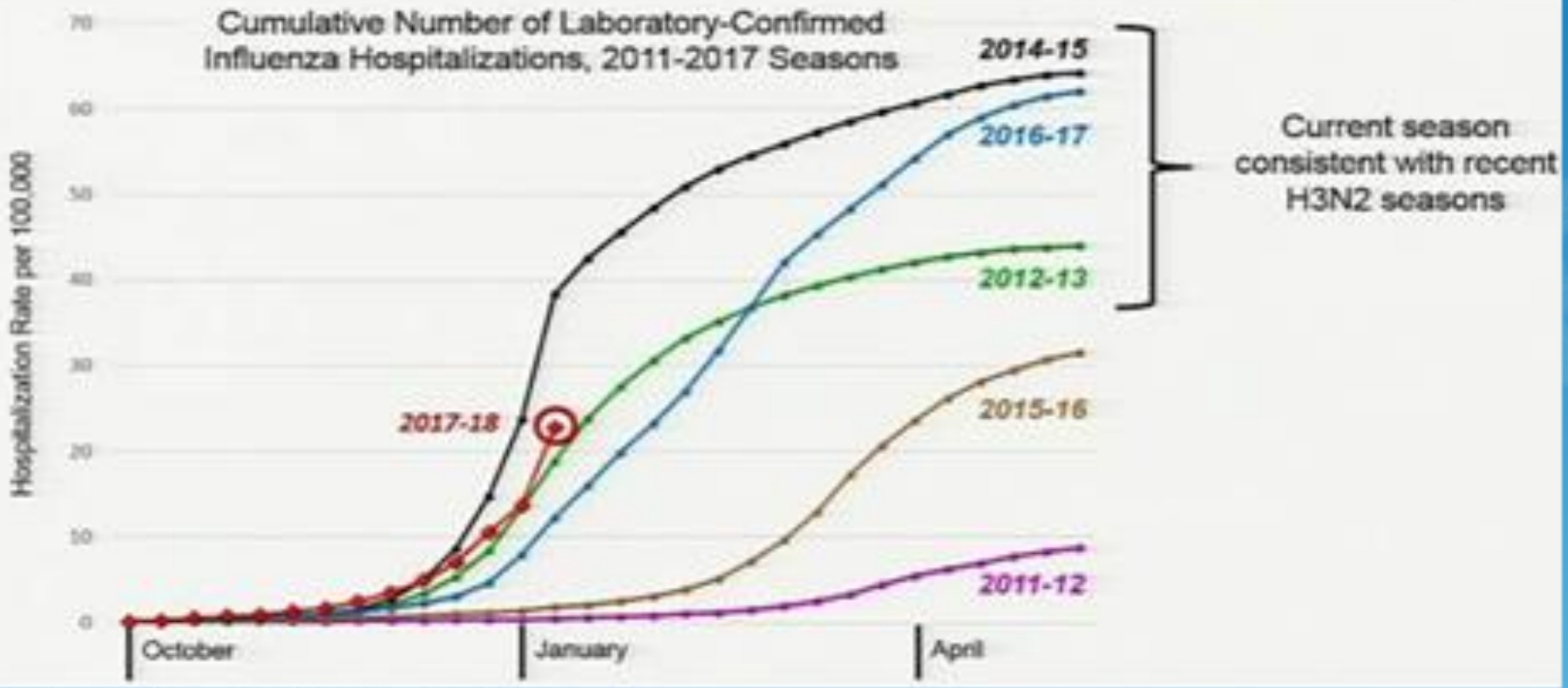
CDC. https://www.cdc.gov/flu/about/disease/2015-16.htm; Molinari et al Vaccine 2007; Iuliano et al Lancet 2017

Influenza Impact Varies by Season, Highest with H3N2



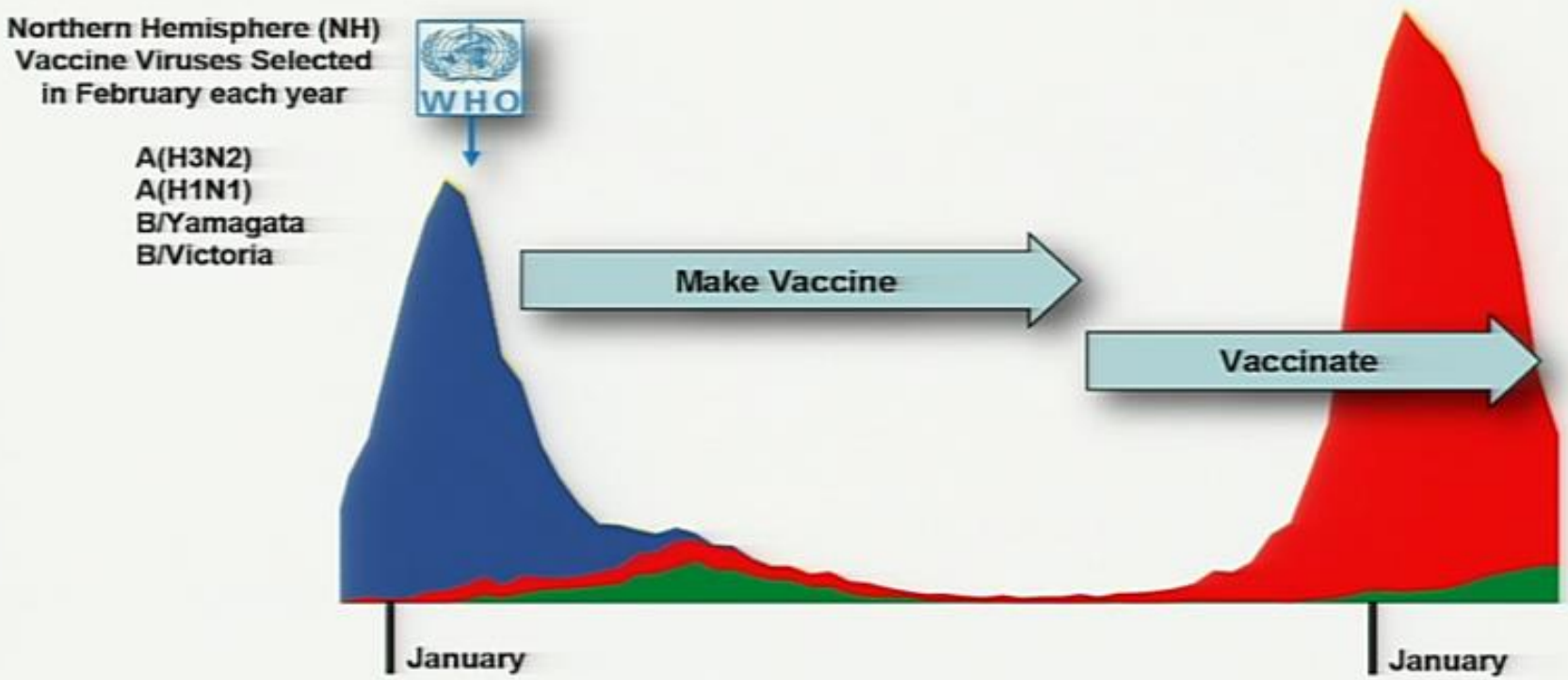
CDC. https://www.cdc.gov/flu/about/disease/2015-16.htm

Hospitalizations Tracking with Recent H3N2 Seasons

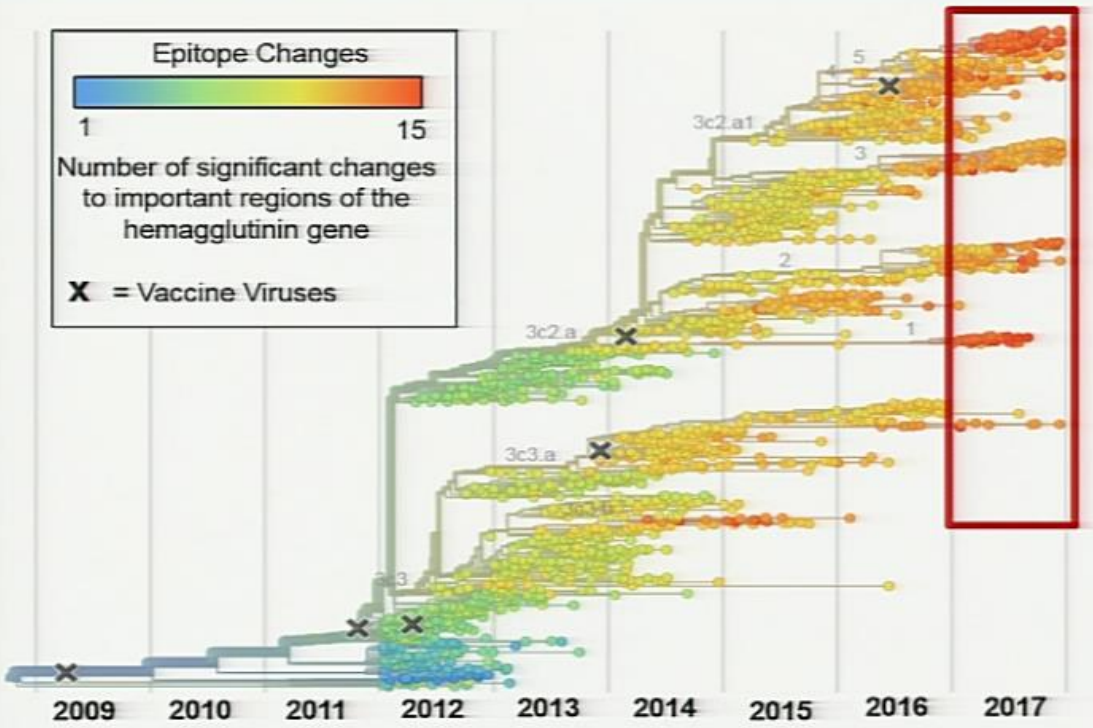


CDC FluView, https://www.cdc.gov/flu/weekly/index.htm

Vaccine Viruses Need to be Selected Six Months in Advan



Improved Genetic Characterization Shows Rapid Evolution and Diversity of H3N2



- 97% of circulating H3N2 viruses are similar to the cell-propagated H3N2 reference viruses representing the virus used in the vaccine this season in the U.S.

 CDC collaboration with NextFlu. Neher, Bedford et al.

Influenza Vaccine Manufacturing Requires Specially Prepared Viruses

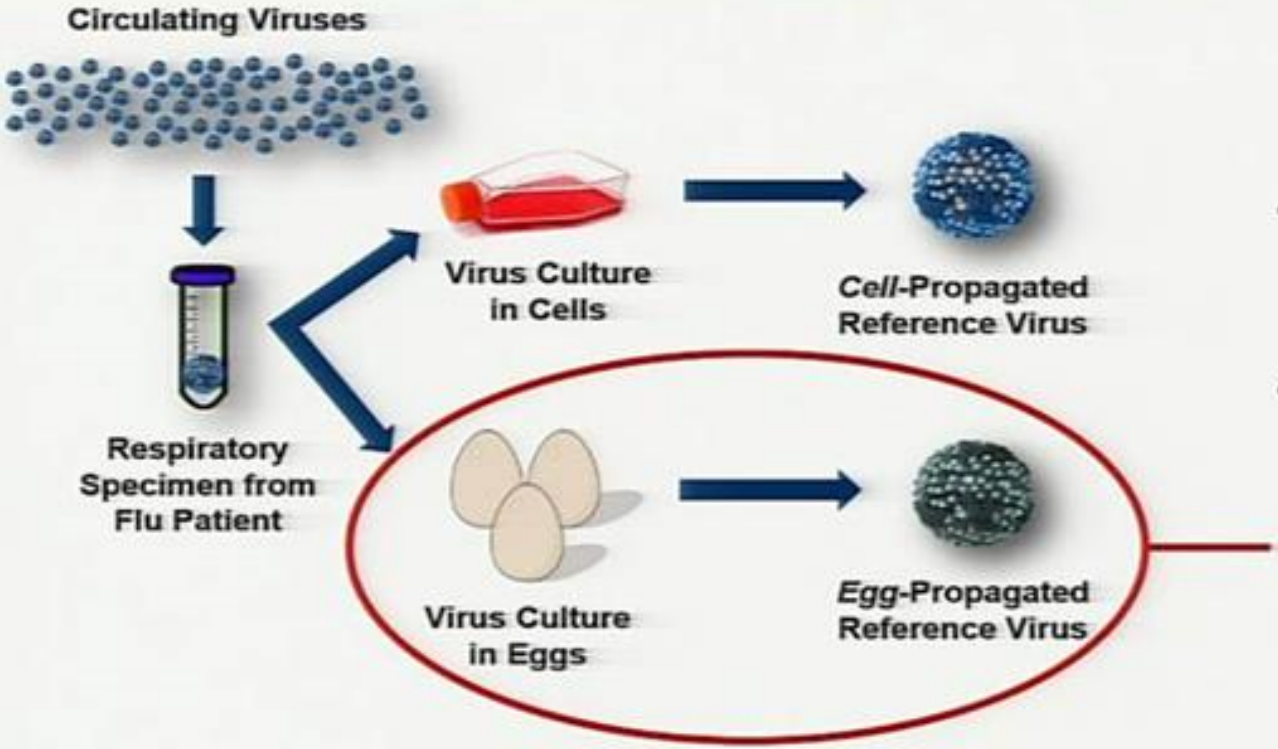
Egg-Based Influenza Vaccines

- Primary manufacturing technology for over 50 years
- Majority (~87%) of available vaccines in the U.S. use eggs
- CDC and other laboratories isolate viruses directly from human respiratory specimens in eggs
  - Influenza viruses can undergo changes as they are grown in eggs

Influenza Vaccines Made Without Eggs

- Cell-Based Manufacturing
  - CDC provides cell-propagated candidate vaccine viruses to the cell-based manufacturer
- Recombinant Protein Manufacturing
  - CDC provides gene segment sequences to manufacturer which then generates protein using insect cells

H3N2 Virus Growth in Eggs Is Increasingly Challenging



- **Poor Propagation:** H3N2 viruses are difficult to propagate in eggs.
- **Egg Propagation Can Change Antigenicity:** Contemporary H3N2 (3C.2a) viruses acquire changes on the hemagglutinin protein upon propagation in eggs and this can impact the antigenic properties.

H3N2 Summary

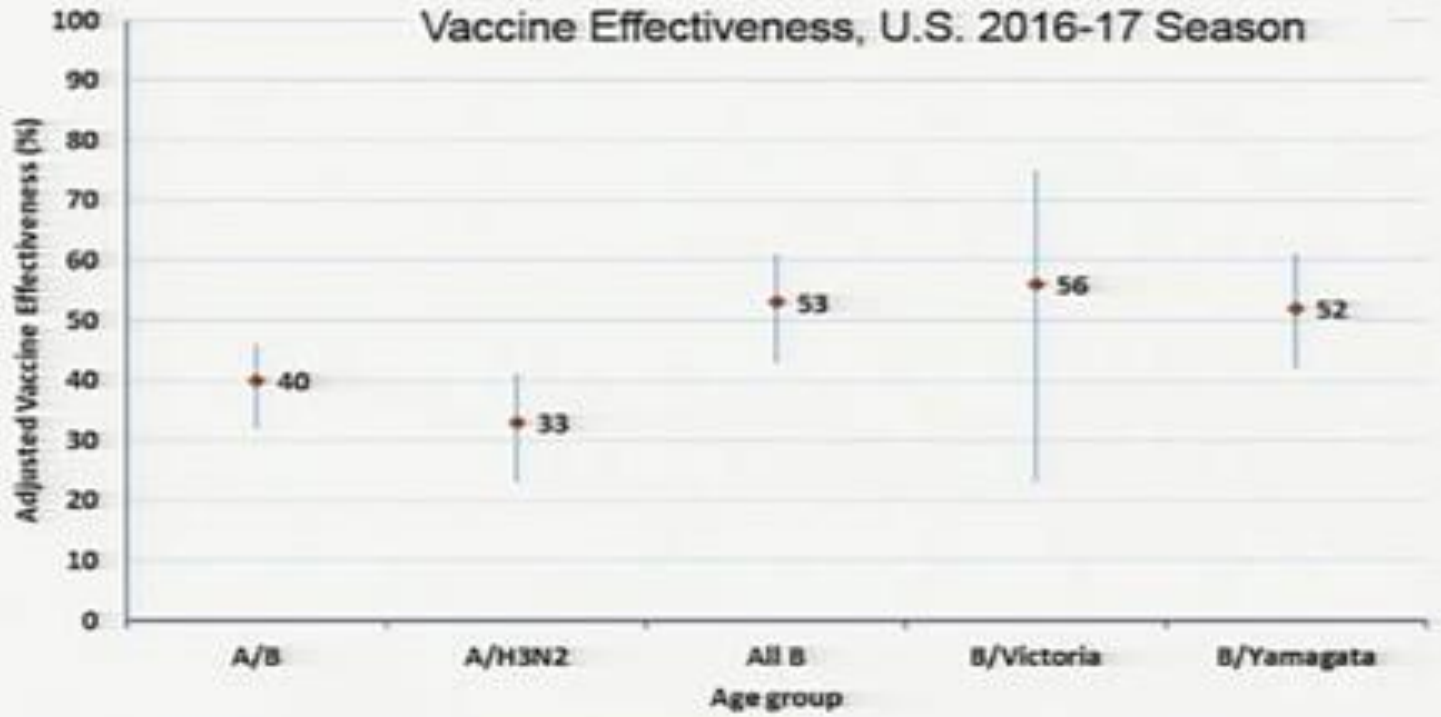
- **H3N2 viruses rapidly evolve and evade immunity generated from prior exposure and or vaccines**
  - Many divergent populations are co-circulating
  - H3N2 changes rapidly to adapt to selective pressures
- **Efforts are underway to overcome contemporary H3N2 vaccine challenges**
  - Improving virus strain selection
    - Increased use of Next-Generation sequencing and fitness forecasting
    - Development of new assays
  - Manufacturers employing new technologies
    - Cell-propagated vaccine viruses
    - Recombinant protein vaccines

In recent years, the H3N2 vaccine component has not worked as well as H1N1 or B vaccine components

- **Meta-analysis of observational VE studies conducted in ambulatory care settings, 2004-2015**
  - Pooled VE against influenza B viruses was 54%
  - Pooled VE against influenza A(H1N1)pdm09 viruses was 61%
  - Pooled VE against H3N2 viruses was 33%

Belongia, et al Lancet ID

Last Season (2016-17), Vaccination Reduced Influenza-Associated Outpatient Visits by 40%



https://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm

Current influenza vaccines reduce the burden of illnesses in the US

- **In 2016-17, vaccination provided substantial prevention:**

Modeled using estimates of disease burden, vaccine coverage and effectiveness, based on Reed et al https://www.cdc.gov/flu/about/disease/2015-16.htm

Our second line of defense after vaccination: antiviral medications for treatment of influenza

- **3 FDA-approved neuraminidase inhibitors* (NAIs) are recommended**
  - Oral oseltamivir (Tamiflu® or generic formulation)
    - Approved for treatment age ≥14 days (*recommended for all ages*)
  - Inhaled zanamivir (Relenza®)
    - Approved for treatment age ≥7 years
  - Intravenous peramivir (Rapivab®)
    - Approved for treatment age ≥2 years

*Only medications active against circulating influenza viruses. Not effective against other viruses.

Evidence for neuraminidase inhibitors (NAI) efficacy

- **Randomized placebo-controlled clinical trials (RCTs) in outpatients with lab-confirmed influenza:**
  - Early treatment (within 2 days of illness onset) shortened duration of fever and illness symptoms by ~1 day

- **No placebo controlled clinical trials for *prevention of severe outcomes***

Evidence for NAI effectiveness against severe outcomes from meta-analyses and observational studies

- **Evidence from meta-analyses of RCTs in outpatients and observational studies in hospitalized and outpatients demonstrate that early treatment reduces severe illness**

Outpatients with lab-confirmed influenza: Reduction in subsequent otitis media (34%) in children, and lower respiratory tract illnesses requiring antibiotics (37-44%) and hospitalizations (63%) in adults, and reduction of hospitalizations (75%) in high risk persons (all ages)

Hospitalized patients: Reduction in mortality in adults (50%) and shortened length of PICU stay (18%) and post admission mechanical ventilation (34-77%) in children

Dobson, Lancet ID 2015; Lipsitch, CID 2013; Malosh, CID 2017; Venkatesan et al Clinical Infectious Diseases 2017; Muthuri, Lancet Resp Med 2014; Coffin PIDJ 2011; Eriksson Ped Crit Care Med 2012

CDC Antiviral Guidance focuses on severe illness

- **Antiviral treatment is recommended as early as possible for any patient with suspected or confirmed influenza who is:**
  - Hospitalized
  - Has severe, complicated, or progressive illness
  - Is at high risk for influenza complications
- **Antiviral treatment can be considered for any previously healthy, symptomatic outpatient not at high risk with confirmed or suspected influenza on the basis of clinical judgment**
  - If treatment can be initiated within 48 hours of illness onset

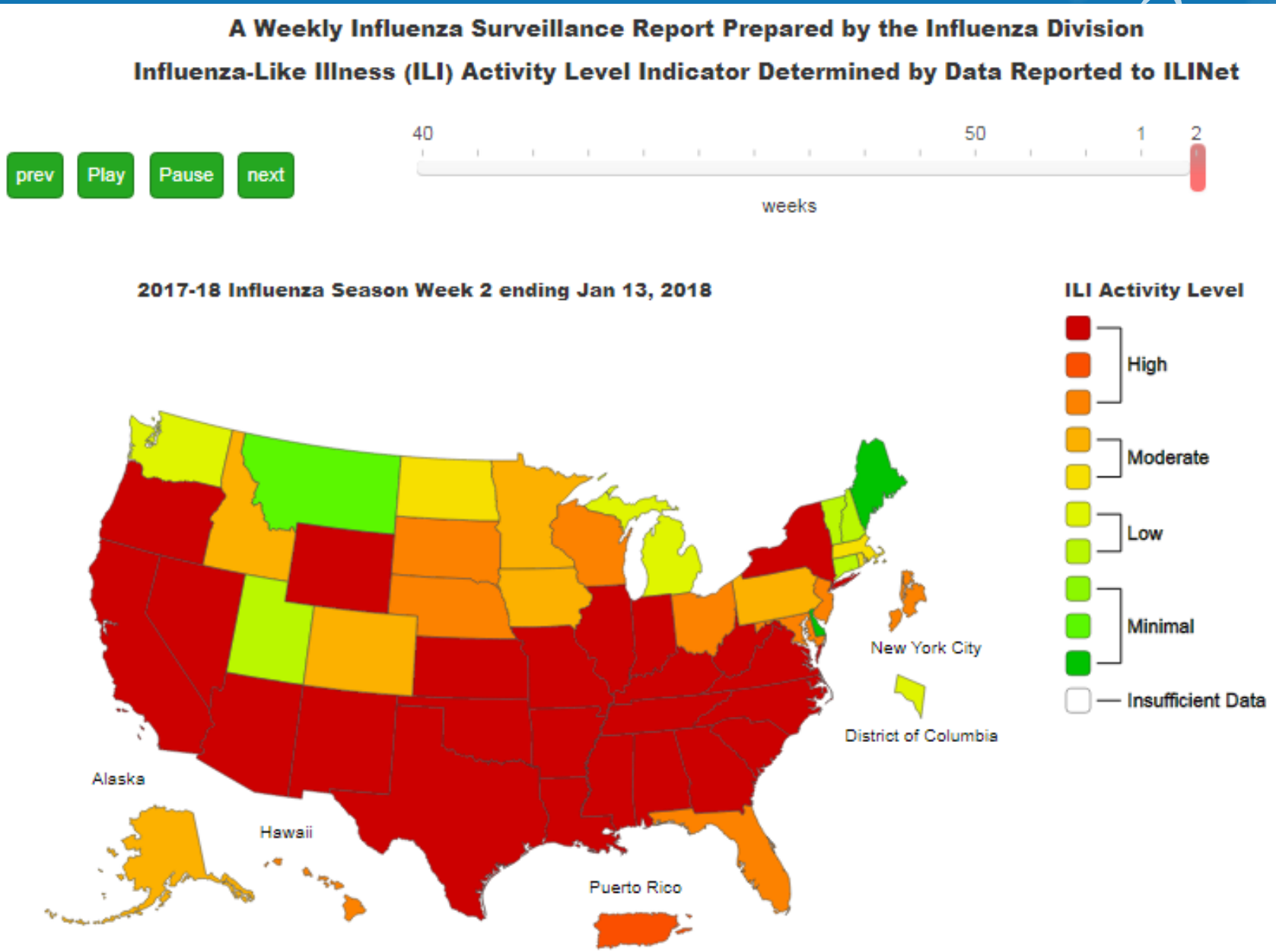
https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm

Conclusions

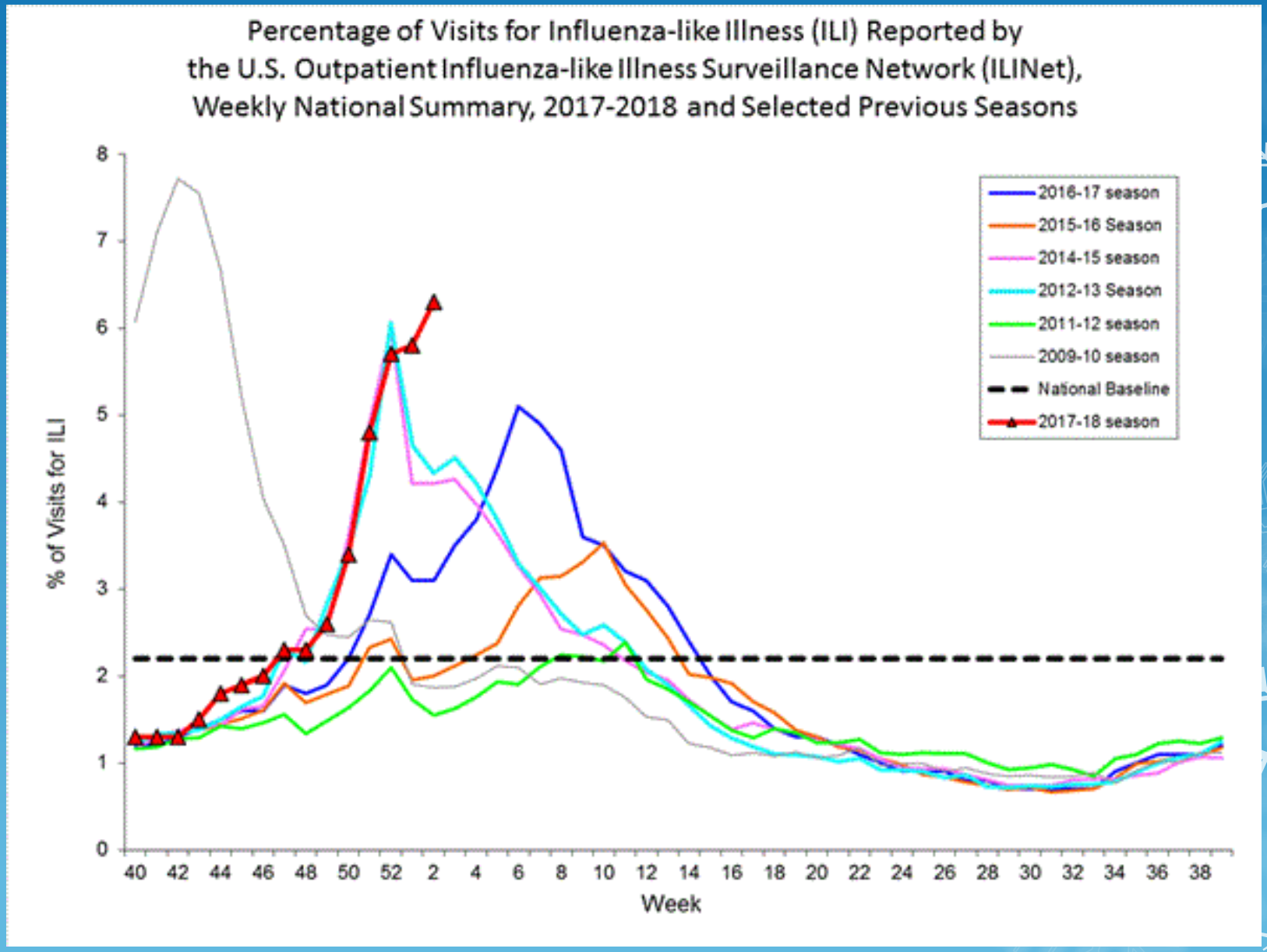
- Influenza is affecting most of the country
- Peak activity may be occurring now, but influenza will circulate for many more weeks
- Urge your friends, family, and patients to get vaccinated if they have not done so yet
- Think flu - treat hospitalized patients and high risk outpatients with influenza antivirals as soon as possible

https://www.cdc.gov/flu/resource-center/nivw/index.htm

State of the Nation- FLU



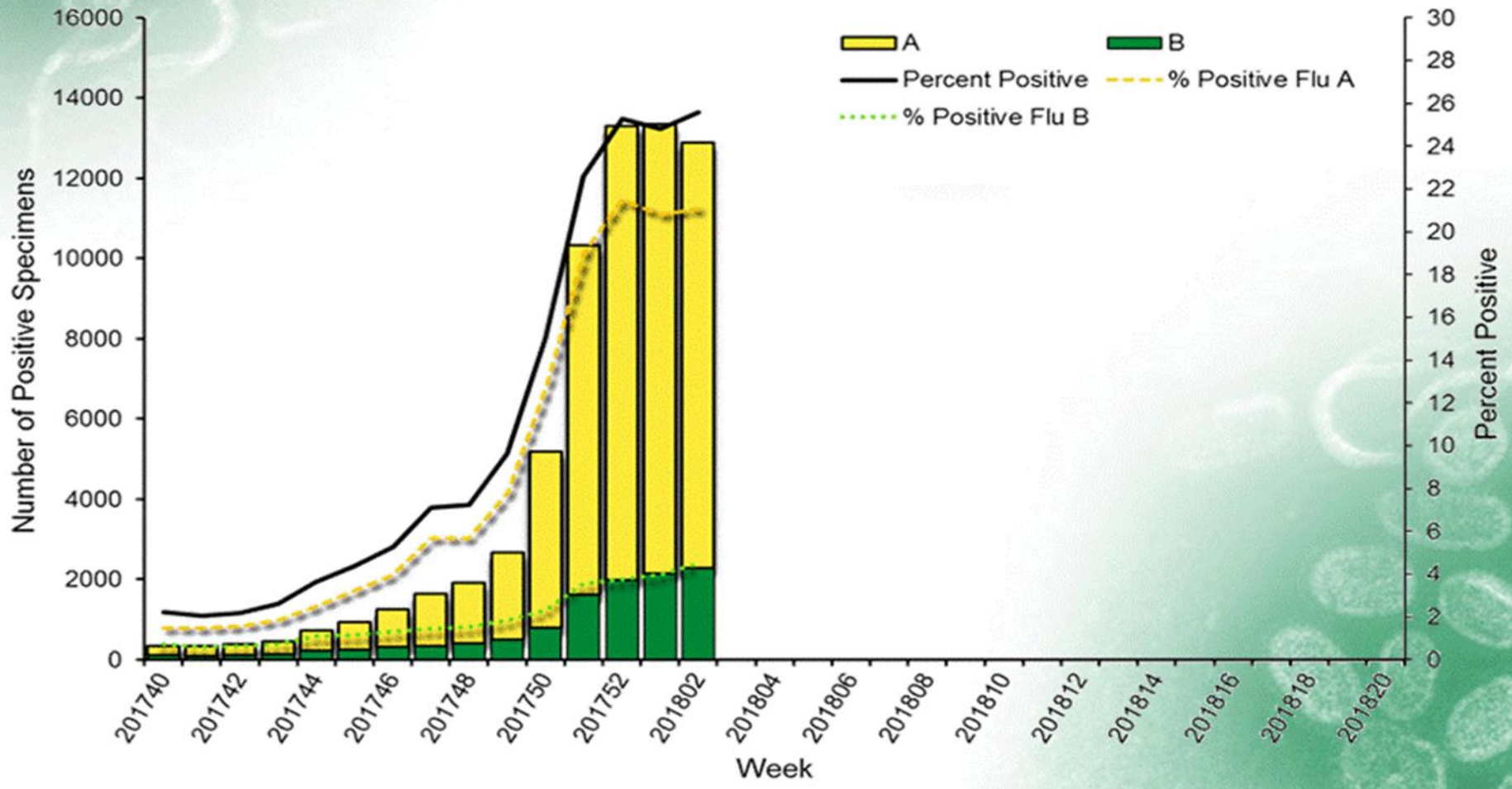
State of the Nation- FLU



FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Influenza Positive Tests Reported to CDC by U.S. Clinical Laboratories, National Summary, 2017-2018 Season



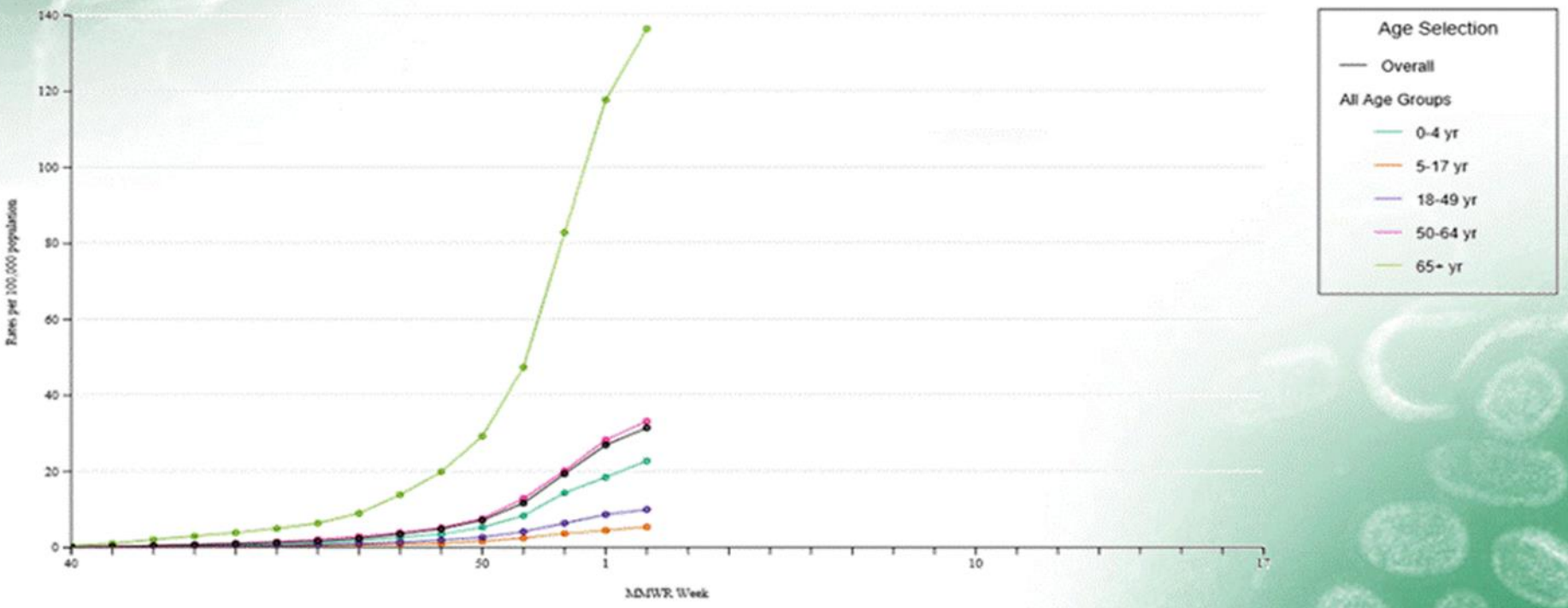
FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Laboratory-Confirmed Influenza Hospitalizations

Preliminary cumulative rates as of Jan 13, 2018

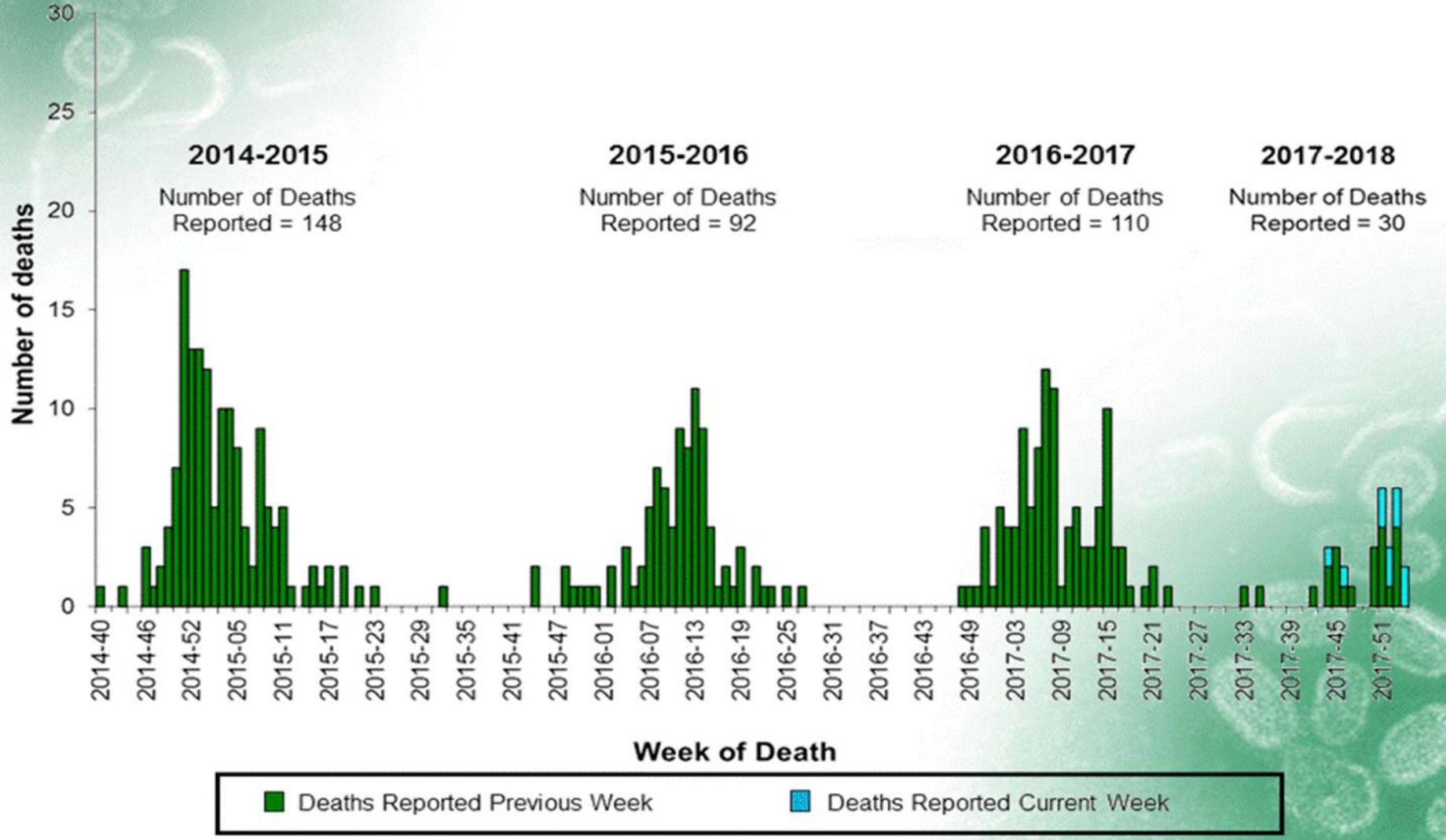


FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

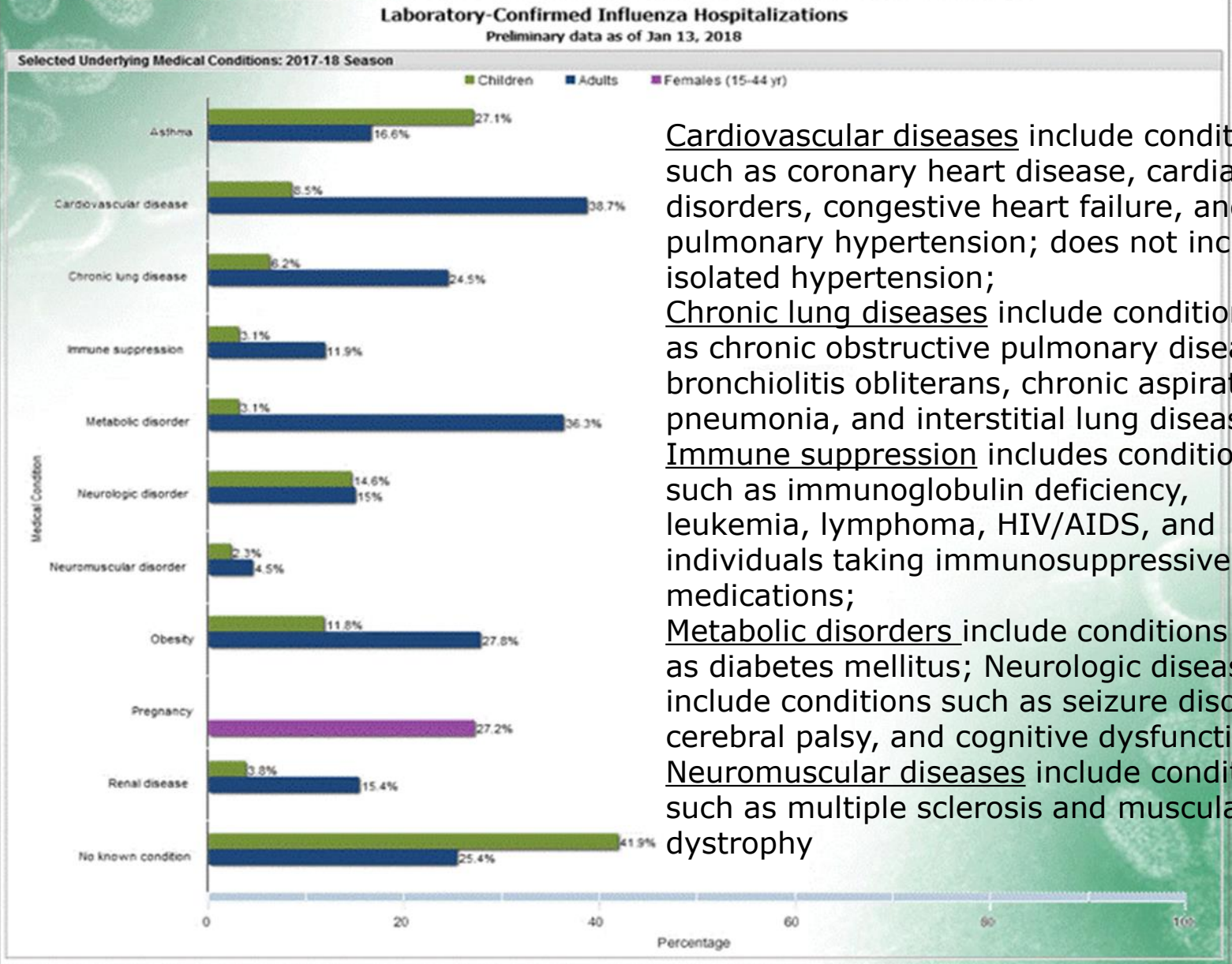
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Number of Influenza-Associated Pediatric Deaths by Week of Death: 2014-2015 season to present



FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division



Cardiovascular diseases include conditions such as coronary heart disease, cardiac valve disorders, congestive heart failure, and pulmonary hypertension; does not include isolated hypertension;

Chronic lung diseases include conditions such as chronic obstructive pulmonary disease, bronchiolitis obliterans, chronic aspiration pneumonia, and interstitial lung disease;

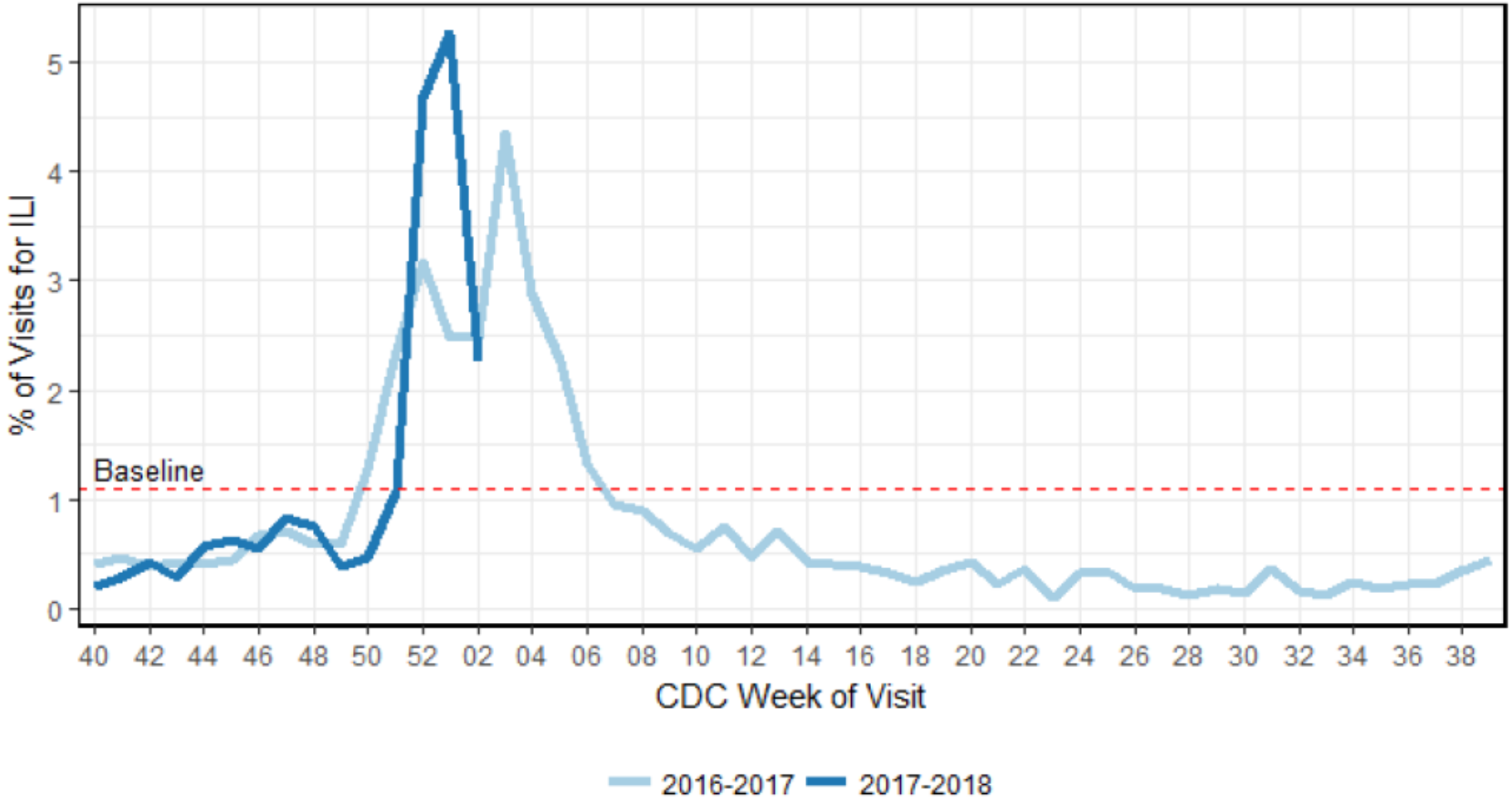
Immune suppression includes conditions such as immunoglobulin deficiency, leukemia, lymphoma, HIV/AIDS, and individuals taking immunosuppressive medications;

Metabolic disorders include conditions such as diabetes mellitus; Neurologic diseases include conditions such as seizure disorders, cerebral palsy, and cognitive dysfunction

Neuromuscular diseases include conditions such as multiple sclerosis and muscular dystrophy

State of the State - ILI

Figure 3: Percentage of ILI Visits Reported by Sentinel Providers, Washington, 2016-2018



https://www.doh.wa.gov/Portals/1/Documents/5100/420-100-FluUpdate.pdf

State of the State-FLU

Figure 2: Influenza Positive Tests Reported to CDC, WA Commercial Laboratories

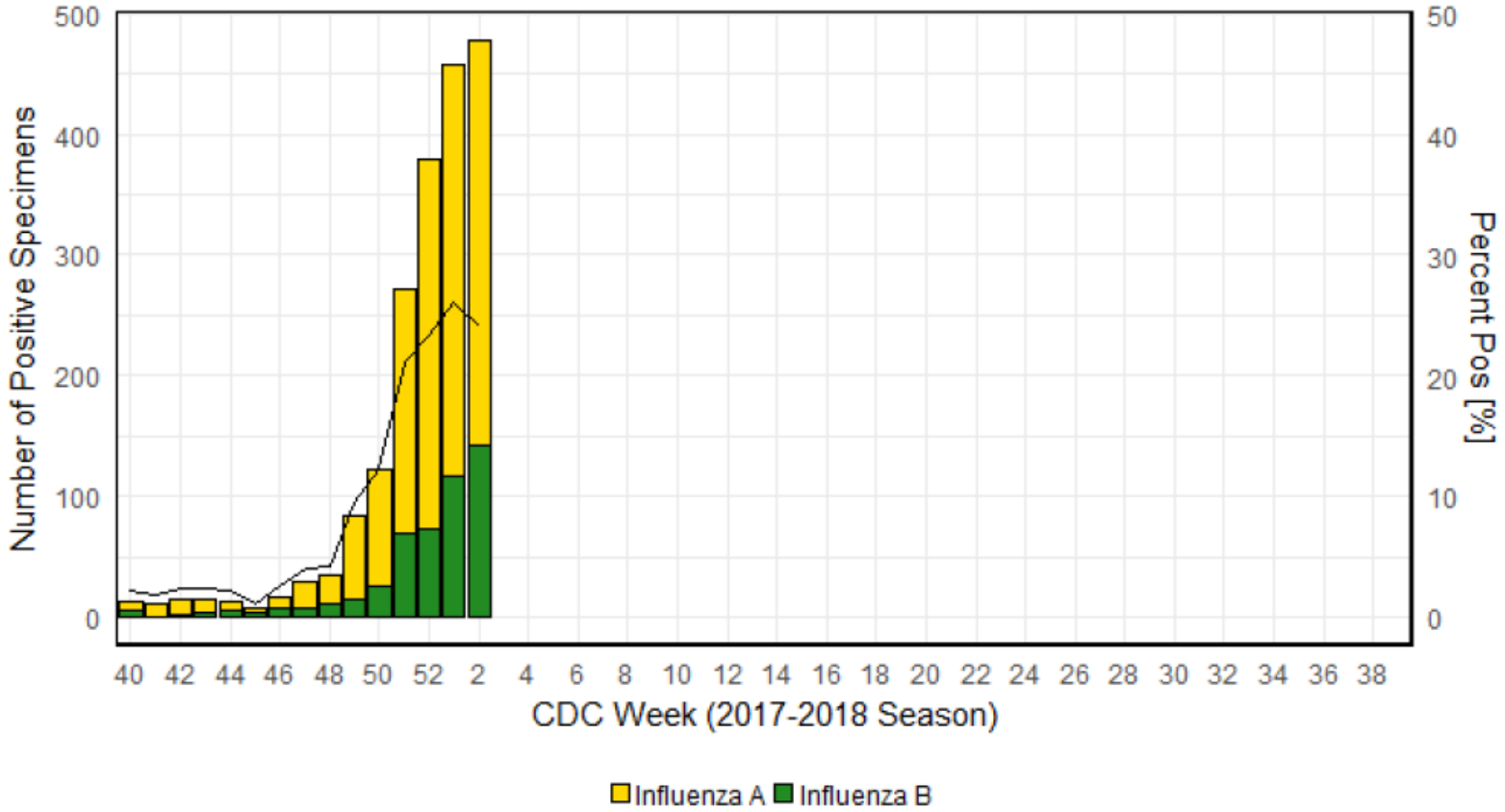


Table 1: WA Influenza Specimens Reported to CDC, Public Health Laboratories and Commercial Laboratories

Week	A (H1)	A (2009 H1N1)	A (H3N2)	A (Unable to Subtype)	A (Subtyping not performed)	B	BYam	BVic	Total Tested	% Flu Positive
51	0	2	13	0	195	71	3	0	1,294	21.9
52	0	13	20	0	290	74	1	1	1,653	24.1
01	0	14	31	0	316	117	2	0	1,802	26.6
02	0	5	33	0	301	146	0	0	2,002	24.2

https://www.doh.wa.gov/Portals/1/Documents/5100/420-100-FluUpdate.pdf

State of the State –FLU Deaths

Table 4: Count and rate of reported laboratory-confirmed influenza-associated deaths by age group, Washington, 2017-2018 season to date

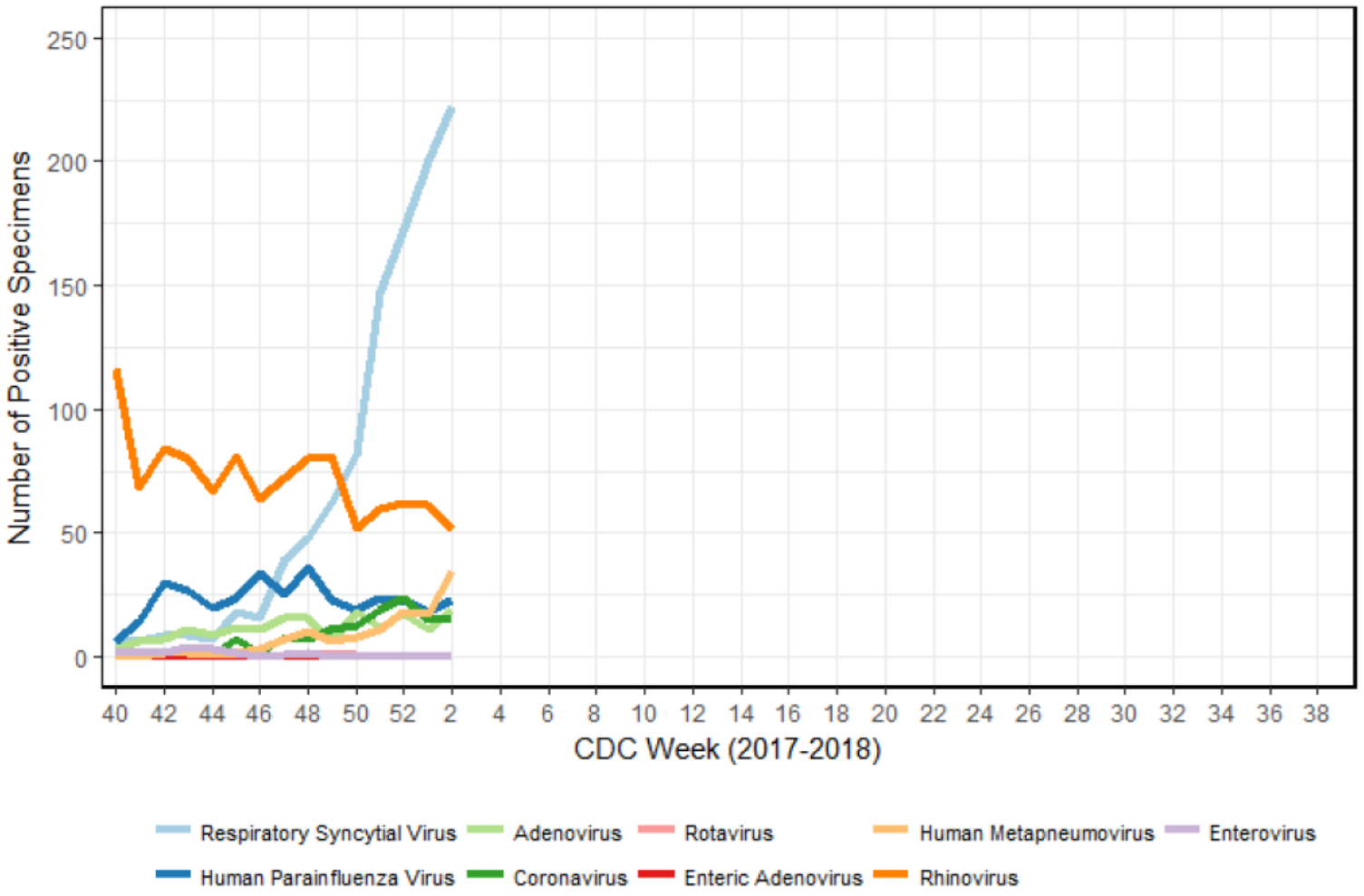
Age Group (in years)	Count of Deaths	Death Rate (per 100,000 population)
0-4	1	0.23
5-24	0	0.00
25-49	3	0.13
50-64	17	1.22
65+	65	6.94
Total	***86***	***1.25***

Table 5: Count of Reported Laboratory-Confirmed Influenza-Associated Deaths, Past Seasons to Week 02 and Total

Season	Count of Deaths as of Week 02 of Season	Count of Deaths Reported for the Entire Season (week 40 to week 39)
2017-2018, to date	86	86
2016-2017	110	278
2015-2016	8	67
2014-2015	87	156
2013-2014	30	80
2012-2013	20	54
2011-2012	1	20
2010-2011	4	36

Other causes of respiratory infections in WA

Figure 10: Respiratory and Enteric Viruses, Washington, 2017-2018 Season to Date



Week	Reporters	RSV	Human Parainfluenza Virus	Adenovirus	Coronavirus	Rotavirus	Enteric Adeno virus	Human Metapneumovirus	Rhinovirus	Enterovirus
51	16	147	24	12	19	0	0	11	60	1
52	16	172	23	17	24	1	0	18	62	0
01	14	200	18	11	15	0	0	17	61	1
02	12	222	23	19	15	0	0	35	51	0

Local Flu Situation

County	Count of Deaths Reported to WA DOH from week 40 of 2017 to present
Benton	4
Chelan	1
Clallam	2
Clark	4
Grant	1
Grays Harbor	2
Island	1
King	9
Kitsap	8
Mason	1
Pierce	8
Skagit	1
Snohomish	19
Spokane	15
Stevens	1
Thurston	1
Walla Walla	2
Whatcom	3
Yakima	3

Meningococcal Disease

Meningococcal disease is a rare, but very serious illness caused by a type of bacteria called *Neisseria meningitidis*. Even if treated quickly, meningococcal disease can cause long-term problems or be deadly. Getting vaccinated is the best way to prevent meningococcal disease.

Meningococcal Disease Can Lead to Meningitis or Bloodstream Infection

Meningococcal disease has two common outcomes – meningitis and bloodstream infection. These infections typically appear within 3 to 7 days after being exposed to the bacteria. Both of these conditions are very serious and can be deadly. In fatal cases, deaths can occur in as little as a few hours. People who recover from meningococcal disease can have lifelong complications, such as loss of limb(s), deafness, nervous system problems, or brain damage.

Meningitis

When someone has meningococcal meningitis, the tissue covering the brain and spinal cord becomes infected and swells. Symptoms of meningococcal meningitis include sudden onset of **fever**, **headache**, and **stiff neck**. There can be additional symptoms, such as:

- Nausea
- Vomiting
- Confusion

In babies, these symptoms can be difficult to notice or may not be there at all. Instead, a baby may appear slow or inactive, be irritable, vomit, or feed poorly.

Bloodstream Infection

When someone has a meningococcal bloodstream infection, the bacteria can enter the bloodstream and multiply, damaging the walls of the blood vessels and causing bleeding into the skin and organs. Symptoms may include:

- Fever or cold chills
- Tiredness (fatigue)
- Vomiting or diarrhea
- Cold hands and feet
- Severe aches or pain in the muscles, joints, chest, or belly (abdomen)
- Rapid breathing
- A dark purple rash

Meningococcal disease is a very serious illness that requires immediate medical care.

CDC
Centers for Disease Control and Prevention
National Center for Immunization and Respiratory Diseases

https://www.cdc.gov/meningococcal/downloads/17-275138A-MeningococcalDis-FS.pdf

Certain People are at Increased Risk for Meningococcal Disease

Babies, teens, and young adults have higher rates of meningococcal disease than people of other ages do. Other factors, such as having certain medical conditions or traveling to certain countries, can increase your risk for getting this disease, no matter how old you are. **Talk to your healthcare professional to see if you or your child is at increased risk for meningococcal disease.**

Meningococcal Disease is Spread from Person to Person

The bacteria that cause meningococcal disease are spread by exchanging respiratory and throat secretions (saliva or spit) during close (for example, coughing or kissing) or lengthy contact, especially if living in the same household. Fortunately, these bacteria are much harder to spread than viruses that cause the common cold or the flu.

Meningococcal Disease is Very Serious but Treatable

Meningococcal disease can be treated with antibiotics (medicine that kills bacteria in the body). It is important that treatment be started as soon as possible. However, about 1 to 2 out of every 10 people who get meningococcal disease will die from the infection, even with quick and appropriate treatment. **If you think you or your child has meningococcal disease, seek medical care right away.**

Who Should Get Vaccinated Against Meningococcal Disease?

- All preteens and teens
- People 2 months old or older with certain medical conditions that affect the immune system
- Microbiologists who routinely work with *N. meningitidis*
- People 2 months old or older who are traveling to certain countries
- People 2 months old or older at risk because of an outbreak in their community

There are two types of vaccines that help protect against meningococcal disease. Most people who get a meningococcal vaccine do not have any serious problems with it. Side effects are usually mild and go away on their own within a few days, but serious reactions are also possible. **Talk to your healthcare professional about which vaccines you or your child may need.**

When Do Teenagers Need to be Vaccinated?

All preteens and teens should get vaccinated against meningococcal disease.

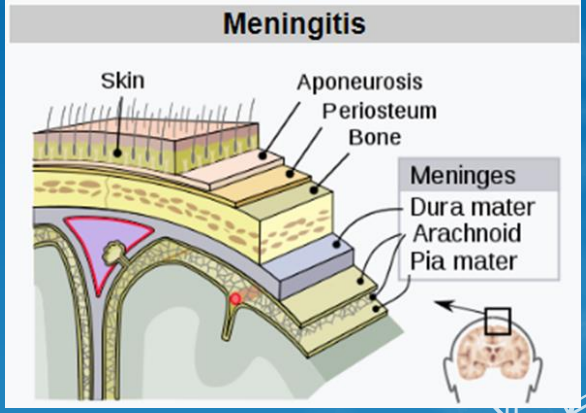
Preteens

All 11 to 12 year olds should receive one dose of a meningococcal conjugate vaccine that helps protect against four types (serogroups) of the bacteria: A, C, W, and Y.

Teens and Young Adults

Teens should receive a booster dose of a meningococcal conjugate vaccine when they are 16 years old to continue having protection during the years (16 through 23 years) when they are most at risk for getting meningococcal disease. Teens and young adults (16 through 23 year olds) may also be vaccinated with a serogroup B meningococcal vaccine, preferably when they are between 16 and 18 years old.

Causes of Meningitis



- **Bacterial**-types vary according to the infected individual's age (next slide)
- **Viral**-enteroviruses, HSV (mostly type 2; less type 1), varicella zoster, mumps, HIV and LCMV
- **Fungal**-Cryptococcus neoformans, Coccidiodes immitis, Histoplasma capsulatum, Blastomyces dermatitidis, Candida species
- **Parasitic**-Angiostrongylus cantonensis, Gnathostoma spinigerum, Schistosoma as well as conditions cysticercosis, toxocariasis, baylisascariasis, paragonimiasis
- **Non-infectious**-malignant or neoplastic cancer, drugs (mainly non-steroidal anti-inflammatory drugs and IV immunoglobulins). Neurosarcoidosis, systemic lupus erythematosis, some forms of vasculitis, epidermoid cysts and dermoid cysts

https://en.wikipedia.org/wiki/Meningitis

Bacterial meningitis by individual's age group

Premature Babies and Newborns up to 3 months

- **Group B Streptococci** (subtype III in vagina)
- **E. coli** with K1 antigen
- **Listeria monocytogenes**

Older children

- **Neisseria meningitidis**
- **Streptococcus pneumoniae**

Adults

- **Neisseria meningitidis** and
- **Streptococcus pneumoniae** together cause 80% of bacterial meningitis cases.
- **Listeria monocytogenes** risk is increased in persons over 50 yo

https://en.wikipedia.org/wiki/Meningitis

Local Report

MENINGITIS, MENINGOCOCCAL OREGON MIDDLE SCHOOL STUDENT

January 17, 2018

A student at Linus Pauling Middle School in Corvallis has been hospitalized with meningococcal disease. The student was admitted to the hospital on [Sun 14 Jan 2018] and testing is being done to determine which strain of the potentially deadly disease is involved.

Up to 6 undergraduates at Oregon State University have been infected with meningococcus [serogroup] B since the fall of 2016, but so far there is no indication of a connection between the Linus Pauling case and the OSU outbreak.

Questions?