Influenza in the Healthcare Setting

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March 15, 2019

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Financial Disclosure

I have no financial relationships to disclose

Learning Objectives

1. Influenza virus introduction
    1. Review what the influenza virus does, how it spreads, and how it can become serious or fatal
2. How nosocomial transmission of influenza contributes to burden of flu and affects patients at high risk for complications
3. How to prevent flu in the healthcare setting
4. How flu surveillance works in New Mexico, and how healthcare professionals/IPs can contribute

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Introduction to Influenza

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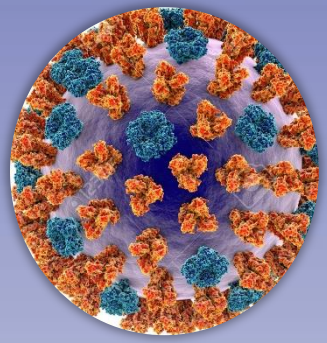
Cause(s) of Influenza

- Italian, literally, influence, from Medieval Latin *influentia*; from the belief that epidemics were due to the influence of the stars

  - Merriam Webster Dictionary – History & Etymology

- Later modified to *influenza del freddo* ("influence of the cold")
- Influenza virus first isolated in 1901 from poultry, in 1931 from swine, and in 1933 from humans

Influenza Virus



- Antigenic drift: minor continuous changes within a type; the reason you need a new vaccine every year
- Antigenic shift: major change in virus that results in a new strain, and can cause a pandemic

- Orthomyxoviridae family; comes in 3 types:
  - A – Have 2 surface antigens: hemagglutinin (HA) and neuraminidase (NA). Experiences antigenic drift and shift
  - B – experiences antigenic drift
  - C – antigenically stable; causes mild, sporadic disease

(A Few) Influenza A Types

- A(H3N2)-dominant seasons have 2.3 times higher average mortality rates than other seasons
- A(H1N1_pdm2009) emerged in 2009 and caused a pandemic, resulting in 4 times the usual number of pediatric deaths
- A(H5N1) and A(H7N9) are avian flus associated with severe disease and high case fatality rates
  - A(H7N9) currently ranked as strain with highest potential pandemic risk

What Strains Does the 2018-2019 Flu Shot Cover?

This season, the trivalent flu shot contains:

- **A**/Michigan/45/2015**(H1N1)pdm09**-like virus
- **A**/Singapore/INFIMH-16-0019/2016A(**H3N2**)-like virus
- **B**/Colorado/06/2017-like (**Victoria** lineage) virus

And the quadrivalent flu shot contains all the above and:

- **B**/Phuket/3073/2013-like (**Yamagata** lineage) virus

What the Virus Does to You

- Virus replicates in epithelial cells throughout respiratory tree
  - Infects and destroys cells mainly in upper respiratory tract and trachea, but also lungs in severe/fatal cases
- Causes redness and mucous discharge (sneezing, coughing)
- Immune response causes inflammation, fever, and chills

NBC. *Parks and Recreation*. 2014.

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How the Flu Can Kill

- If virus reaches lungs, the damage to cells can cause pneumonia, pulmonary hemorrhage, and respiratory failure
- If virus reaches heart, damage to heart cells can cause cardiomyopathy and make the heart unable to pump blood well enough on its own
- Immune system can overreact with a “cytokine storm,” overwhelming the body with immune cells that attack both infected and healthy cells
  - Common culprit when young, healthy adults die of flu

Influenza Antivirals

Antiviral Agent	Activity Against	Use	Recommended For	Not Recommended for Use in	Adverse Events
Oral Oseltamivir	**Influenza A and B**	**Treatment**	Any age[1]	N/A	**Adverse events:** nausea, vomiting, headache. Post marketing reports of serious skin reactions and sporadic, transient neuropsychiatric events[2]
		Chemo-prophylaxis	3 months and older[1]	N/A	
Inhaled Zanamivir	**Influenza A and B**	**Treatment**	7 yrs and older[3]	people with underlying respiratory disease (e.g., asthma, COPD)[3]	**Adverse events:** risk of bronchospasm, especially in the setting of underlying airways disease; sinusitis, and dizziness.. Post marketing reports of serious skin reactions and sporadic, transient neuropsychiatric events[2]
		Chemo-prophylaxis	5 yrs and older[3]	people with underlying respiratory disease (e.g., asthma, COPD)[3]	
Intravenous Peramivir	**Influenza A and B[4]**	**Treatment**	2 yrs and older[4]	N/A	**Adverse events:** diarrhea. Post marketing reports of serious skin reactions and sporadic, transient neuropsychiatric events[2]
		Chemo-prophylaxis[5]	Not recommended	N/A	
Oral Baloxavir	**Influenza A and B[6]**	**Treatment**	12 yrs and older[6]	N/A	**Adverse events:** none more common than placebo in clinical trials
		Chemo-prophylaxis[5]	Not recommended	N/A	

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Nosocomial Transmission

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Wilson KE, Wood SM, Schaecher KE, et al. Nosocomial outbreak of influenza A H3N2 in an inpatient oncology unit related to health care workers presenting to work while ill. Am J Infect Control. 2019;0(0).

Nosocomial outbreak of influenza A H3N2 in an inpatient oncology unit related to health care workers presenting to work while ill

- Outbreak of H3N2 influenza in November 2017 in a military hospital's oncology unit
  - 23 cases: 16 healthcare workers (HCWs) and 7/10 patients
  - Nine of the 16 HCWs (64%) attended work while ill, including the index case
    - 56% cited a "sense of duty as a health care worker"
    - 44% viewed illness as too minor to pose a risk to others
  - Unclear exactly how many HCWs were truly exposed, but cost of prophylactic oseltamivir for 108 people and treatment for 23 people added up to $9,799
- Responsibility to care for patients includes protecting them from yourself if you become ill. Discourage staff from working while they are sick

Healthcare-associated influenza in Canadian hospitals from 2006 to 2012.

- Analysis of 3,299 influenza cases among hospitalized adults from 2006-2012
  - Defined healthcare-associated influenza as illness onset occurring ≥96 hours after admission
  - 17% of cases were healthcare-associated
    - Of those, 60.5% were acquired in a long-term care facility, and 39.5% were acquired in an acute care facility

Taylor G, Mitchell R, McGeer A, et al. Healthcare-associated influenza in Canadian hospitals from 2006 to 2012. Infect Control Hosp Epidemiol. 2014;35(2): 169-75.

Nosocomial outbreak of the pandemic Influenza A (H1N1) 2009 in critical hematologic patients during seasonal influenza 2010-2011: detection of oseltamivir resistant variant viruses

- 23/76 (30.2%) of patients hospitalized in the hematologic/oncologic ward of an Italian hospital were infected with H1N1pdm09 influenza
  - All 23 infected patients immunocompromised
  - 3/23 positive for mutation giving oseltamivir resistance
  - 3/23 (13%) died after admission to ICU
    - One of the three had the mutation for resistance
- Immunocompromised patients have longer viral shedding periods, and must be treated for longer periods of time, which gives the influenza virus a better opportunity to develop oseltamivir resistance

Pollara CP, Piccinelli G, Rossi G, et al. Nosocomial outbreak of the pandemic Influenza A (H1N1) 2009 in critical hematologic patients during seasonal influenza 2010-2011: detection of oseltamivir resistant variant viruses. BMC Infect Dis. 2013;13:127.

Frenzel E, Chemaly RF, Ariza-Heredia E, et al. Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients. Am J Infect Control. 2016;44(9): 1016-21..

Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients

- 8-year study at large hospital in Texas
- Influenza vaccination rate of all employees increased from 56% in 2006-2007 to 94% in 2013-2014
  - Initially reduced barriers by moving vaccination clinic to main hospital and increasing hours clinic was available
  - Mandatory vaccination program piloted in 2009, targeting HCWs in high-risk areas and nursing staff
    - Unvaccinated had to wear/regularly change surgical masks
    - Vaccinated had compliance sticker on badge
  - New state law in 2011 allowed mandatory vaccination program for all HCWs and employees with direct patient contact
    - Compliance stickers still used for vaccinated, and surgical masks still used for exemptors/unvaccinated

Frenzel E, Chemaly RF, Ariza-Heredia E, et al. Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients. Am J Infect Control. 2016;44(9): 1016-21..

Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients

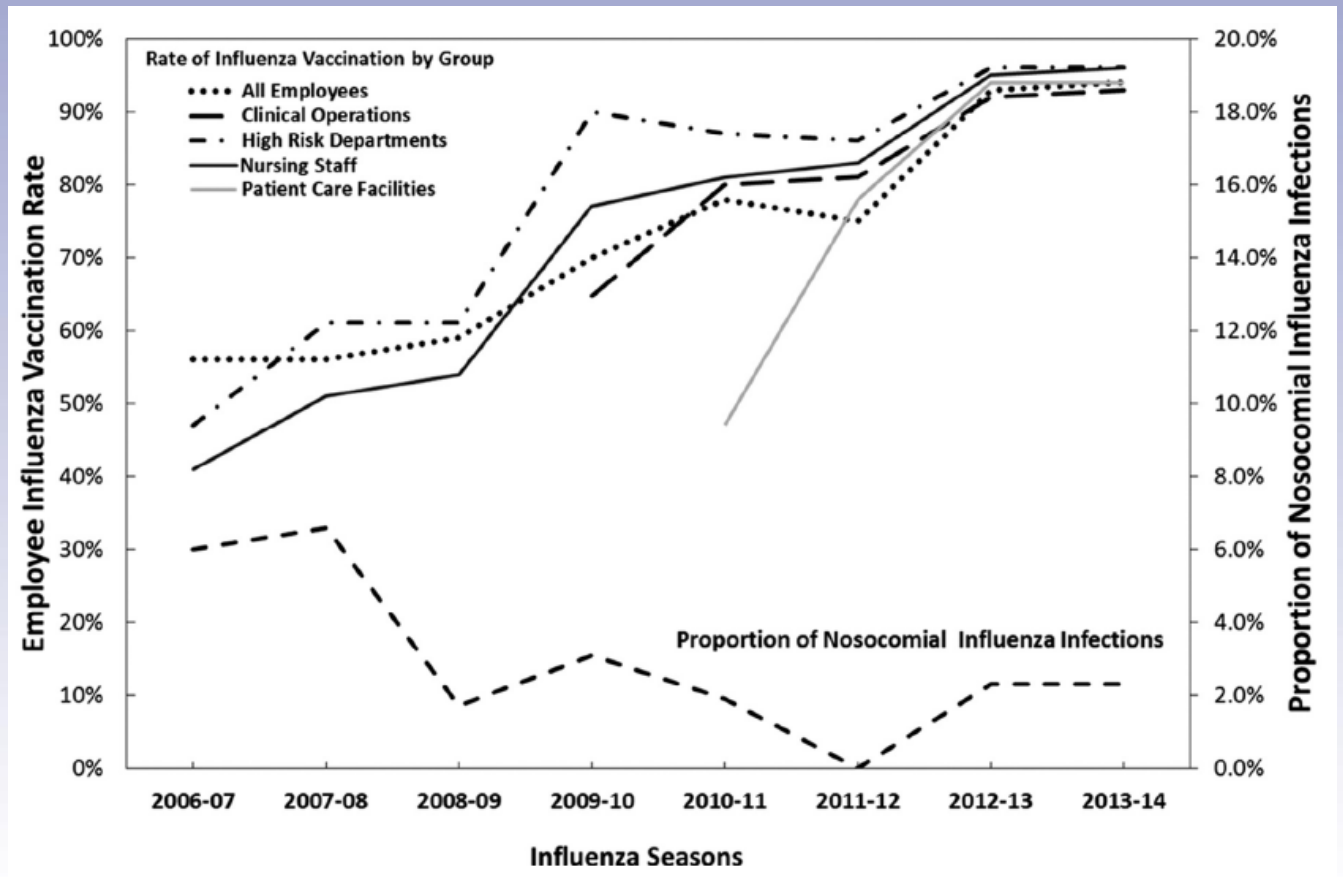

Fig 2. Health care worker vaccination rates and proportion of nosocomial influenza infections at our institution (2006-2014).

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Preventing Nosocomial Transmission

Part 1: Vaccination

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Vaccination Recommendations

EVERYONE 6 months of age and older is recommended to get a flu shot every season

People who are vaccinated are:

- Less likely to catch flu
- If they do catch flu, they are less likely to have severe illness or need to visit a doctor
- Less likely to infect you, other patients, or other people in the community

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Common Excuses

- "The flu shot gave me flu"

FALSE. THE FLU SHOT CANNOT CAUSE THE FLU.

What probably really happened:

1) The flu shot can cause mild side effects, including soreness, redness, or swelling at the injection site, and less commonly, headache or mild fever
2) The flu shot takes up to 2 weeks to go into effect. If you were exposed to flu around the time of the shot, the vaccine may not have been given soon enough to give protection

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Common Excuses

- “I never get the flu”

ANYONE CAN GET THE FLU. EVEN YOU.

I have never been in a car accident, but I still wear my seatbelt just in case.

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Common Excuses

- “The flu shot doesn’t work”

IT WORKS BETTER THAN NO SHOT

It’s true that we need a better flu vaccine. Vaccine effectiveness of 30-60% each season is not ideal, but skipping the shot is 0% effective.

If you get exposed to someone with flu, would you rather have some protection or none?

Common Excuses

- “I hate needles”

IT COULD BE WORSE

The flu shot is a one-second pinprick, and it’s over.

If you get the flu, you could miss work or school for a week, be exhausted and coughing for another week, and if it gets bad, hooked up to an IV and getting even more needles in the hospital.

Common Excuses

- "I'm pregnant and am afraid of hurting the baby."

DEFINITELY GET VACCINATED

Flu is more likely to be severe in pregnant women, and can put the developing baby at risk. The flu vaccine also helps protect the baby with maternal antibodies after it's born, for up to several months.

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Common Excuses

- "I'm allergic to eggs"

IT'S STILL SAFE TO GET VACCINATED

People with egg allergies can receive any licensed, age-appropriate influenza vaccine.

People with a history of severe egg allergy (worse than hives) should be vaccinated in a medical setting, supervised by a health care provider who can respond to any potential allergic reaction.

Common Excuses

- "I've had Guillain Barre Syndrome before"

STUDY FINDINGS HAVE BEEN INCONSISTENT, SO TALK TO YOUR DOCTOR FIRST

Guillain Barre Syndrome (GBS) occasionally develops after a diarrheal, lung, or sinus illness. A person is much more likely to develop GBS after being sick with the flu than after being vaccinated.

However, some studies have found there may be an additional 1-2 cases of GBS than expected per 1,000,000 flu vaccine doses administered. The reason for this possible link remains unknown. Talk to your doctor about the benefits and risks, and make a decision together.

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Preventing Nosocomial Transmission

Part 2: Strategies in Addition to Vaccination

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What about when the vaccine isn't enough?

Remember this article?

Nosocomial outbreak of influenza A H3N2 in an inpatient oncology unit related to health care workers presenting to work while ill

- 15/16 of the infected HCWs had been vaccinated, but 2017-2018 was a very poor vaccine match season
  - All infected persons in this outbreak had an influenza strain that was 6 amino acids different from the one used in the vaccine, due to a mutation that occurred during vaccine production

Wilson KE, Wood SM, Schaecher KE, et al. Nosocomial outbreak of influenza A H3N2 in an inpatient oncology unit related to health care workers presenting to work while ill. Am J Infect Control. 2019;0(0).

Contamination of health care personnel during removal of contaminated gloves

Hand Hygiene

- HCWs were asked to rub fluorescent solution (visible with blacklight) on their gloves and to take them off as usual
- 37% of HCWs contaminated their skin with the fluorescent solution when doffing gloves

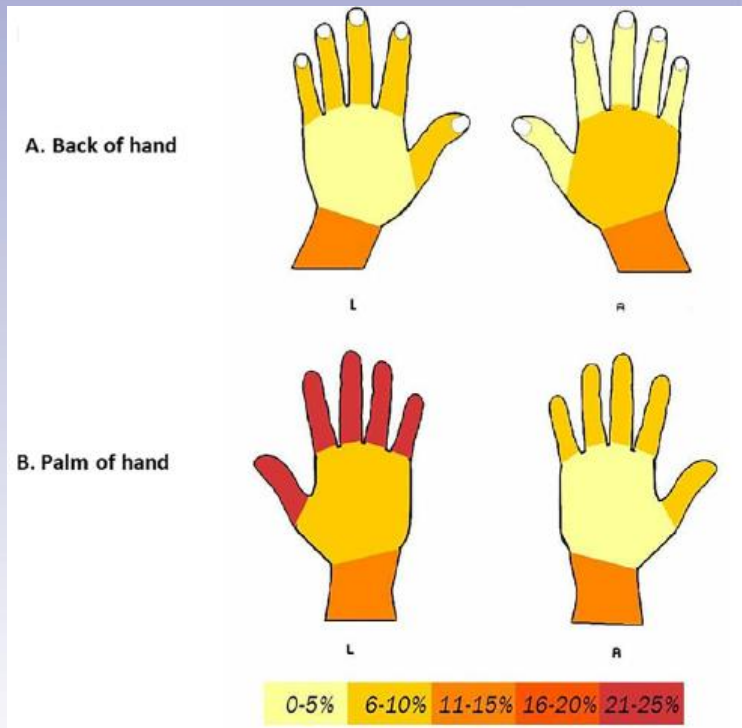


Fig 1. Frequency of contamination of skin sites during removal of gloves contaminated with fluorescent solution. (A) Percentage of contamination of sites on the back of the hands. (B) Percentage of contamination of sites on the palmar surface of the hands.

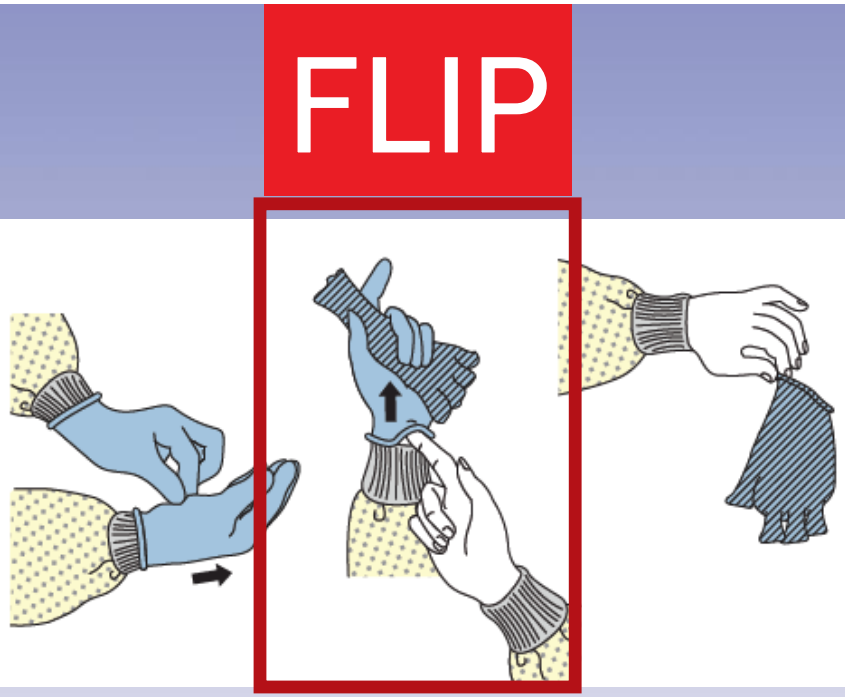
Alhmidi H, Gonzalez-Orta M, Cadnum JL. Contamination of health care personnel during removal of contaminated gloves. Am J Infect Control. 2019(18).

Contamination of health care personnel during removal of contaminated gloves

Hand Hygiene

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container



- 24% - 33% of HCWs contaminated skin when using CDC method (above)
- In this study, only 10% contaminated skin when using a modified version of CDC method, pulling glove off on posterior side rather than anterior (palm) side of wrist

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Contamination of health care personnel during removal of contaminated gloves

Hand Hygiene

- In best case scenario, 10% still contaminated skin when doffing gloves
- Demonstrates importance of thoroughly washing hands with soap and water or an alcohol rub every time gloves/PPE come off
- Double-gloving or disinfecting gloves before removing them can also help reduce contamination risk

Masks and Isolation

Visitors

- Screen visitors and mask any with respiratory symptoms. Symptomatic visitors should be restricted from visiting high-risk patients (e.g. oncology, hematology, ICU)

Patients

- Immediately mask patients with respiratory symptoms
- Place suspected influenza patients in private rooms, and have them masked anytime they leave the room
- Healthcare providers should wear surgical mask (or fit-tested respirator) when within 6 feet of a suspected or lab-confirmed influenza patient
- Keep influenza patients on standard and droplet precautions until
  - 7 days after onset or
  - 24 hours after resolution of fever and respiratory symptoms (whichever is longer)

Exclusion of Ill Healthcare Workers

- Any staff who develop respiratory illness should put on a surgical mask and be excluded from the facility until afebrile >24 hours without antipyretic treatment (and with improvement in respiratory symptoms), or no earlier than 5 days after illness onset
  - Lack of fever does not necessarily mean lack of infectiousness

Uyeki TM, Bernstein HH, Bradley JS, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America: 2018 Update on Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management of Seasonal Influenza. Clin Infect Dis. 2019;68(6): 895-902.

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Surveillance

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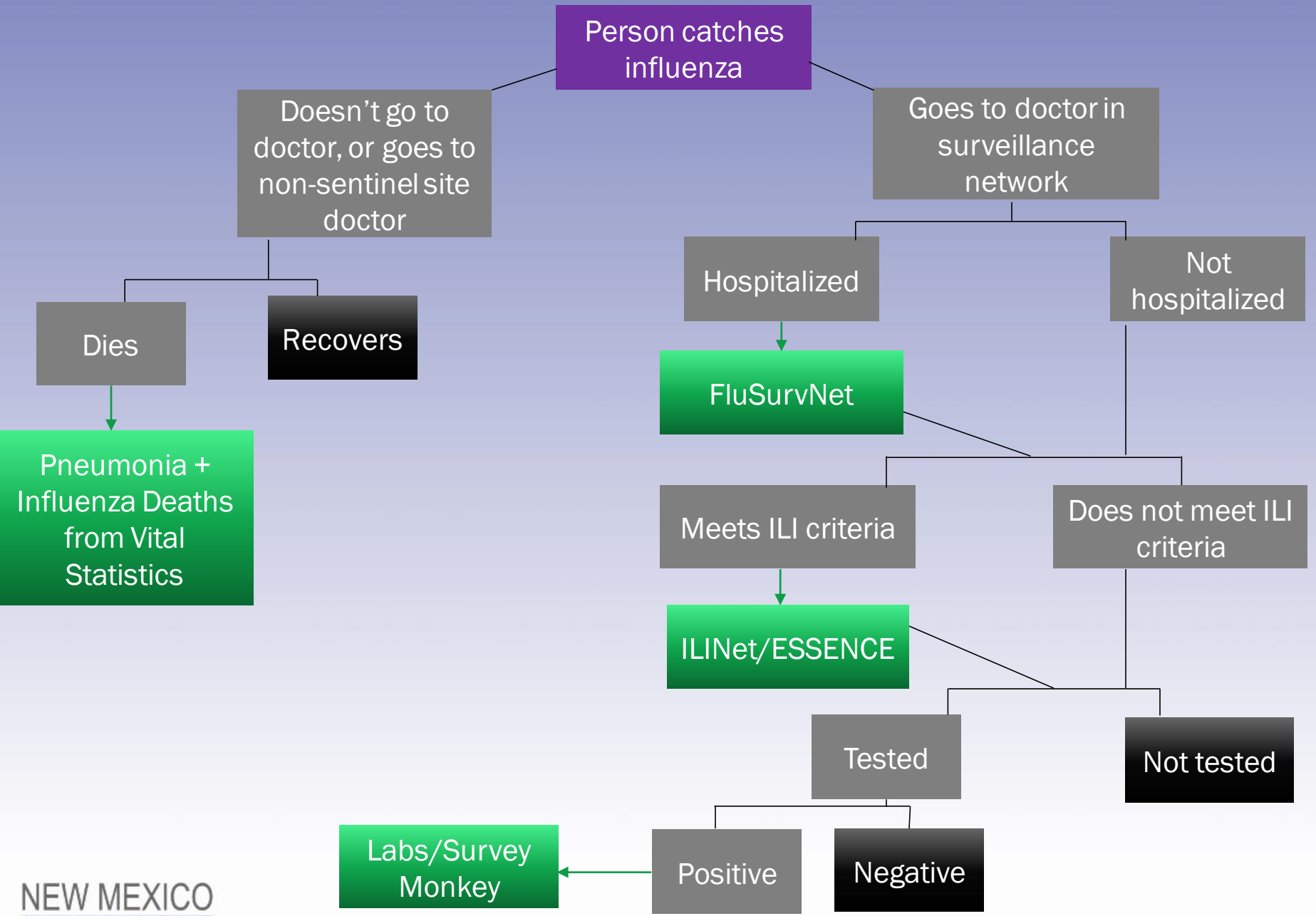
Influenza Surveillance Methods

- FluSurvNet
  - Captures hospitalized cases
- ILINet
  - Sentinel sites and ESSENCE capture percent of patients presenting with fever and cough/sore throat
- Lab Surveillance
  - Surveillance of SLD, private labs, and Survey Monkey survey of hospital labs captures percent positive specimens and dominant subtypes circulating
- Pneumonia and Influenza Deaths
  - Vital Statistics reports all deaths that include “pneumonia” or “influenza” as a cause of death



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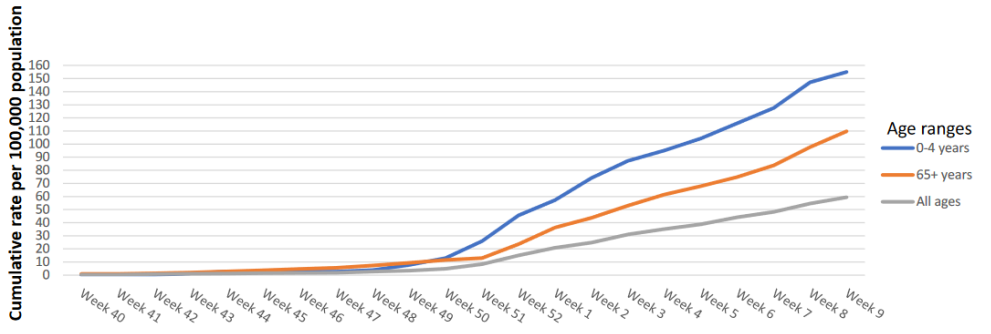
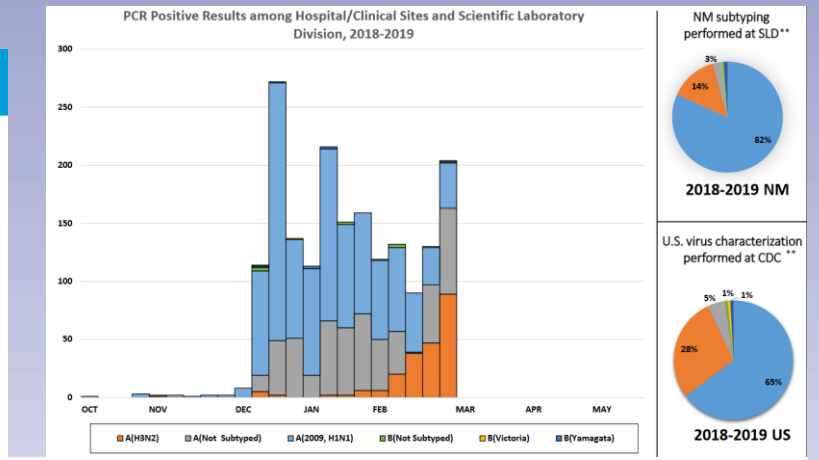
Weekly Flu Report

Influenza Hospitalizations – New Mexico, 2018-2019





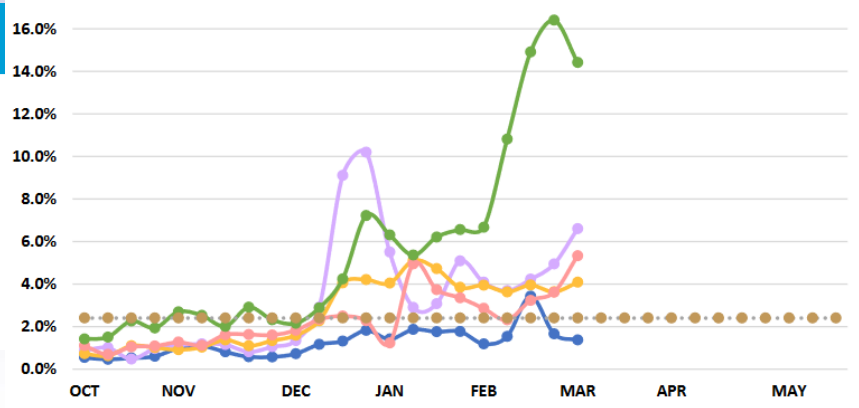
Pneumonia and Influenza (P & I) Deaths, NM, 2015-2019*

Season	Pneumonia (P) Deaths	Adult Influenza (I) Deaths	Pediatric Influenza Deaths	Total P & I Deaths
2018-2019	93	27	0	120
2017-2018	222	67	3	284
2016-2017	195	27	0	222
2015-2016	159	30	1	190

Pneumonia death: Is defined as having a cause of death that is related to pneumonia & influenza (P & I) not including: aspiration pneumonia, pneumonitis, or pneumococcal meningitis.
Influenza death: Is defined as having a cause of death that is related to pneumonia & influenza (P & I) not including: parainfluenzae or Haemophilus *influenzae*.

* Death data is delayed up to 8 weeks

NM ILI Activity by Health Region, 2018-2019



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Influenza Surveillance

- If you're interested in participating in ILINet OR in receiving the weekly flu report, please email me at

  emma.stanislawski@state.nm.us

- Participation in ILINet involves:
  - Reporting total # patients seen and # of patients with influenza-like illness (ILI) each week from October – May
  - Sending up to 5 unscreened swabs from ILI patients to SLD for testing and subtyping each week, free of charge

Contact

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Questions