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Pandemic planning best practices – H1N1 Update

Pandemic Planning Best Practises

Donald E Low

Objectives

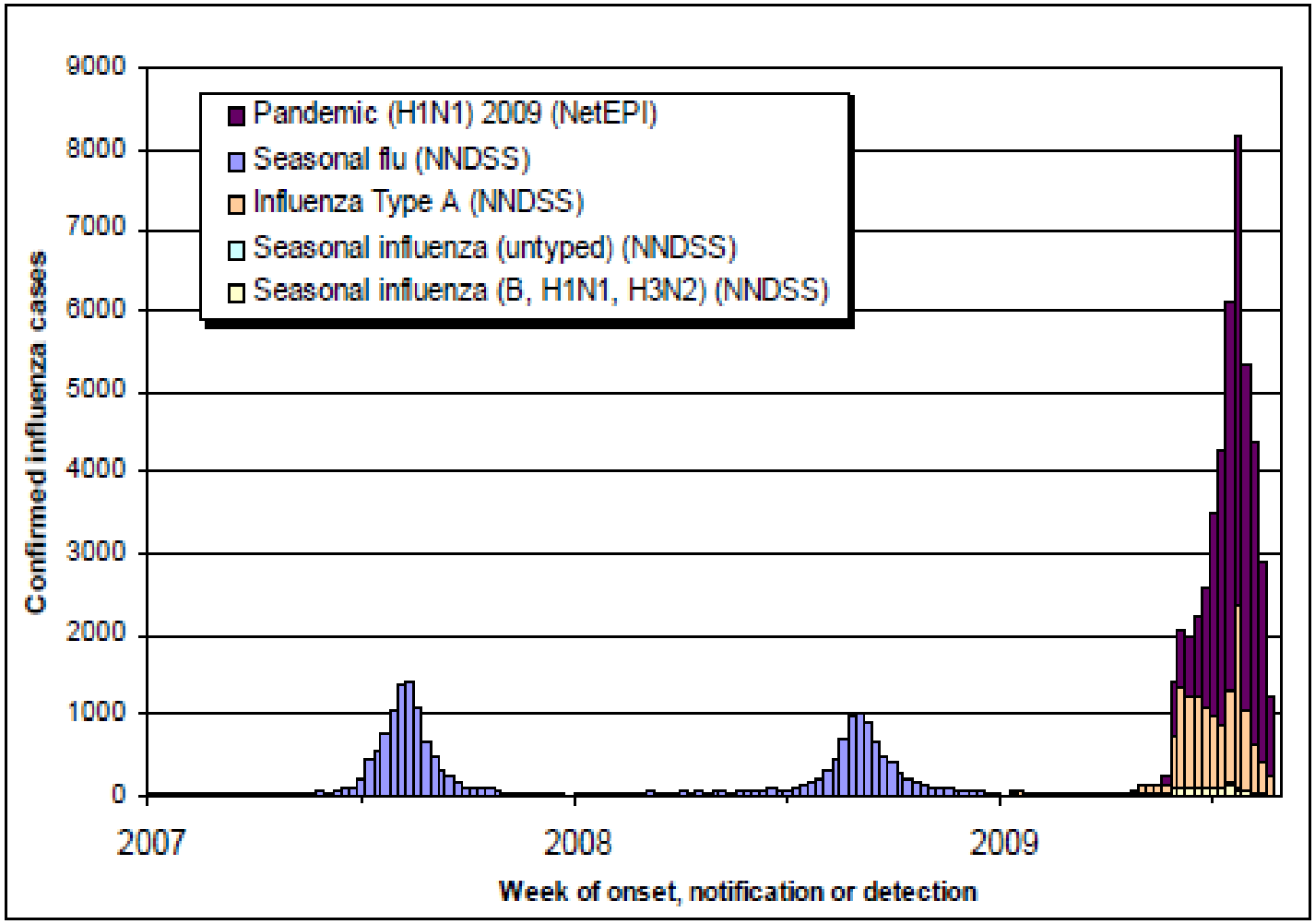
- Update on H1N1 and on what's happening this fall in Canada
- Update on the vaccine controversy
- Infection Control Measures

Fitness of Pandemic H1N1 and Seasonal influenza A viruses during Co-infection

Evidence of competitive advantage of pandemic H1N1 influenza versus seasonal influenza

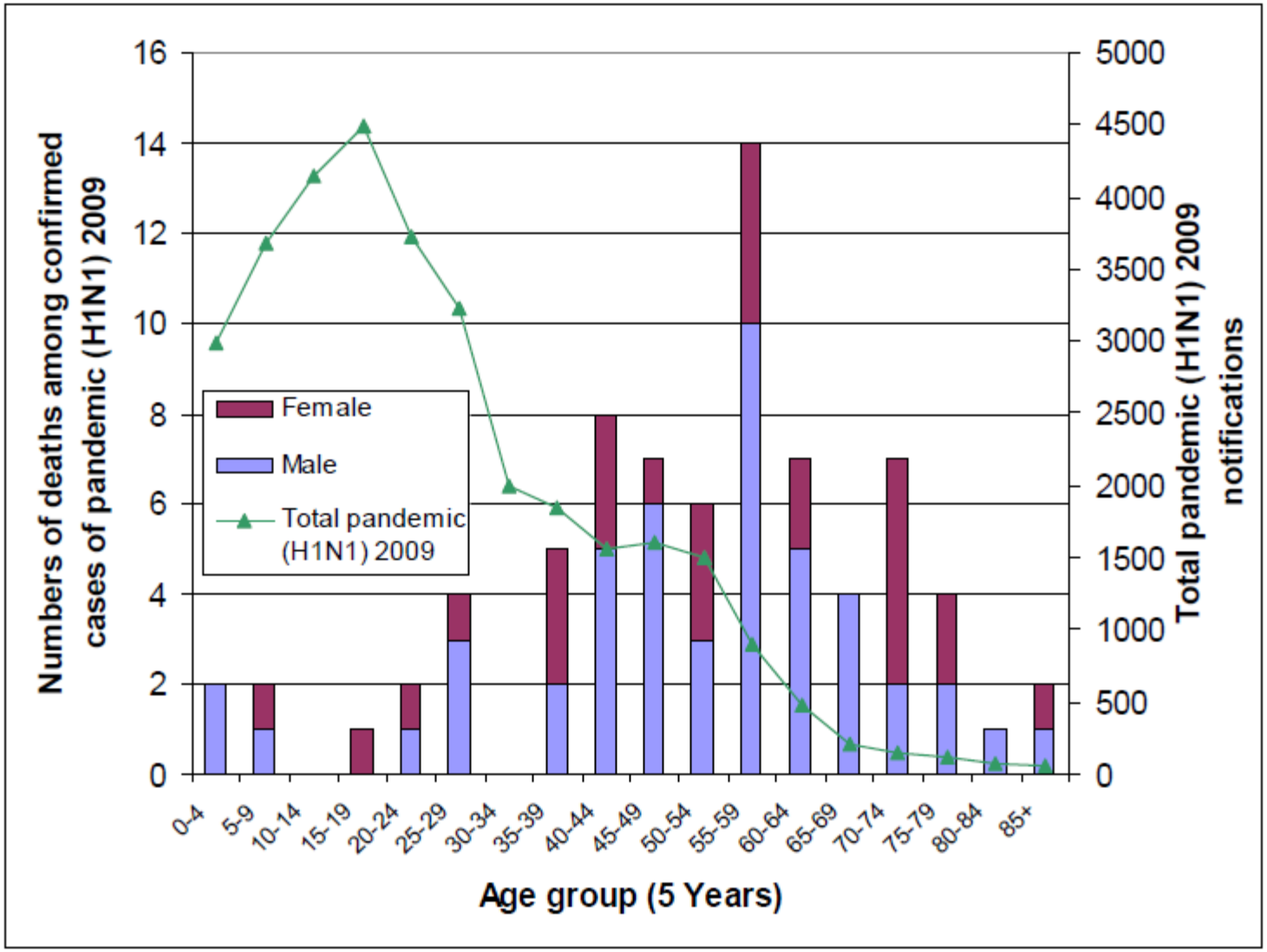
Daniel Perez et al. *PLOS Current* 2009

Figure 2. Influenza activity in Australia, by reporting week, years 2007, 2008 and 2009*



Australian Surveillance Report

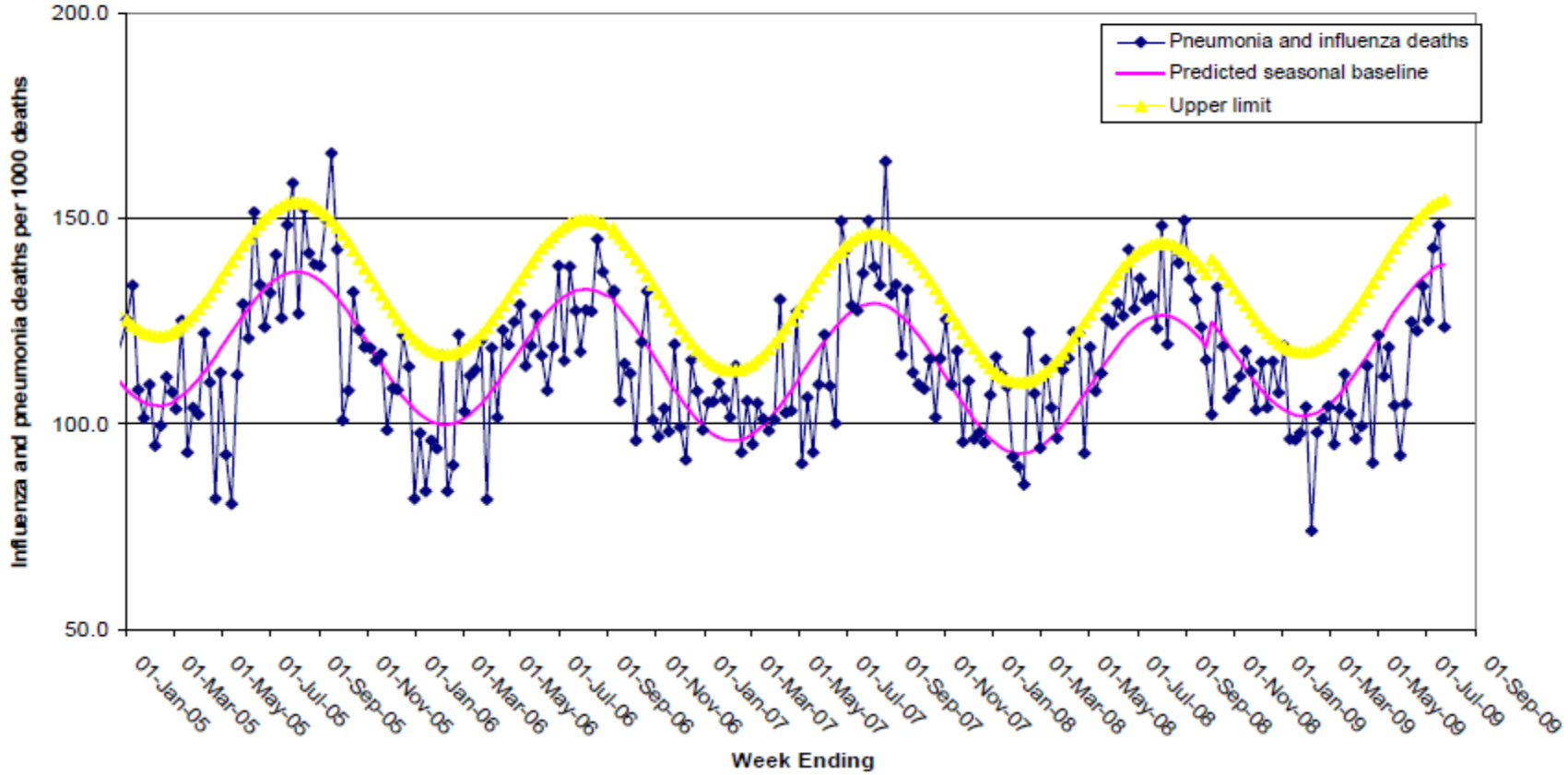
Figure 13. Numbers of deaths (NSW, NT, TAS, VIC & WA only) among confirmed cases of pandemic (H1N1) 2009, by age group and sex, compared with total laboratory confirmed pandemic (H1N1) 2009 notifications by age group, to 21 August 2009, Australia



Australian Surveillance Report

In NSW, death certificate data as of 31 July 2009 show that there were 68 influenza or pneumonia deaths per 1,000 deaths in NSW, which was below the expected seasonal threshold for this time of year of 154 per 1,000 (Figure 15).

Figure 15: Rates of deaths classified as influenza and pneumonia, NSW Registry of Births, Deaths and Marriages, 1 January 2004 to 31 July 2009



This Fall

Swine flu outbreak hits Vancouver Island First Nations

One death linked to virus reported on reserve near Victoria

Last Updated: Thursday, September 17, 2009 | 1:25 PM PT Comments 210 Recommend 169
CBC News

More than 100 people in an aboriginal community north of Tofino, B.C., have reportedly fallen ill with swine flu, in what's being described as the first pandemic outbreak in Canada's fall flu season, while one death linked the virus has been reported on a reserve near Victoria.

A death in Beecher Bay

All the cases in the Ahousat outbreak have reportedly been "fairly mild" and treatable with the antiviral drug Tamiflu, with only two patients — an infant and an adult age 50 — requiring hospital care. Most of the cases are reportedly younger adults, between ages 20 and 40, and some teenagers, the article states.

But the Vancouver Island Health authority confirmed on Thursday that other First Nations communities on Vancouver Island have also been hit with the virus.

On Wednesday, an aboriginal woman from the Beecher Bay reserve, southwest of Victoria, died after becoming infected with the swine flu. The health authority said the unidentified woman had an underlying health problem, and did not link her death with the outbreak in the Tofino area, which is roughly 200 kilometres away.

They also revealed a child under the age of five from an undisclosed First Nations community farther north up the island is in serious condition in hospital after becoming infected with the virus.

Has swine flu hit where you live?

CBC reporter Theresa Lalonde wants to hear your story

Three B.C. schools report students sick with H1N1 flu virus

Another Vancouver school missing one-third of its students, though presence of H1N1 not confirmed

One-third of students at a downtown Vancouver elementary school are absent with flu-like symptoms and the pandemic virus strain has been confirmed in pupils at three other British Columbia schools, signalling that the influenza season has arrived weeks before a vaccine is ready.

Principles of Influenza Transmission

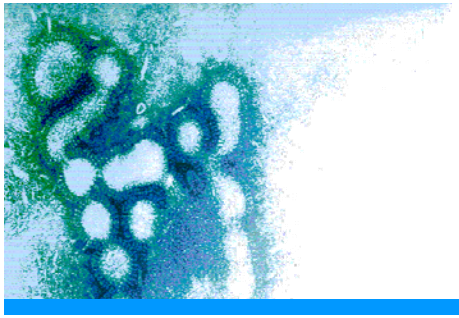
- **Contact Transmission**
  - **Direct Contact** Transmission occurs when the transfer of microorganisms results from direct physical contact between an infected or colonized individual and a susceptible host.
  - **Indirect Contact** involves the passive transfer of microorganisms to a susceptible host via an intermediate object such as contaminated hands that are not washed between patients or contaminated instruments or other inanimate objects in the patient's immediate environment

Principles of Influenza Transmission

- **Droplet Transmission**
  - Refers to large droplets generated from the respiratory tract of the source (infected individual) during coughing or sneezing, or during procedures such as suctioning or bronchoscopy. These droplets are propelled a distance of <2 meters through the air and are deposited on the nasal or oral mucosa of the new host (newly infected individual) or in the immediate environment.

Principles of Influenza Transmission

- **Airborne Transmission**
  - Refers to the dissemination of microorganisms by aerosolization.
  - Organisms are contained in droplet nuclei, airborne particles less than 5 μm that result from the evaporation of large droplets remain suspended in the air for long periods of time
  - Such microorganisms are widely dispersed by air currents and inhaled by susceptible hosts who may be some distance away from the source patients or individuals, even in different rooms or hospital wards



Influenza Transmission and the Role of Personal Protective Respiratory Equipment: An Assessment of the Evidence

The Council of Canadian Academies

Public Health Agency of Canada asked the CCA to appoint an independent expert panel to assess the current science that is relevant to the following questions:

a) How and where are seasonal influenza and pandemic influenza transmitted based on existing reviews, or where needed, original literature generated from seasonal influenza outbreaks and from previous pandemics?

b) Based on the conclusions of this review, what is your assessment of the contribution that N95 respirators or surgical masks will make to the prevention of transmission of seasonal and pandemic influenza?

THE EXPERT PANEL ON INFLUENZA / PPRE

- Donald Low (Chair)
- Michael Gardam, Susan Tamblyn, Raymond Tellier, Allison McGeer
- Anne-Marie Bourgault, Karen Bartlett
- Hon. Justice Jean-Louis Baudouin,
- Lisa Brosseau, Penny Ericson,
- Linda O'Brien-Pallas, Grant Stiver

Transmission of Influenza

- From infected patient
  - Expulsion (coughing, sneezing, talking)
  - Direct transfer (kissing, hands to fomites)
- To susceptible recipient
  - Contact
    - Direct (body to body)
    - Indirect (fomites)
  - Inhalation

Transmission of Influenza

- Traditional terminology
  - Contact
  - Large droplet
  - Aerosol

Expulsion

- Size of expelled particle dictates distance it can travel
  - Large droplet (>30 μm)
    - Short-range (<2 M)
  - Small particle size (≤ 30 μm)
    - Short-range (<2 M)
    - Long-range (>2 M)

Kowalski and Bahnfleth, 1998

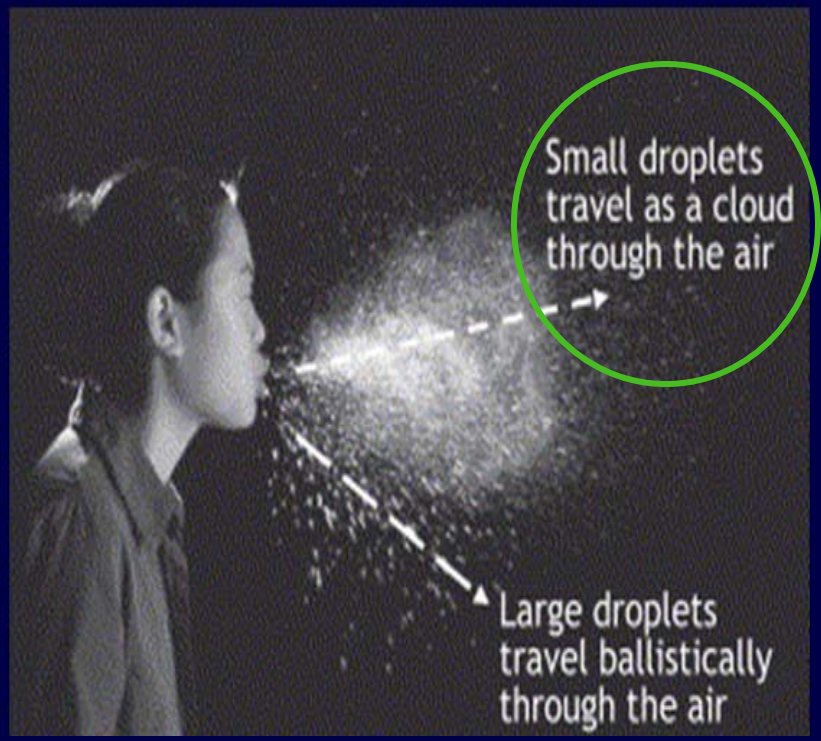
Expulsion of infectious material: Effect of Particle Size

- Diameter greater than 100 µm (Ballistic particles)
  - predominantly affected by gravitational forces

Kowalski and Bahnfleth, 1998; Tang JW et al. *J Hosp Infect* 2006

Expulsion of infectious material: Effect of Particle Size

- Diameters 0.1 to 100 μm range (inhalable particles)
  - Can remain in air seconds to days



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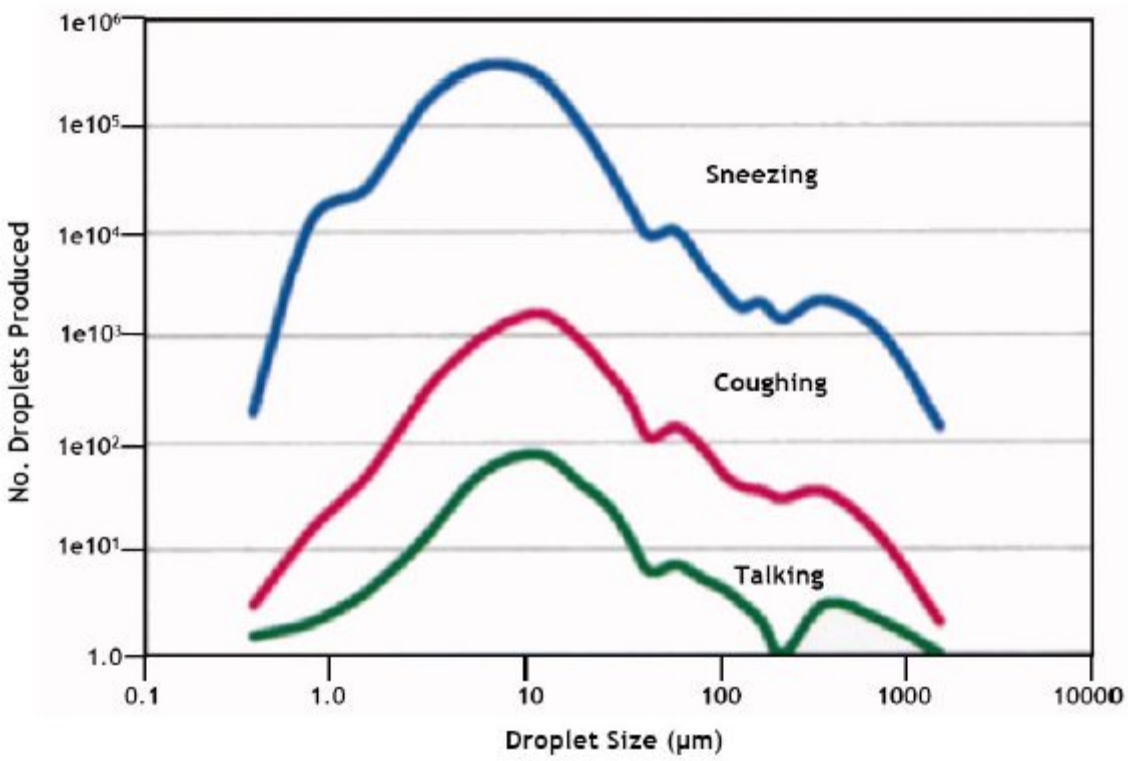
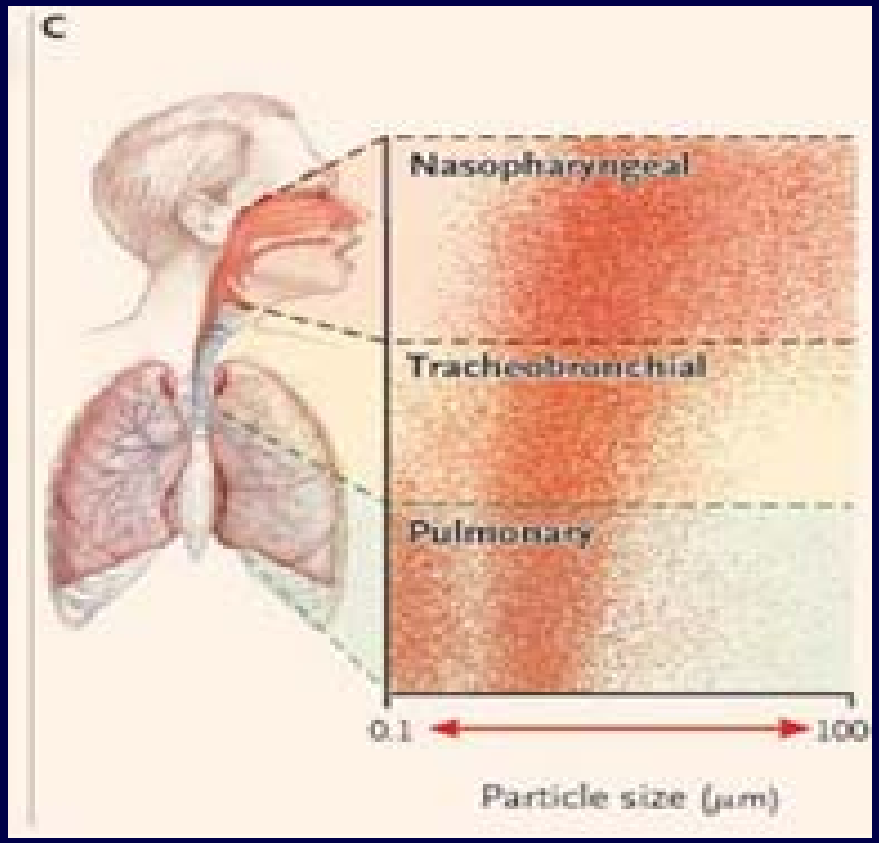


Size distribution of droplet formed by talking, coughing, and sneezing

(Kowalski & Bahnfleth, 1998)

Inhalation

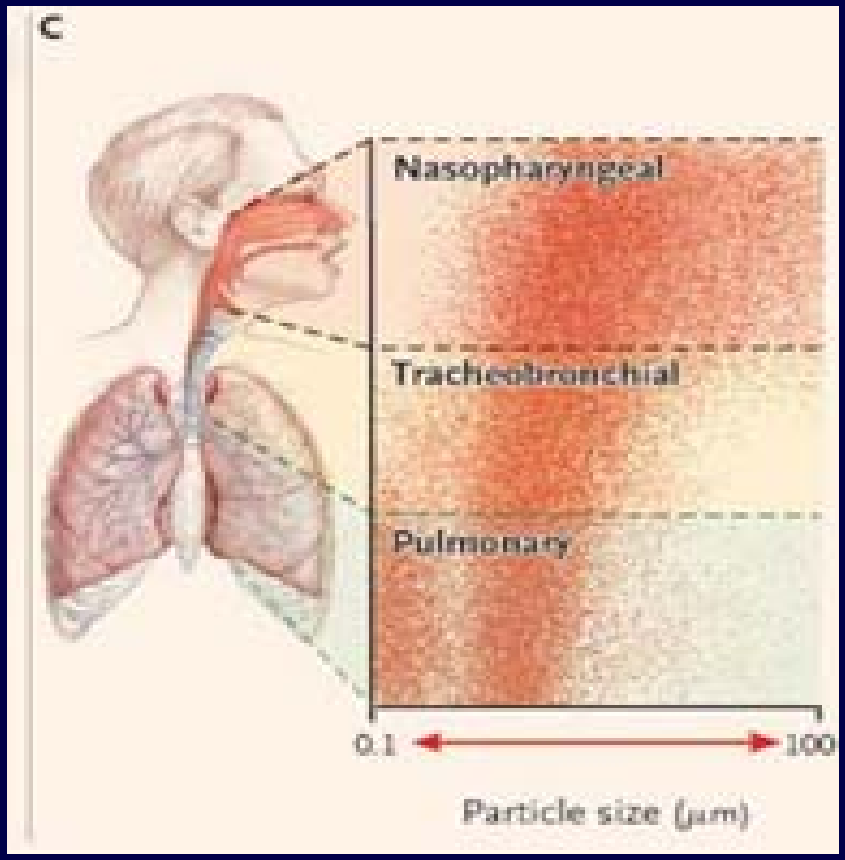
- Inhalable size particles account for <10% of volume of a cough
- Size of expelled particle dictates where it gets deposited in the respiratory tract



Roy CJ *NEJM* 2004

Inhalation

- Nasopharyngeal-sized particles
  - 20 to 100 μm in diameter
- Tracheobronchial-sized particles
  - 10 to 20 μm in diameter
- Alveolar-sized particles (pulmonary)
  - ≤10 μm in diameter



Roy CJ *NEJM* 2004

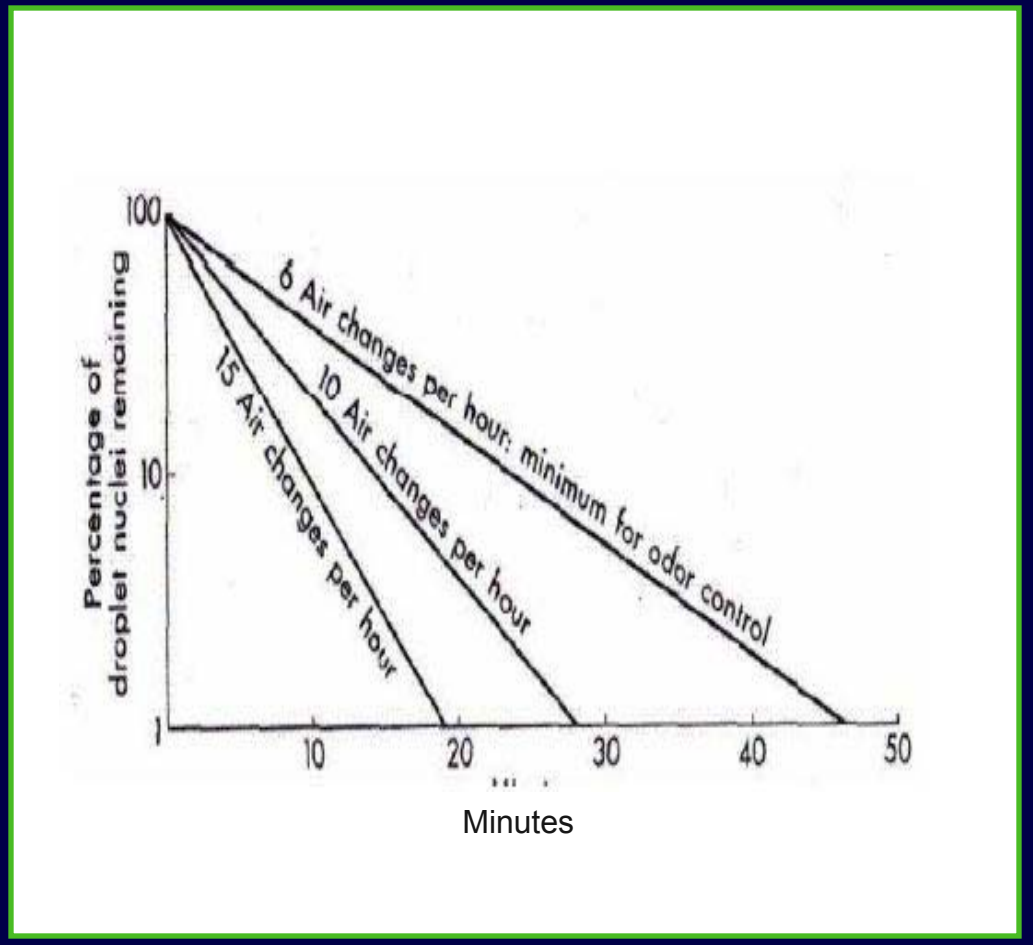
Measures to prevent or slow the spread on virus

1. Reducing the susceptibility of uninfected persons
   - Vaccination or antivirals
2. Reducing infectiousness of infected individuals
   - Treatment
3. Reducing contact rates with the virus
   - Physical barriers
   - Socially distancing

} Non-pharmaceutical interventions (NPI)

The Hierarchy of Control

- Engineering controls
- Administrative controls
- Personal protective equipment (PPE)



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Personel Protective Equipment

- PPE is traditionally defined as:
  - goggles
  - gloves
  - gowns
  - surgical masks
  - respirators

Personel Protective Equipment

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Data inconclusive regarding benefits

Surgical Masks: What they don't do

- Don't filter out small particles
  - Efficacy of filtering out tracheobronchial- or alveolar-sized particles varies from 2 to 92%
  - They are not certified
- Don't provide an effective seal to the face
  - thereby allowing inhalable particles access to the respiratory tract

Surgical Masks: What they do

- Do protect mucous membranes of nose and mouth from
  - Splashes
  - Contaminated hands

Respirators

- Respirator (e.g., N95, FFP2)
  - designed to protect you from breathing in very small particles, which might contain viruses
  - respirators fit tightly to the face so that most air is inhaled through the filter material
  - to work the best way, they should be "fit-tested“

Surgical Mask vs N95

- Loeb et al JAMA *IN PRESS*

Surface Cleaning

- hand transfer of virus from surfaces to mucous membranes is estimated to be an important factor in the transmission of influenza virus infection among groups of people (e.g., coworkers, family members)

http://www.flu.gov/professional/hospital/influenzaguidance.html

Surface Cleaning

- Influenza A and B viruses can persist on both nonporous and porous environmental surfaces for hours to days depending on a variety of human and environmental factors
  - However, the extent to which these surfaces and materials contributed to actual spread of infection was not determined.
- The secondary spread of infectious virus from environmental reservoirs to susceptible persons is accomplished primarily via hand transfer (i.e., hand contact with contaminated surfaces and then touching mucous membranes of the eyes, nose, and mouth)
- Proper handwashing or hand hygiene, coupled with respiratory hygiene and cough etiquette is the principal means of interrupting this transfer

Surface Cleaning

- Laboratory studies document survival periods that vary widely in length, depending on environmental factors
  - Low relative humidity levels (e.g., < 50%) and cool, ambient temperatures are associated with longer periods of activity
  - Influenza A virus can survive on hard, nonporous surfaces (e.g., stainless steel, hard plastic) for 24 – 48 hours and on porous materials (e.g., cloth, paper) for < 8 – 12 hours in ambient temperatures
  - Virus persistence on surfaces increases up to 72 hours when those surfaces are moist or wet

Surface Cleaning

- Influenza virus persistence on hands also varied widely.
  - One early study demonstrated that dried influenza virus can persist on hands for at least 3 hours
  - whereas more recent studies have shown that virus can remain stable on the hands for $\leq$ 5 minutes
- Infectious virus can be transferred to hands from nonporous surfaces for at least 2 – 8 hours during periods of heavy viral shedding in respiratory secretions
- Virus transfer from porous materials to the hands is much less efficient, being severely affected by rapid drying
  - infectious virus was transferred at detectable levels to the hands for only 15 minutes

Surface Cleaning

- Cleaning with soap or detergent in water is the first step in surface treatment
- Cleaning will remove soil and organic matter that would otherwise reduce the effectiveness of the disinfection step that follows
- There is no indication for cleaning procedures that differ from what is done routinely
- Any commercially available soap or detergent can be used
- Water can be cold or warm, or as recommended on the label of the cleaning product used (if a specific temperature is listed).

Cleaning and Surface Disinfection Strategies in Healthcare Facilities:

- Clean and disinfect surfaces that are touched routinely by hand (e.g., doorknobs, bed rails, bedside- and over-bed tables, bathroom surfaces, safety/pull-up bars, television controls, call buttons) on a more frequent schedule than that used for large housekeeping surfaces.
- Clean large housekeeping surfaces (e.g., floors) in patient-care areas with detergent/disinfectants in accordance with manufacturer instructions on a regular basis as per facility policy (i.e., at least daily and terminally cleaned at patient discharge).
- Detergent and water are adequate for cleaning surfaces in nonpatient-care areas (e.g., administrative offices).

Directions for Preparing and Using Chlorine-based Disinfectants

Product	Intended Use	Recommended dilution	Level of available chlorine
Household bleach (5% sodium hypochlorite solution with 50,000 ppm* available chlorine)	Cleanup of blood spills	Use concentrations ranging from 1 part bleach to be mixed with 99 parts of tap water (1:100) or one part of bleach to be mixed with 9 parts of tap water (1:10), depending on the amount of organic material (e.g., blood or mucus) present on the surface to be cleaned and disinfected.	0.05% or 500 ppm 0.5% or 5,000 ppm
	To add to laundry water	One part (one 8 ounce cup) of bleach to be mixed with about 500 parts (28 gallons†) of tap water	0.01% or 100 ppm
	Surface cleaning Soaking of glassware or plastic items	One part (one 8 ounce cup) to be mixed with about 50 parts (2.8 gallons) of tap water	0.1% or 1,000 ppm
NaDCC (Sodium dichloroiso-cyanurate) powder with 60% available chlorine	Cleanup of blood spills	Dissolve 8.5 g in one litre of tap water	0.85% or 5,000 ppm
Chloramine-T powder with 25% available chlorine	Cleanup of blood spills	Dissolve 20 g in one litre of tap water	2.0% or 5,000 ppm

* Parts per million

† Imperial gallon (4.5 litres)

Swine flu contagious longer than thought

- The CDC has been recommending people to stay home from work and school and avoid contact with others until a day after their fever breaks

Institute of Public Health in Quebec

- nose and throat swabs from 43 patients with lab-confirmed flu and other sick family members
  - On the eighth day after symptoms struck, 8% to 19% were still shedding live H1N1 virus

Singapore

- involved 70 patients
- 80% were still shedding virus after five days of illness, 40% at seven days, and 10% at 10 days.
- People who were treated with oseltamivir shed virus for an average of three fewer days than those not given the anti-flu drug, but some were showing signs of viral shedding after a week