Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

INFLUENZA

Monica Mehta, PharmD
Assistant Professor of Pharmacy Practice
Long Island University
Arnold & Marie Schwartz College of Pharmacy
Bronx-Lebanon Hospital Center
monica.mehta@liu.edu

Hosted by Paul Webber
paul@webbertraining.com

www.webbertraining.com

Presentation Objectives

- Briefly review influenza
  - History and epidemiology
  - Structure and classification
  - Pathogenesis
  - Diagnosis of influenza
- Discuss management of influenza with antiviral agents
- Describe influenza vaccination
  - Including influenza survey-based study at a hospital in Bronx, New York

Seasonal Influenza Overview

- Infection caused by influenza type A or B
- Acute, usually self-limited, febrile illness
- Outbreaks generally occur annually in winter
  - Rates 10-40% over 5-6 week period
  - Mortality ~35,000 per year in US due to pulmonary complications
- Clinical manifestations include fever, malaise, and cough
- Anti-viral agents may reduce severity and duration
- Vaccination is the best way to prevent influenza

History of Influenza

- Cause of recurrent epidemics/pandemics every 1-3 years over last 400 years
- Greatest known pandemic in 1819
  - Three waves of influenza
  - 21 million deaths worldwide (most deaths d/t secondary bacterial PNA)
- At present, influenza vaccination, antibiotics, and antiviral agents have decreased mortality rates

History of Influenza Epidemics & Pandemics

Year	Population	~Deaths per 1,000	Influenza A subtype
1675, 1782, 1837, 1847	London	1 - 10	Unknown
1890	UK	1-2.5	
1918-1919	Worldwide India Western Samoa Alaska New Zealand whites New Zealand Maori	2-25 70 200 up to 600 5.5 42	H1N1
1957	Worldwide	0.7	H2N2
1968-1969	Worldwide	0.3	H3N2
Seasonal influenza	Developed countries	0.03-0.3	H3N2, H1N1

Mathews J, et al. *Influenza and Other Resp Virus*;3:143-149.

Epidemiology

- Worldwide influenza deaths 250K-500K annually
- US deaths average ~36K annually (1990-1999)
  - 90% deaths occur in ≥ 65 year olds
  - Deaths in oldest elderly (≥ 85 year olds) are 16x higher compared to persons aged 65 - 69 years
- US hospitalizations ~226K annually
  - Rates of infection highest among children
- Overall rates have been increasing (due to growing predominance of influenza A and aging population)

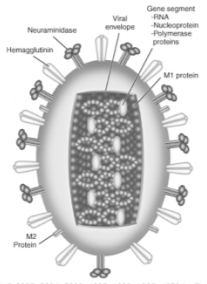
Influenza

Monica Mehta, PharmD, Long Island University
A Webber Training Teleclass

Morbidity & Mortality

- Gateway to more serious ailments
  - Pneumonia, COPD exacerbation
- Causes of death
  - Complications of pneumonia and superimposed bacterial infections
  - Exacerbations of respiratory, cardiac, and renal conditions

Influenza Cell Structure

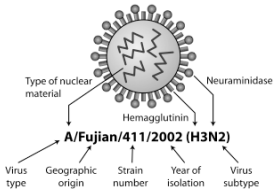


Influenza Classification

- Three types: Influenza A, B, & C
- Influenza A and B are the two types of influenza viruses that cause epidemic human disease
  - Influenza type C infections cause a mild illness

Influenza Classification

- Standard nomenclature = influenza type + place of initial isolation + strain designation + year of isolation
  - E.g. A/Puerto Rico/8/34 = Influenza A virus isolated from a patient in Puerto Rico in 1934



Influenza Classification

- Influenza A viruses are categorized into subtypes on the basis of two surface antigens
  - Hemagglutinin (H) – mediates entry of virus into the cell
  - Neuraminidase (N) – cleaves and releases newly formed viral particles
- Influenza A has 16 H subtypes and 9 N subtypes
  - Significant diversity among different viruses types
    - Genetic, structure, host range, epidemiology, clinical manifestations

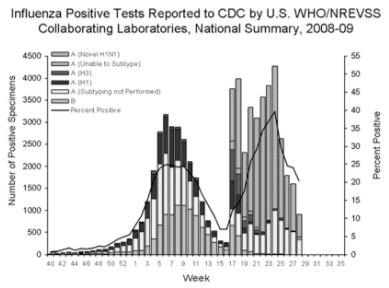
Antigenic Drift

- Antigenic variants develop due to point mutations during replication
- Frequent emergence of variants through antigenic drift is the virological basis for seasonal epidemics
- Antigenic drift: Influenza A > B
- Reason for the usual incorporation of one or more new strains in each year's vaccine

Influenza

Monica Mehta, PharmD, Long Island University
A Webber Training Teleclass

Antigenic Characterization of Influenza Positive Tests



Clinical Manifestations

- Symptoms are abrupt in onset and vary considerably from person to person
- Systemic symptoms (predominate early)
  - Fever, chills, HA, myalgia, malaise, anorexia
    - Myalgias = back, calf, possibly eye muscles
    - Fever 100-104° F typically
  - Severity related to fever
  - Systemic symptoms persist ~3 days
- Respiratory symptoms
  - Dry cough, severe pharyngeal pain, nasal obstruction & discharge, hoarseness, cough

People at High Risk for Complications From Influenza

- ≥ 65 years old or residents of LTCF
- People w/ long-term health problems (asthma, renal disease, DM, anemia, CVD)
- People w/ certain muscle or nerve disorders (seizures, severe cerebral palsy)
- People w/ weakened immune system (HIV, long-term steroids, chemotherapy)
- People 6 months - 18 years of age on long-term ASA (they can develop Reye Syndrome if they got influenza)
- Women who will be pregnant during influenza season
- All children 6-59 months of age

Diagnosing Influenza - Tests

- Diagnostic tests should be combined with clinical suspicion
- Three main testing modalities:
  1. RT-PCR
     - Highest sensitivity; used as a confirmatory test
  2. Immunofluorescence (fluorescent antibody staining)
     - Performance depends on laboratory expertise
  3. Rapid Diagnosis
     - Based on immunologic detection of viral antigen in respiratory secretions
     - Results in 30 minutes
     - Sensitivity 40-80%

Antiviral Agents

- Neuraminidase Inhibitors
  - Oseltamivir (Tamiflu)
    - Oral
  - Zanamivir (Relenza)
    - Inhaler
- Amantadines
  - Amantadine
  - Rimantadine

Who should be considered for Antiviral Therapy?

- Unvaccinated infants (12-24 months)
- Asthma or other chronic pulmonary diseases (e.g. CF)
- Significant cardiac disease
- Immunosuppressed
- HIV-infected
- Requiring long-term ASA (e.g. rheumatoid arthritis)
- Sickle cell anemia
- Chronic renal disease
- Cancer
- Chronic metabolic disease (e.g. DM)
- Neuromuscular disorders, seizure disorders, or cognitive dysfunction
- Adults > 65 years old
- Residents of long-term care institutions or nursing homes

Influenza

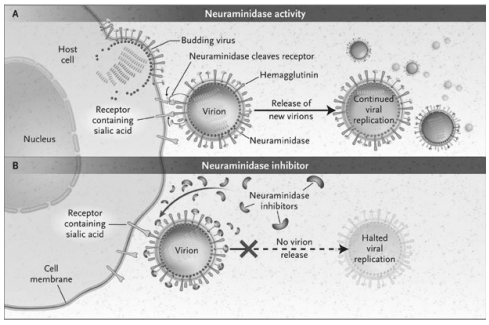
Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Antiviral Usage

- Neuraminidase Inhibitors = primary agents
- Initiate within 2 days of illness onset
- Benefits of treatment
  - Shown to decrease the duration of influenza by one day compared with placebo
  - May prevent complications (pneumonia) or exacerbation of chronic disease
  - May decrease mortality
  - Data on viral shedding is mixed
- Chemoprophylaxis may be used in patients exposed to influenza
  - Especially in high risk patients
- Resistance rapidly emerging

Neuraminidase Inhibitors Mechanism



Neuraminidase Inhibitors: Indications

- Active against Influenza A and B
- Approved for use in adults and children
  - Zanamivir approved for treatment of persons age 7 years and older; prophylaxis in age 5 and older
  - Oseltamivir approved for treatment and prophylaxis of persons age 1 and older

Neuraminidase Inhibitors: PK

- Zanamivir
  - Dry powder for inhalation; not orally bioavailable
  - 10-20% of the active compound reaches the lungs and the rest is deposited in the orophyaynx
  - 5-15% is absorbed and excreted in the urine
- Oseltamivir
  - Capsule or powder for liquid; Readily absorbed from GI
  - Converted by hepatic esterases to active form
  - Widely distributed in body
  - T1/2 = 6-10 hours; excreted primarily via kidneys (dose adjust in renal failure)

Amantadines

- Mechanism:
  - Inhibition of M2 ion channel activity of susceptible viruses (M2 channels play a role in replication)
  - Interfere with viral uncoating inside the cell
- Inhibitory for most influenza A, but not for influenza B
- Widespread high levels of resistance among influenza A (H3N2)
- Rimantadine is preferred over amantadine because of a more favorable adverse effect profile

Antivirals: Dosing in Influenza A & B

Antiviral Agent	Adult Dosing
Zanamivir (treatment)	10mg (2 inhalations) BID
Zanamivir (prophylaxis)	10mg (2 inhalations) daily
Oseltamivir (treatment)	75mg PO BID
Oseltamivir (prophylaxis)	75mg PO daily
Amantadine & Rimantadine (treatment)	100mg PO BID (100mg daily in elderly over 65 years)
Amantadine & Rimantadine (prophylaxis)	100mg PO BID (100mg daily in elderly over 65 years)

Hosted by Paul Webber paul@webbertraining.com
www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University
A Webber Training Teleclass

Antivirals – Treatment Duration

- Treatment: 5 days
- Prophylaxis: 5 – 10 days after last known exposure
  - May be longer in hospitals and long-term care facilities; minimum of 14 days

Adverse Effects

Amantadines	Oseltamivir	Zanamivir
CNS side effects (higher in amantadine)*	Nausea & Vomiting	Bronchospasm**
Nausea, Anorexia	Transient neuropsychiatric events (e.g. delirium)	Nausea & Diarrhea
		Nasal symptoms

*CNS side effects include nervousness, anxiety, insomnia, difficulty concentrating, and lightheadedness

**Zanamivir is contraindicated in patients with underlying respiratory disease

Management of Influenza: Antiviral Resistance

	Isolates tested (n)	Isolates tested (n), Resistant Viruses, Number (%)		Isolates Tested (n)	Resistant Viruses, Number (%)
		Oseltamivir	Zanamivir		Adamantanes
Seasonal Influenza A (H1N1)	1,099	1,094 (99.5%)	0 (0)	1,100	6 (0.5%)
Influenza A (H3N2)	213	0 (0)	0 (0)	216	216 (100%)
Influenza B	620	0 (0)	0 (0)	N/A*	N/A*
Novel Influenza A (H1N1)	274	0 (0)	0 (0)	312	312 (100%)

FluView, 2008-2009 Influenza Season Week 28 ending July 18, 2009 CDC. 27

Influenza Vaccination

- Most effective means to prevent flu
- 70-90% effective in healthy adults <65 years old when vaccine and virus are antigenically similar
- 50-77% when antigenically dissimilar
- 90% effective in preventing influenza-related hospitalization

Influenza Vaccination Indications

- Persons aged 50 years and older
- Adults and children who have any condition that can compromise respiratory function or the handling of respiratory secretions or that can increase the risk for aspiration
- Residents of nursing homes and other chronic-care facilities
- Health-care workers
- Healthy household contacts (including children) and caregivers of persons with medical conditions that put them at higher risk for severe complications from influenza

Not a complete list (see www.cdc.gov for all indications)

Other Means of Prevention

- Isolation precautions, negative pressure rooms, & good hand/respiratory hygiene
  - Offers modest benefit
  - Not been studied adequately to determine if they reduce transmission

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

CDC/ACIP Recommendations

- 1981: All HCW should be vaccinated
  - Who are HCW?
- Vaccination goals: reduce transmission, staff illness & absenteeism, morbidity & mortality among high risk persons
- JCAHO: must offer
  - But cannot enforce (violation of employee rights)

Inactivated Influenza Vaccine

- Sterile suspension prepared from influenza viruses propagated in embyonated chicken eggs
- Standardized for particular season
- The 2009–2010 trivalent influenza vaccines will contain:
  - A/Brisbane/59/2007 (H1N1)-like antigen
  - A/Brisbane/10/2007 (H3N2)-like antigen
  - B/Brisbane/60/2008-like antigen
- Dose = 0.5ml in prefilled syringe given IM (preferably in deltoid)

Pharmacology

- Effectiveness depends on age, immunocompetence, and degree of similarity between the vaccine and infecting virus
- Majority develop high post-vaccination hemagglutination-inhibition antibody titers
- These antibody titers are protective against illness caused by strains similar to those in the vaccine

Pharmacology

- Antibody against one virus type or subtype confers little or no protection against another virus
- Antibody to one antigenic variant may not protect against a new antigenic variant

Contraindications

- Contraindications: known hypersensitivity, reaction to egg/chicken proteins
- Delay in active neurologic d/o (ok when stable)
- Delay in febrile or acute disease (ok when stable)
- Warnings: Guillain-Barre syndrome within 6 weeks of prior vaccine, bleeding disorders (hemophilia, thrombocytopenia, on anticoagulant) - monitor for hematoma, latex allergy
- Pregnancy category C (but risk of influenza complications is increased during pregnancy)

Guillain-Barre Syndrome

- 1976 swine influenza vaccine was associated with increased frequency of GBS (1 case in 100,000)
- GBS has an annual incidence of 10-20 cases in1 million adults
- No evidence indicates an increase fatality from GBS among people vaccinated
- Potential benefits outweigh estimated risk of vaccine-associated GBS

Hosted by Paul Webber paul@webbertraining.com

www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Fluarix Adverse Events

Adverse Event	Fuarix (n=760)	Placebo (n=192)
Local pain	54.7	12
Local redness	17.5	10.4
Local swelling	9.3	5.7
Muscle aches	23	12
Fatigue	19.7	17.7
Headache	19.3	21.4
Arthralgia	6.4	6.3
Shivering	3.3	2.6
Fever (>100.4-degrees F)	1.7	1.6

Other Adverse Events

- Unsolicited adverse events (AE) from Study Fluarix-US-001
- AE ≥ 1% of recipients - Fluarix (placebo):
  - RTI 3.9% (2.6%), nasopharyngitis 2.5% (1.6%), nasal congestion 2.2% (2.1%), diarrhea 1.6% (0%), influenza-like illness 1.6% (0.5%), vomiting 1.4% (0%), dysmenorrhea 1.3% (1%)

Timing of Vaccination

- Influenza seasons vary in timing and duration
- >80% US outbreaks occurred in January or later
- Vaccination should begin soon after vaccine becomes available and continue throughout the season
- Vaccination campaigns for HCW should ideally begin mid-October and continued through December

Key in Education to HCW

- CDC: “Inactivated influenza vaccine contains killed viruses, and thus cannot produce signs or symptoms of influenza virus infection.”

Vaccination Rates

- Per CDC, average national vaccination rate of HCW was 40.1% (2003) & 42% (2006)
- Individual institutions 2% to 60% in 2004
- Of those surveyed at Bronx-Lebanon Hospital Center (BLHC), 56.5% were vaccinated during 2006-2007 influenza season

Vaccination Goals

- National Health Objective has a goal of 60% immunization rate by 2010 to provide protective immunity
- Vaccination rate of 80% desired to confer herd immunity
  - 98% measles vaccination rate would potentially eradicate the measles virus

Hosted by Paul Webber paul@webbertraining.com

www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Factors Influencing Vaccination Rate

- Prior Vaccination
  - Kimura study: statistically significant correlation b/w getting vaccinated and being vaccinated previously ($p<0.001$)
- Motivation
- Knowledge & Attitude
  - Belief that vaccine is "safe, valuable, and wise" correlated with accepting vaccine

Steps To Increase Vaccination Rates

- Educational campaign + formalized "vaccine day"
- Strongly developed leadership role
- Mobile vaccine carts
- Providing vaccination % to directors/chiefs half way through season
- Declination forms

Influenza Vaccination Survey-Based Study

- Mehta M, Pastor CA, Shah B. Achieving optimal influenza vaccination rates: a survey-based study of healthcare workers in an urban hospital. *J Hosp Infect*. 2008;70:76-79.

Purpose of Survey

- During employee health screenings, many HCW declined influenza vaccine
  - "Do not believe in vaccines"
  - "Vaccines have made my friends very sick"
  - "The vaccine may decrease spermatogenesis"
- How pervasive are these beliefs?

What We Hoped to Learn...

- Which groups of HCW refused the influenza vaccine?
- Why did they refuse?
- Is refusal linked to other factors?
  - Job position, frequency of pt contact
  - Perceived reason for vaccination
  - Knowledge of influenza & CDC recommendations

Bronx-Lebanon Hospital Center

- BLHC is a 858-bed, non-profit, community teaching medical center located in south central Bronx
- Two major divisions + ambulatory sites
  - Major focus of survey = Grand Concourse division
- Total of ~3,500 healthcare workers (HCW)

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Hypotheses

- Influenza vaccine acceptance linked with two parameters in particular
  - Knowledge of influenza
  - Motivation for getting vaccinated

First Wave: The Survey

- Eight questions
- Three categories of questions
  - General information of employee
  - Influenza vaccination
  - Knowledge
- IRB approved

Methods

- Cross-sectional design
- Survey team distributed and collected surveys by hand over ~2-weeks
- Distribution of survey
  - Attended grand rounds (IM, Peds, FM)
  - Attended meetings (housekeeping, pharmacy)
  - Floor to floor (nurses, PCTs)
  - Departmental managers (respiratory therapy, dietary)

Methods

- Survey was purely optional and anonymous
- Employees were offered a survey with no or minimal explanation
- Raffle w/ prizes served two functions (increased overall participation, decreased participation bias)
- Data entered into SPSS (statistical package for the social sciences)

Results

- 570 surveys collected
- Overall vaccination rate (2006-2007 flu season) 56.5%
- Top two reasons for not receiving vaccine
  - "I feel I do not need" (31.8%)
  - "I am afraid of getting sick from vaccine" (23%)

Respondent Demographics: Job Position

Position	Frequency	Percent
Physician	166	29.2%
Nurse, PA, NP	114	20%
Technician	83	14.6%
Pharmacist	12	2.1%
Housekeeper/Maintenance	41	7.2%
PT/RT/Nutritionist	24	4.2%
Dietary	23	4%
Office/Administrator	70	12.3%
Other	36	6.2%
Total	569	100%

Hosted by Paul Webber paul@webbertraining.com

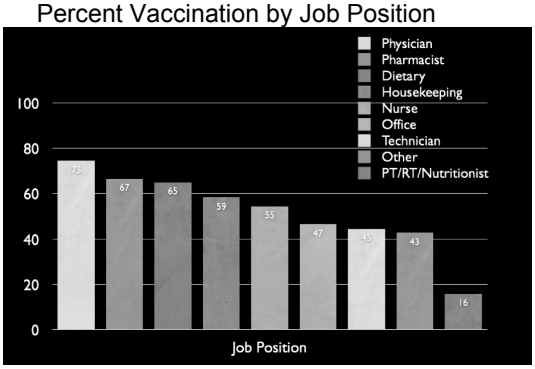
www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Percent Vaccination by Job Position

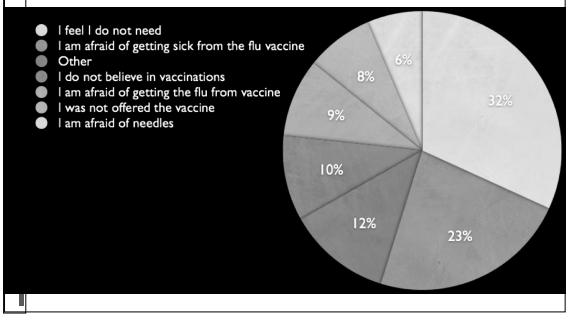


Job Position

- Significant differences between groups when data was collapsed
  - Physicians* vs. Non-physicians (p=0.001)
  - Technicians vs. Non-technicians* (p=0.02)
  - Therapists (PT/RT/nutritionists) vs. Non-therapists* (p=0.001)

* Group with higher vaccination rate

Rationale for not Receiving Vaccine



Significant Findings: Knowledge

- Survey "knowledge" questions:
  - What is your best estimate regarding the number of deaths that occur each year due to the flu in the US?
  - Do you believe that the CDC recommends that health care workers receive the flu shot?
  - How often do you think the flu vaccine should be administered?

Significant Findings: Knowledge

- Knowledge score correlated with getting vaccinated
  - 3 "knowledge" questions
  - Participants vaccinated = 2.35/3 correct
  - Participants not vaccinated = 2.17/3 correct
    - Statistically significant (p = 0.003)

Significant Findings: Knowledge

- However, no relationship between getting all 3 knowledge questions correct and being vaccinated.
- Why might this be?
  - Other reasons…

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

Significant Findings: Motivation

- Survey "motivation" question:
  - Why are flu vaccines for health care workers encouraged? (choose one):
    - To minimize sick days and loss of productivity
    - Because healthcare workers can get exposed to the flu by sick patients
    - Because sick patients are exposed to the flu by healthcare workers
    - To set an example to other workers

Significant Findings: Motivation

- HCW who received the vaccine were 3x more likely than those who did not receive the vaccine to indicate that:
  - "influenza vaccines are encouraged because sick patients are exposed to influenza by healthcare workers."
- Statistically significant ($p = 0.001$)

Second Wave: Additional Players

- Managers were interviewed using a structured tool
- To assess:
  - Involvement of Management
    - Positive or Negative Reinforcement
    - Distribution of literature
  - Access: Mobile cart

Additional Players

	Vaccination Rate	Mobile Cart	Management involvement	Formal medical education
Physicians	74.7%	Y	Y	Y
Pharmacists	66.7%	Y	N	Y
Dietary	65.2%	Y	Y	N
Housekeeping	58.5%	N	Y	N
Nursing	54.6%	Y	N	Y
PT	16%	N	N	Y
RT		N	N	Y
Laboratory (as part of technician group)	44.6%	N	N	N

Study Limitations

- Skewed representation: largest % of participants = physicians (29.2%); second largest = nurses (20%); third largest = technicians (14.6%)
- No to little data collected from night shifts and outpatient clinics
- Only two questions to test internal validity
- Possibility of > 1 survey/person
- Assumption that surveys reflect truth
- Other unknown factors (e.g. declination form)

Live Attenuated Influenza Vaccine

- Flumist™
- Contains live, attenuated virus and can cause mild symptoms related to influenza
- Intranasal administration
- Approved ONLY for use among healthy, non-pregnant, persons age 2 - 49 years
- Including HCW (per CDC)
- Advantages: broad mucosal & systemic response in children, ease of use, & increased acceptability

Influenza

Monica Mehta, PharmD, Long Island University
A Webber Training Teleclass

Vaccine Comparison

Trivalent inactivated influenza vaccine	Live attenuated influenza vaccine (FluMist®)
Inactivated virus (therefore, cannot produce s/sx of influenza)	Live, attenuated virus (has potential to produce s/sx of influenza, e.g. runny nose, sore throat and congestion)
Intramuscular administration	Intranasal administration
Less expensive	More expensive
Approved for use among persons > 6 months, including those who are healthy and with chronic medical problems.	Approved only for use among healthy persons age 2 to 49 years.
Efficacy: conflicting and limiting data (some studies showing greater efficacy with LAIV compared to TIV and others showing no significant difference)	

Mandatory Vaccination for HCW in New York State 2009-2010

- On 8/13/09, an emergency regulation went into effect, requiring all personnel of healthcare settings receive seasonal annual influenza vaccine
  - Purposes: 1) protect health and safety of vulnerable patients, 2) maintain a healthy workforce
  - Must be vaccinated by 11/30/09 of each year
  - Unless medical contraindication or NY State determines that there is a shortage

New York State Department of Health. Accessed 9/1/09.

Mandatory Regulation Applies to…

- Hospitals, diagnostic/treatment centers, home health care agencies, long-term care, hospice
- Personnel who have direct contact with patients or whose activities are such that they pose a risk of transmission of influenza to patients
  - Including students & volunteers

New York State Department of Health. Accessed 9/1/09.

2009 Novel H1N1 Influenza

- Previously called “swine flu”
  - Was initially believed many of the genes were similar to an influenza virus that normally occurs in pigs
- Most cases have occurred in people between the ages of 5 - 24-years-old
- Treatment: neuraminidase inhibitors (zanamivir, oseltamivir) only
  - Novel H1N1 is resistant to amanatadines
- Infection control and prevention practices are critical

CDC. Accessed 7/27/09.

2009 Novel H1N1 Influenza Vaccine

- The seasonal flu vaccine is unlikely to provide protection against novel H1N1 influenza
- A novel H1N1 vaccine
  - Currently in production
  - May be ready in the fall
  - Should be given in addition to seasonal vaccine

CDC. Accessed 9/1/09.

Recommendations on Recipients of Novel H1N1 Vaccine

- Pregnant women
- Household contacts and caregivers for children < 6 months
- Healthcare and EMS personnel
- All people 6 months to 24 years of age
- People aged 25 - 64 years who have health conditions associated are high risk
  - Current studies indicate that the risk for infection among persons age > 65 is less vs. younger age groups

CDC. Accessed 9/1/09.

Hosted by Paul Webber paul@webbertraining.com
www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

INFLUENZA

Monica Mehta, PharmD
Assistant Professor of Pharmacy Practice
Long Island University
Arnold & Marie Schwartz College of Pharmacy
Bronx-Lebanon Hospital Center
monica.mehta@liu.edu

References

- G. Mandell, J. Bennett, and R. Dolin. Principles and Practice of Infectious Diseases. Philadelphia. Elsevier, 2009. Accessed 06 July 2009. http://www.ppidonline.com/
- Harper SA, Bradley JS, Englund JA, et al. Seasonal Influenza in Adults and Children—Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management: Clinical Practice Guidelines of the Infectious Diseases Society of America. Clin Infect Dis 2009;48:10003-1032.

References

- Kumura: Kumura A, Iga J, Nguyen C et al. Interventions to increase influenza vaccination of health-care-workers-California and Minnesota. JAMA 2005;293:1719-1721.
- Centers for Disease Control. Influenza Vaccination of Health-Care Personnel: Infection Control Practices Advisory Committee (HICPAC) and the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2006;55(RR02):1-16.
- Centers for Disease Control. Prevention and Control of Influenza - Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2007;56(RR06):1-54.
- Willis B, Wortley P. Nurses attitudes and beliefs about influenza and the influenza vaccine: A summary of focus groups in Alabama and Michigan. AJIC 2006;35:20-24.
- Manuel D, Henry B, Hockin J, Naus M. Health behavior associated with influenza vaccination among healthcare workers in long-term-care facilities. Infect Control Hosp Epidemiol 2002;23:609-614.

References

- Improving influenza vaccination rates in health care workers: strategies to increase protection for workers and patients. National Foundation for Infectious Diseases 2004. (How to reference?)
- Canning H, Phillips J, Allsup S. Health care workers beliefs about influenza vaccine and reasons for non-vaccination – a cross-sectional survey. Journal of Clinical Nursing 2005;14:922-925.
- Bautista D, Vila B, Uso R, Tellez M, Zanon V. Predisposing, reinforcing, and enabling factors influencing influenza vaccination acceptance among healthcare workers. Infect Control Hosp Epidemiol 2006;27:73-77.
- Armstrong K, Berlin M, Schwartz S, Propert K, Ubel P. Barriers to influenza immunization in a low-income urban population. Am J Prev Med 2001;20:21-25.

References

- McCullers J, Speck K, Williams B, Liang H, Mirro J. Increased influenza vaccination of healthcare workers at a pediatric cancer hospital: results of a comprehensive influenza vaccination campaign. Infect Control Hosp epidemiol 2006;27:77-79.
- Polgreen P, Pottinger M, Polgreen L, Diekema D, Herwaldt L. Influenza vaccination rates, feedback, and the hawthorne effect. Infect Control Hosp Epidemiol 2006;27:98-99.
- Bridges C, Kuehnert M, Hall C. Transmission of influenza: Implications for control in health care settings. CID 2003;37:1094-1101.
- Poland G, Tosh P, Jacobson R. Requiring influenza vaccination for health care workers: seven truths we must accept. Vaccine 2005;23:2251-2255.

References

- Lugo N. Will carrots or sticks raise influenza immunization rates of health care personnel? Am J Infect Control 2007;35:1-6.
- Saluja I, Kaczorowski T, Kaczorowski J. Influenza vaccination rate among emergency department personnel: a survey of four teaching hospitals. Can J Emerg Med 2005;7:17-21.
- JCAHO. Joint Commission establishes infection control standard to address influenza vaccines for staff. Press Release, June 13, 2006.
- Centers for Disease Control and Prevention. Influenza vaccine efficacy in nursing home outbreaks reported during 1981-1982. MMWR Morb Mortal Wkly rep. 1982;31:190,195.

Hosted by Paul Webber paul@webbertraining.com
www.webbertrainng.com

Influenza

Monica Mehta, PharmD, Long Island University

A Webber Training Teleclass

References

- Kimura A, Nguyen C, Higa J, Hurwitz E, Vugia D. The effectiveness of vaccine day and educational interventions on influenza on influenza vaccine coverage among health care workers at long-term care facilities. Am J Public Health. 2007;97:684-690.
- Spaude K, Abrutyn E, Kirchner C, Kim A, Daley J, Fishman D. Influenza vaccination and risk of mortality among adults hospitalized with community-acquired pneumonia. Arch Intern Med. 2007;167:53-59.
- Steckel C. Mandatory influenza immunizations for health care workers-an ethical discussion. AAOHN Journal. 2007;55:xx-xx.
- Nace D, Hoffman E, Resnick N, Handler S. Achieving and sustaining high rates of influenza immunization among long-term care staff. J Am Med Dir Assoc 2007;8:128-133.

References

- Centers for Disease Control and Prevention. Outbreaks of influenza among nursing home residents-Connecticut, United States. MMWR Morb Mortal Wkly rep. 1985;34:478-482.
- Gross PA, Hermogenes AW, Sacks HS, Lau J, Levandowski RA. The efficacy of influenza vaccine in elderly persons. A meta-analysis and review of the literature. Ann Intern Med. 1995;123:518-527.
- Patriarca PA, Weber JA, Parker RA, et al. Efficacy of influenza vaccine in nursing homes. Reduction in illness and complications during an influenza A (H3N2) epidemic. JAMA. 1985;253:1136-1139.
- Monto AS, Hornbuckle K, Ohmit SE. Influenza vaccine effectiveness among elderly nursing home residents: a cohort study. Am J Epidemiol. 2001;154:155-160.