Pandemic Flu Preparedness

Nicole Kenny, BSc, Assoc Chem
Manager of Professional & Technical Services
Virox Technology Inc
nkenny@virox.com

The Infection Control Team

- Controlling Infectious Disease is everybody’s business
- Environmental Services department plays an important role in closing the gap in Infection Control
- Engage all personnel from every department

The Bermuda Triangle

The Agent

- Where does it come from?
- Comes from students, staff, visitors
- Students: Respiratory secretions, feces, wounds, other body fluids
- Staff: mouth, nose, hands
- Visitors: Respiratory secretions, hands

The Host

- Why are they susceptible?
- Age
- Developing Immunity
- Breaks in the natural defenses
- Other illnesses (asthma, allergies etc)

Infection and Incubation Time

- Infection doesn’t always lead to disease
- The time from infection to the onset of symptoms ranges from hours to years

- Salmonella: 6 - 48 hrs
- Hepatitis B: 50 - 150 days
- Tuberculosis: 6 months - 2 years
- HIV: 3 - 10 years

The Infection Control Team

"Controlling Infectious Disease is everybody’s business"
"Environmental Services department plays an important role in closing the gap in Infection Control"
"Engage all personnel from every department"

The Bermuda Triangle

The Agent

- Where does it come from?
- Comes from students, staff, visitors
- Students: Respiratory secretions, feces, wounds, other body fluids
- Staff: mouth, nose, hands
- Visitors: Respiratory secretions, hands

The Host

- Why are they susceptible?
- Age
- Developing Immunity
- Breaks in the natural defenses
- Other illnesses (asthma, allergies etc)
The Environment

How do we get these together?
- Overcrowding
- Shared equipment (toys, instruments, sports)
- Cleaning & disinfection practices
- Poor hand hygiene (staff, visitors and students)

Transmission

Chain of Infection
- Microorganisms are carried by & on humans / animals / insect body (Reservoir)
- Microorganisms released from body by coughs, sneezes, feces, blood, saliva
- Inanimate objects, environmental surfaces, food, water become contaminated which leads to potential transmission of disease

How do Microorganisms Spread?
- Transmitted from person to person through human contact, air currents, on animals or insects, in food, in water or on inanimate objects
- The human hand is capable of transporting microorganisms from one person to another, from one contaminated object to another, or from a contaminated object to another person

HOW MICROORGANISMS ARE ACQUIRED

- Direct
- Indirect
- Droplet

- Airborne
- VEHICLE
- VECTORBORNE

SARS
Norwalk
Influenza
Measles
Mumps
Rubella
Colds
Viruses

- Viruses are even smaller than bacteria and cannot be seen under an ordinary microscope
- Viruses cannot live independently and are not self-sufficient
- Viruses are referred to as obligate parasites meaning they are dependent on cells of a living host to replicate & multiply

Viruses

- Classified as either DNA virus or RNA virus
- New research shows there is a small group of viruses that contain both DNA & RNA
- Viruses are also classified by shape, size & other structural characteristics for example
  - Enveloped or Non-enveloped Viruses

Enveloped Viruses

- Envelop refers to the Lipoprotein outer layer of some viruses derived from plasma membrane of the host cell
- Considered easier to kill than even Vegetative Bacteria
- Examples: HIV, Herpes, Hepatitis B & C, Influenza, Coronavirus

Non-Enveloped Viruses

- Non-enveloped viruses lack the lipoprotein coat
- Considered hardier and more resistant
- Examples: Polio, Norovirus, Rhinovirus, Rotavirus, Parvovirus

The Influenza Virus
The Influenza Virus

- All type A influenza viruses are genetically labile (able to change physically) & well adapted to elude host defenses hence its relationship to pandemics & epidemics
- Infect a wide variety of mammals, including man, horses, pigs & birds
- Outer surface of the virus has a lipid envelope with two types of glycoproteins
  - Haemagglutinin (H or HA) of which there are 15 different subtypes
  - Neuraminidase (N or NA) of which there are 9 different subtypes

Influenza Surface Proteins

- Neuraminidase
- Haemagglutinin

Introduction to Influenza

- Multiple serotypes exist: HxNy
- Only certain serotypes easily infect humans
  - H1-N1
- Other serotypes may inefficiently infect humans during massive exposures
  - Current avian pandemic strain H2N1

Influenza Epidemiology

- Spread by direct contact with respiratory droplets, aerosols, airborne spread in crowded populations & enclosed spaces, direct contact and occasionally transmitted by fomites
- Virus may persist for hours in dried mucous
- Transmission is very efficient – 3 to 9 new infections per clinical case
- Peak infectivity 1 – 2 days before & 4 – 5 days after clinical signs
- Epidemics usually last 3 – 6 weeks

The Possibilities of Transmission

Impact of an Influenza Infection

- Frequency
  - Between 1 – 4 in 10 fall ill every year
  - 1 in 25 will consult a doctor
- Consequences
  - 5 – 6 days of reduced physical activity
  - 3 – 4 day immobility
  - 3 or more days of absenteeism from workplace or school
  - Almost every second case requires medical care
Yearly Global Impact

- 5 – 15% of the world population affected (mainly children 5 – 9 years of age)
- 3 – 5 million severe cases
- 250,000 to 500,000 deaths, mainly in elderly (>65 years) and high risk groups

Influenza Mutation

- Antigenic drift
  - Influenza virus constantly mutates as it reproduces...occasionally resulting in a new prevalent strain
- Antigenic shift
  - Influenza viruses can also recombine with other influenza viruses—intra and interspecies...this can result in a pandemic strain
  - Gradual adaptation of animal viruses to human transmission

Antigenic Shift

What is a Pandemic?

- Definition
  - Pandemic: very widespread disease: a disease or condition that is found in a large part of a population
- Pandemics occur when a completely new strain of influenza emerges for which humans have no immunity
- Antigenic shift of the virus from animal to human

What makes a good pandemic virus?

- Highly infectious
  - Current avian strain needs to become more “human”
- Needs to remain as “foreign” as possible
  - No preexisting population immunity
  - Disproportionate deaths in young in 1918
- Virus is easily transmissible from person-to-person
What history tells us

- 1918 pandemic killed a presumed 50 million people
- 1957 pandemic killed 70,000 people
- 1986 pandemic killed 1 million people

Pandemics last century

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COLLOQUIAL NAME AND SUBTYPE</th>
<th>SOURCE</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>&quot;Spanish&quot; flu (H1N1 virus)</td>
<td>Possibly emerged from wild or an avian host, of a mutated H1N1 virus</td>
<td>Pandemic with &gt;20 million deaths globally</td>
</tr>
<tr>
<td>1957</td>
<td>&quot;Asian&quot; flu (H2N2)</td>
<td>Possibly mixed infection of an animal with human H2N2 and avian H2N2 virus strain in Asia</td>
<td>Substantial pandemic H2N2 virus (in Asia)</td>
</tr>
<tr>
<td>1968</td>
<td>&quot;Hong Kong&quot; flu (H3N2)</td>
<td>High probability of mixed infection of an animal with human H3N2 and avian H3N2 virus strains in Asia</td>
<td>Substantial pandemic H3N2 virus (in Asia)</td>
</tr>
<tr>
<td>1977</td>
<td>&quot;Russian&quot; flu (H1N1)</td>
<td>Same subtype, but virus is unclear, characterized in humans in Russia, but appearances described at almost the same time in China and Siberia</td>
<td>Begins pandemic, primarily involving persons born after the 1960s, H1N1 virus has co- circulated with H3N2 virus in humans since 1967</td>
</tr>
</tbody>
</table>

Why now?

- Amount of immigration & global travel & commerce occurring today, migration of the influenza virus is a cinch
- As long as facilities are lax about hand hygiene, respiratory etiquette, isolation practices & contact precautions, we’re sitting ducks

Not If, When!

- If Avian Influenza does become the next pandemic it could kill as many as 7 million people
- The number of people that will be affected will go beyond billions because between 25 & 30% of the world’s population will fall ill

What will the pandemic strain look like?

- Assume it will result from the recombination of unlike viruses
  - Recombination in humans, other animals?
- It cannot be identical to the current avian pandemic strain
  - May be a variant however
Avian Flu

- First described in chickens in Italy in 1878
- Detected in more than 90 species of wild birds (natural host for all subtypes of Influenza A)
- Asymptomatic in most wild species (ducks, gulls etc)
- Pathogenic in other birds (domestic poultry)
  - Low pathogenic form
  - High pathogenic form

Avian Flu: HPAI

- Only H5 & H7 Subtypes
- No natural reservoir
- Emerges usually by mutation in poultry
- 90 – 100% death rate for poultry
- Rare until 2004
  - only 24 outbreaks since 1959
  - 14 in the past 10 years!
- Control measures include
  - Culling of all infected or exposed birds
  - Proper disposal of carcasses
  - Quarantining & disinfection of farms

Spread among Birds

- Domestic birds can be infected by direct contact with infected wild waterfowl or other infected poultry
- Indirect contact with contaminated surfaces (dirt, cages) or materials (water, feed)
- People, vehicles or other inanimate objects can be source of spread from farm to farm

Spread to Humans

- Avian Influenza A viruses do not usually infect humans
- May be transmitted to humans in 2 ways
  - Directly from birds or from contaminated environment to people
  - Through an intermediate host such as a pig
- Most human cases thought to have occurred from contact with infected poultry or surfaces

Avian flu: the current situation

- Avian influenza now endemic in South East Asia
  - 8 countries have had outbreaks
  - 100 000 000 birds have died
- Most human infections have been traced to direct contact with infected birds
- A few cases have resulted from human-human transmission

Why Be Concerned About Avian Influenza

- First recorded cases of Avian influenza in 1997 in Hong Kong
- Primarily associated with avian species
- 18 people infected and 33% died; strain not transmissible among humans
- 1.4 million chickens culled and slaughtered to prevent its spread
- Pandemic avoided because strain not transmissible between humans
Why Be Concerned About Avian Influenza

- 2003 H7N7 Avian influenza caused 80 cases in humans in Netherlands (1 person died); 30 million chickens culled
- February 2, 2004 in Fraser Valley Region H7N3 subtype caused influenza in chickens
  - 1.3 million chickens infected but 19 million chickens culled
  - 2 human cases (conjunctivitis) after not wearing protective eyewear

Planning assumptions

- Children and young adults at greatest risk
  - 1/3 of deaths in < 65 age group
- Attack rate of 35%
- Most ill people will not require medical attention
- Those who recover will have immunity

Impact on healthcare system

- 1/3 of healthcare workers will become ill
- Healthcare services will require supplementation
- Lab services will be reduced
- Demand for inpatient beds will exceed supply
- Long term care and homecare may off-load hospitals

Impact on healthcare system

- Non-urgent healthcare services will be scaled back
- MOHLTC will provide centralized distribution of protective equipment, drugs, vaccine
- Provincial emergency will be declared early in the pandemic
Cleaning & Disinfection Protocols

Hands & Surfaces

Did you know?

- Cleaning reduces or eliminates the reservoirs of potential pathogenic organisms
- Proper cleaning methods & the mechanical action of cleaning alone will physically remove 99 to 99.9% of organisms on a surface
- Cleaning alone will make most surfaces safe for staff & students
- Actual physical removal of organisms & soil by wiping or scrubbing is probably as important, if not more so, than any antimicrobial effect of the cleaning agent used

Cleaning

- The removal of adherent visible soil, blood, protein substances (tissue) and other debris from surfaces by mechanical or manual process
- Generally accomplished with water and detergents
- Removes or eliminates the reservoirs of potential pathogenic organisms

Cleaning Strategy

- Minimize contamination of cleaning solutions & cleaning tools
- Bucket solutions become contaminated almost immediately during cleaning & continued use of the solution transfers increasing numbers of microorganisms to each subsequent surface to be cleaned
- Cleaning solutions should be replaced frequently

Housekeeping - Floors

- Extraordinary cleaning & decontamination of floors is unwarranted
- Studies have demonstrated that disinfection of floors offers no advantage over regular detergent/water cleaning & has minimal or no impact on the occurrence of HAIs
- Newly cleaned floors become rapidly re-contaminated from airborne microorganisms & those transferred from shoes, equipment wheels & body substances
- Methods that produce minimal mists & aerosols or dispersion of dust in patient-care areas are preferred

Environmental Reservoirs

- Association between reservoirs and outbreaks
- Protocols should include careful cleaning of wet surfaces and equipment to prevent the build up of Biofilms
- Examples:
  - Faucet aerators, Shower Heads
  - Sinks, Drains
  - Flower Vase Water
  - Ice Machines
  - Hydrotherapy Tubs
Disinfectant Selection

Consider:
- Efficacy
- Spectrum
- Versatility
- Ease of use
- Safety profile

What's in your bottle?

Effects of Germicides on Microorganisms

- HCWs take for granted the action of disinfectants without fully understanding mechanism of action
- Differences in the action of antimicrobial ingredients
- Differences depending on concentration of chemical used

Proper Use of a Disinfectant

- Disinfection should be considered a two step process (clean, then disinfect)
- Disinfection is a result of allowing the appropriate contact (dwell) time on each surface
  - 10 minute contact time MEANS surface must stay wet for 10 minutes!

Increase Cleaning Procedures

- High traffic areas & frequent hand contact areas should be cleaned & disinfected on a more frequent schedule
- Provide a disinfectant product for staff to use in class rooms BUT be sure to teach everyone how to use it!
- Desks & high touch areas in a classroom should be cleaned & disinfected between each class to help eliminate risk of transmission
- Shared equipment should be cleaned & disinfected between use

Personal Protective Equipment

- Disposable gloves should be used for cleaning & disinfecting of all surfaces
- Disposable masks (procedure masks) should be available for use of cleaning & disinfection surfaces with body fluids and bathrooms
- Training on the proper donning & doffing of PPE should be conducted

FACTS

- Play a major role in the transmission of pathogenic microorganisms to susceptible hosts
- Hands acquire known or potential pathogens by contact with objects and animate and inanimate surfaces
- Strict adherence to HH is more likely to prevent the spread of infections than procedures exceeding routine cleaning of the environment.
Hand Hygiene

- Recognized as the best way of stopping the spread of organisms in this setting
- Soap and water
  - No indication for antimicrobial soap
  - 10-15 seconds of lathering
- Alcohol
  - more research into concentration required to kill all viruses

Adherence - Hand Hygiene

- Many studies conducted on HH report that HCWs practice appropriate HH only 25 – 50% of the time
- Female HCWs wash 33% more frequently than males, but when males did wash, they washed more effectively
- It is sobering to realize that despite the research, despite the product innovation & technology – it all comes down to us & whether or not we choose best practice & wash our hands

Handwashing

- Challenge staff to make a difference in the lives of patients, our families & ourselves by setting the standard, that model for HH against which everyone else is compared

Stay Healthy–Wash Your Hands

Virox Technologies Inc.

Engineering Revolutionary Disinfectants for the War Against Microbes

References


References

- Rutala, APIC Guideline for Selection and Use of Disinfectants (1990)
- Webber, P. Hospital & Housekeeping Infection Control, Sanitation Canada, March/April 2005, pg 30 – 36
References

- Centers for Disease Control. Isolation of Avian Influenza A (H5N1). Viruses from Humans-Hong Kong, May-Dec 1997

References

- Lee Y, Mak KH, Saw TA. The Avian Flu (H5N1): One Year On Hong Kong Public Health and Epidemiology Bulletin 999;8:1-8
- Laver WG, Bischofberger N, Webster RG. Disarming flu viruses, Sci Am 1999;January