State of the Science

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OSAP 2011 Symposium
June 10, 2011

Disclosure

• Dr. DePaola has no potential conflicts of interest in any of the material presented.
  - The content of this was developed and controlled by Dr. DePaola.
Infectious Agent
Bacteria, viruses, fungi

Susceptible Host
Immunization
Successful Tx

Source/ Reservoir
People
Equipment

Portal of Entry
Mucous membranes
Respiratory tract
Broken skin

Portal of Exit
Aerosol
Splash/splatter

Mode of Transmission
Direct & indirect contact
Inhalation/Airborne

Infectious Agent
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Antimicrobial Resistance

Healthcare Associated Infections

Vaccines & Vaccine Preventable Diseases

State of the Science

Bacteria

Fungi

Antimicrobial Resistance

Viruses

Parasites

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What Is Antimicrobial Resistance?

• Antimicrobial (drug) resistance is the ability of bacteria, viruses, parasites and other microorganisms to change and cause an antimicrobial agent (drug) to be ineffective against the resistant organism.
  - All classes of antimicrobials affected including antibiotics, antivirals, antifungals and antimaterials
  - This results in standard treatment regimens becoming less and less effective.
    - Infections persist.
    - Infections can spread to others.
    - Infections cost much more to treat.
    - Higher rates of morbidity and mortality.

Antimicrobial Resistance: A Global Problem

• Over the last several decades, multiple factors have lead to an alarming increase in the number and types of resistant microorganisms.
• Infections from these emerging resistant organisms are increasing in number and becoming very difficult, and in some instances impossible, to treat.
  - Global trade and the ease of international travel, facilitates the spread of resistant microorganisms to virtually any part of the world.
    - Fast and widespread dissemination of infections.

Causes Antimicrobial (Drug) Resistance

• Microorganisms are constantly changing and development of drug resistance is a natural evolutionary phenomenon.
  - When exposed to an antimicrobial drug, the more susceptible microorganisms are killed.
  - Resistant organisms are not.
    - Resistant organisms thrive and are able to pass on resistance to their progeny.
    - New patterns and pathways of resistance are constantly emerging.
    - Multiple-drug resistant organisms are now frequently encountered in both hospital and community settings.
Causes Antimicrobial (Drug) Resistance

Dramatic worldwide increase in antimicrobial-resistant and nosocomial pathogens

- Inappropriate and indiscriminate use of antimicrobials drives the development of drug resistance.
  - Overuse, underuse and misuse of antimicrobials.
  - Antibiotics are often prescribed for viral infections.
  - Patients do not take prescribed dosage for the entire course of treatment.
  - Inappropriate antimicrobial medications are prescribed to or taken, by the patient (self-medication without Rx).

- Bootleg or counterfeit pharmaceuticals:
  - Illegal drugs – big profits
  - Lack of quality control in drug production facilities leads to under-strength and/or poor quality drugs; some have no pharmacologic activity.
  - Little or no regulation in many countries
  - Many drugs available on internet
  - Quality and content of drugs in some instances questionable


Causes Antimicrobial (Drug) Resistance

- Animal husbandry is a source of drug resistance.
  - Sub-therapeutic doses of antibiotics are used in animal industry to promote growth or prevent disease(s).
  - This can result in resistant microorganisms, transmissible to humans.

- Poor infection control and prevention practices amplifies and perpetuates drug resistance.
  - HCWs non-compliant with recommended infection control practices.
  - Poor infection control and prevention practices can increase the spread of drug-resistant infections.
  - Hospitalized patients are one of the main reservoirs of resistant microorganisms.
  - Infected patients become carriers of resistant microorganisms
  - Become reservoirs of infection in the community.

Non-Compliance to Infection Control

- A recent online survey of 5,446 healthcare practitioners reveals non-compliance with basic infection control practices associated with the use of syringes, needles, multiple-dose vials, single-use vials, and flush solutions.
  - Nearly 1% of respondents admitted to sometimes or always reusing a syringe for more than one patient after only changing the needle
  - 6% of respondents admitted to sometimes or always using single-dose/single-use vials for multiple patients
  - 15% of respondents reported using the same syringe to re-enter a multiple-dose vial numerous times; of this group, about 7% reported saving these multiple-dose vials for use with other patients
  - 9% of respondents sometimes or always use a common bag or bottle of IV solution as a source of flushes and drug diluents for multiple patients.

Antimicrobial Resistant Organisms: 2011

- **Tuberculosis (TB):**
  - 440,000 new multidrug resistance (MDR) TB cases annually;
  - Extensively drug resistance (XDR) TB cases reported in 64 countries so far
- **HIV:**
  - With expanded use of antiretroviral therapy (ART), resistance is a concern,
  - Especially when inappropriate drugs are used and/or patient not adherent to ART regimen.
- **Methicillin-resistant Staphylococcus aureus (MRSA):**
  - Lethal infections in hospital settings becoming increasingly frequent
- **MDR E.coli, K. pneumoniae and Enterobacter sp.:**
  - Infections are on the rise
  - New beta-lactamase, NDM-1, is causing alarm
- **Neisseria gonorrhoeae and Shigella:**
  - Becoming increasingly resistant to drugs


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Distribution of Proportion of MDR Among New TB Cases, 1994-2010

Highly Resistant *Escherichia coli*

Proportion of 3rd generation cephalosporins resistant isolates in 2009

Source: ECDC, Antimicrobial resistance surveillance in Europe 2009
**New Delhi Metallo-β-lactamase-1 (NDM-1)**

- Microorganisms are constantly developing new resistance mechanisms.
  - New Delhi metallo-beta-lactamase 1 (NDM-1)* is a unique genetic mechanism that has produced antibiotic-resistant gram-negative Enterobacteriaceae.1
    - *Also called Plasmid-encoding Carbapenemase-resistant Metallo-B-Lactamase (PCEM)
  - NDM-1 is a novel plasmid-borne metallo-β-lactamase (MBL) first isolated only in Enterobacteriaceae.2
    - *Also called Plasmid-encoding Carbapenemase-resistant Metallo-B-Lactamase (PCEM)
  - Clearly illustrates ability of bacteria to accumulate resistance determinants, maintain infectivity and spread rapidly around the world.3
  - The identification of this resistance determinant was first reported in 2008.2
  - By 2010, it had spread from its base in New Delhi, India across the Indian subcontinent to Pakistan and Bangladesh.
  - Cases now reported in Australia and throughout the US, the UK, France and Canada.4

**Distribution of NDM-1 producing Enterobacteriaceae strains**

Strains in Bangladesh, India, Pakistan and UK

**New Delhi Metallo-β-lactamase-1 (NDM-1) 1-6**

- There are now great concerns about an infectious disease pandemic produced by this strain.1-6
  - In just 3 years, prevalence increased from rarely observed to 1-3% in patients with Enterobacteriaceae infections in India.2
  - NDM-1 documented in USA in clinical isolates from 3 States
    - CA, IL, MA reported in June, 2010.
  - While NDM-1 mechanism is new in the USA, carbapenem resistance in Enterobacteriaceae is common.
    - Carbapenem resistance from Klebsiella pneumoniae carbapenemases (KPC), endemic in some areas, in serious problem in the USA.
  - Highly resistant organisms
    - NDM-1 infections are very difficult, sometimes impossible, to treat.1-6

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New Delhi Metallo-β-lactamase-1 (NDM-1)

- The NDM-1 gene is a unique mechanism for resistance.
  - Not closely related to either other metallo-β-lactamases or other carbapenemases.
  - Not closely related to anything that has been described before.
- The NDM-1 gene specifically is a novel mechanism.
  - It appears to be contained on and able to exist on multiple different kinds of plasmids, sometimes even in the same bacterial cell.
  - Multiple ways for this gene to move around.
  - NDM-1 containing strains were capable of both clinical resistance and plasmid transmission.
  - Other mechanisms probable.
  - Gene very variable and unstable.
- Significantly increasing drug resistance in the Enterobacteriaceae.
- Significant global public health threat.

**Methods**

- Swabs absorbing about 100 μL of seepage water and 15 mL samples of public tap water were collected from sites within a 12 km radius of central New Delhi and tested for the presence of the NDM-1 gene, blaNDM-1, by PCR and DNA probing. Compared to controlled H2O samples from Wales.
- Findings
  - 171 seepage samples and 50 tap water samples from New Delhi and 70 control samples were collected.
  - blablaNDM-1 was detected in two of 50 drinking-water samples and 51 of 171 seepage samples from New Delhi.
- Carriage by enterobacteria, aeromonads, and Vibrio cholerae.
  - NDM-1 has not previously been reported, including Shigella boydii and Vibrio cholerae.
- Not closely related to anything that has been described before.
  - Not closely related to other metallo-beta-lactamases.
  - Other mechanisms probable.
- **Interpretation**
  - The presence of NDM-1 β-lactamase producing bacteria in environmental samples in New Delhi has important implications for people living in the city who are reliant on public water and sanitation facilities.
  - International surveillance of resistance, incorporating environmental sampling as well as investigation of clinical isolates, needs to be established as a priority.

**Dissemination of NDM-1 Positive Bacteria in the New Delhi Environment and Its Implications for Human Health: An Environmental Point Prevalence Study**

- Not all patients infected with NDM-1 positive bacteria have a history of hospital admission in India, and extended-spectrum β-lactamase-producing Enterobacteriaceae are known to be circulating in the Indian community. This study estimated the prevalence of the NDM-1 gene in drinking water and seepage samples in New Delhi.
- **Methods**
  - Swabs absorbing about 100 μL of seepage water and 15 mL samples of public tap water were collected from sites within a 12 km radius of central New Delhi and tested for the presence of the NDM-1 gene, blaNDM-1, by PCR and DNA probing.
  - Findings
    - 171 seepage samples and 50 tap water samples from New Delhi and 70 control samples were collected.
    - NDM-1 containing strains were found in 12 of 171 seepage samples and two of 50 water samples, and included 11 species in which NDM-1 has not previously been reported, including Shigella boydii and Vibrio cholerae.
    - NDM-1 was stable, generally transmissible, and associated with typical resistance.
- 20 strains of bacteria were found in the samples, 12 of which carried NDM-1 on plasmids.
- **Interpretation**
  - The presence of NDM-1 β-lactamase producing bacteria in environmental samples in New Delhi has important implications for people living in the city who are reliant on public water and sanitation facilities.
  - International surveillance of resistance, incorporating environmental sampling as well as investigation of clinical isolates, needs to be established as a priority.

Will We Return to the Pre-Antibiotic Era?

OMG! What have we done??
Environmental Cleaning Intervention and Risk of Acquiring Multidrug-Resistant Organisms From Prior Room Occupants
Rupak Datta, MPH; Richard Platt, MD, MS; Deborah S. Yokoe, MD, MPH; Susan S. Huang, MD, MPH

• Background
  - Admission to intensive care unit rooms previously occupied by carriers of methicillin-resistant Staphylococcus aureus (MRSA) or vancomycin-resistant enterococci (VRE) had been found to confer a 40% increased risk of acquisition, presumably through environmental contamination. Subsequently, a cleaning intervention was shown to reduce MRSA and VRE room contamination. We now evaluate the effect of this intervention on the risk of acquiring MRSA and VRE from prior room occupants.

• Methods
  - We conducted a retrospective cohort study of patients admitted to 10 intensive care units at a 750-bed academic medical center during the enhanced cleaning intervention (from September 1, 2006, through April 30, 2008; n = 9449) vs baseline (from September 1, 2003, through April 30, 2005; n = 8203) periods.
  - The intervention consisted of targeted feedback using a black-light marker, cleaning cloths saturated with disinfectant via bucket immersion, and increased education regarding the importance of repeated bucket immersion during cleaning. Intensive care unit rooms included medical, cardiac, burn/trauma, general surgery, cardiac surgery, thoracic surgery, and neurosurgery units. We calculated the number of room stays involving the potential for MRSA and VRE acquisition and then assessed the frequency at which eligible patients were exposed to rooms in which the prior occupants had MRSA-positive or VRE-positive status.

• Results
  - Acquisition of MRSA and VRE was lowered from 3.0% to 1.5% for MRSA and from 3.0% to 2.2% for VRE (P < .001 for both). Patients in rooms previously occupied by MRSA carriers had an increased risk of acquisition during the baseline (3.9% vs 2.9%, P = .03) but not the intervention (1.5% vs 1.5%, P = .79) period. In contrast, patients in rooms previously occupied by VRE carriers had an increased risk of acquisition during the baseline (4.5% vs 2.8%, P = .001) and intervention (3.5% vs 2.0%, P < .001) periods.

• Conclusions
  - Enhanced intensive care unit cleaning using the intervention methods may reduce MRSA and VRE transmission.
  - It may also eliminate the risk of MRSA acquisition due to an MRSA-positive prior room occupant.


Reducing Antimicrobial Resistance

Intervention to Reduce Transmission of Resistant Bacteria in Intensive Care

Methods

"The results of this trial indicate that merely improving the identification of colonized patients and expanding the use of barrier precautions, at least as achieved during this trial, are measures that are not likely to be broadly effective."

Limitations of this study include possibly insufficient duration of the intervention period to show an effect.

Veterans Affairs Initiative to Prevent Methicillin-Resistant Staphylococcus aureus Infections

Background

Methods

Conclusions

HAIs can be reduced!!!! Infection control is the responsibility of everyone who has contact with patients.
Background
- The fungal species Candida albicans and the bacterial species Staphylococcus aureus are important human pathogens causing significant morbidity and mortality.
- These pathogens possess numerous virulence attributes including the ability to adhere to surfaces where they develop resistance to therapeutic agents resulting in persistent and chronic infections.
- Yet despite their prevalence and the clinical inferences of their co-existence in a host, studies exploring the implications of their interaction within the context of polymicrobial infections have been lacking.

Methods
- This study was designed to determine the molecular mechanisms underlying the interaction between C. albicans and S. aureus and their impact on pathogenesis in a host using in vitro studies and an animal model of oral co-infection.

Results
- The combined findings generated so far have demonstrated that the interaction between these two pathogens in a mouse host enhanced their respective virulence and resulted in a systemic bacterial infection.
- Furthermore, this interaction was shown to be mediated by a specific adhesin on the fungal and a receptor on the bacterial cell walls.

Conclusions
- Further in depth investigations into this unique and intricate interaction between C. albicans and S. aureus are warranted.


Improvements in Technology to Control Disease Transmission

Electronic Faucets Unsafe For Use In High-Risk Patient Hospital Settings: Study Shows Automatic Faucets Carry High Levels Of Bacteria
April 1, 2011

- Electronic-eye, non-touch faucets have been increasingly utilized in healthcare settings to lower water consumption and reduce recontamination of the hands of HCWs.
- Microbiologic sampling showed that electronic faucets are more likely to become contaminated with unacceptably high levels of bacteria, including Legionella spp., compared with traditional manually operated faucets.
  - Investigators examined bacterial growth from 20 manual and 20 electronic faucets receiving water from the same source in two wards.
  - Cultures obtained from the faucets showed that 50 % of water cultures from electronic faucets grew Legionella spp.; compared to 15 % from manual faucets.
  - 26 % of water cultures from electronic faucets had significant growth on heterotrophic plate count (HPC) cultures compared to 13 % of water cultures from manual faucets.
  - Even after flushing of the water system using chlorine dioxide the disparity between electronic and manual faucets persisted with 29 % of electronic faucet cultures still contaminated with bacteria compared 7% of manual faucet cultures.

Sydnor E. Presented abstract at the SHEA 2011 Annual Scientific Meeting; April 1-4, 2011; Dallas.
Healthcare-Associated Infections (HAI): Major Public Health Concern

- The CDC estimates 1.7 million HAIs occur each year.
- Contribute to the death of 99,000 patients annually.
- HAIs are the 4th leading cause of death in the USA.
  - Kill more people annually than AIDS, breast cancer and auto accidents combined.
- Estimated the annual medical costs of HAIs in US hospitals estimated to be between $28 & $45 billion.
  - Adjusted to 2007 dollars.


Healthcare-Associated Infections (HAI): Major Public Health Concern

- HAIs are a threat to patient safety and the most common adverse events resulting from a stay in the hospital.1
  - Approximately 5 to 10% of hospitalized patients in the developed world acquire such infections.2
  - In developing countries the acquisition of HAIs is much higher.2
- Proper use of hand hygiene is critical to the prevention of these infections.2
  - Compliance among HCWs is usually below 40%.1,2


Healthcare-Associated Infections (HAI): Major Public Health Concern

- Clean hands save lives. Protect patients, protect yourself.
  - Hand hygiene is pivotal to preventing the spread of infections.1,2
  - Prophylactic hand hygiene reduces the risk of transmission.1,2
New Hand Hygiene Video Offered by NEJM

- The New England Journal of Medicine is featuring a 14-minute hand hygiene video as part of its Videos in Clinical Medicine:
  - Downloadable at:

Develop New Drugs to Treat HAIs and Educate HCWs About the Importance of Following Rx Dispensing and Dosage Guidelines

- Development of new drugs is critical!
  - Number of new infections dramatically increasing.
  - Dramatic decrease in new antibiotic approvals.
  - Discovery of new drug classes.
  - Developing new drugs from existing classes of antibiotics.

Key Recommendations in the IDSA Policy Paper:

- Support R&D of new rapid diagnostic tests to identify infections more quickly lowering cost of new antibiotic clinical trials.
- Recalibrate unworkable FDA requirements for new antibiotic approvals so that companies can move forward with long-delayed clinical studies.
- Key recommendations

Without immediate and sustained action to address antibiotic resistance, we face a future in which people die of common infections and many of the medical advances we take for granted today are impossible.
Develop New Drugs to Treat HAIs and Educate HCWs About the Importance of Following Rx Dispensing and Dosage Guidelines

- Antibiotics are a shared resource
  - Rapidly becoming a scarce resource.
- Approximately 50% of antibiotic use in hospitals is unnecessary or inappropriate.
  - Use only when indicated.
  - Follow dosage guidelines.
- Reducing unnecessary antibiotic use can:
  - Decrease antimicrobial resistance.
  - Decrease the number of HAIs.
  - Improve patient outcomes.
  - Lower costs.

http://www.cdc.gov/getsmart/healthcare/

Emergence of New Diseases and Resurgence of Vaccine-Preventable Diseases

‘Vintage’ Bugs Return

Pandemic Strain Emergence: Re-assortment of Influenza A Viruses

*Probable mechanism of 2009 H1N1 influenza pandemic.
* Re-assortment of avian and swine viruses from North America, a swine flu strain usually seen in Asia, and a human influenza strain.
* Who estimates > 18,000 deaths due to the 2009 H1N1.

Nations With Confirmed Cases
H5N1 Avian Influenza (April 2007)

Immunizations

Over 42,000 Americans (42,000 adults and 308 children) die each year from vaccine preventable disease(s) and/or their complications.


Impact of Vaccines in the 20th & 21st Centuries

<table>
<thead>
<tr>
<th>Disease</th>
<th>30th Century Annual Morbidity</th>
<th>2007 Total</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox</td>
<td>48,164</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>175,885</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Pertussis</td>
<td>147,271</td>
<td>10,454</td>
<td>93</td>
</tr>
<tr>
<td>Tetanus</td>
<td>1,314</td>
<td>28</td>
<td>98</td>
</tr>
<tr>
<td>Polio (paralytic)</td>
<td>16,316</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Measles</td>
<td>503,282</td>
<td>43</td>
<td>&gt;99.9</td>
</tr>
<tr>
<td>Mumps</td>
<td>152,209</td>
<td>800</td>
<td>99.5</td>
</tr>
<tr>
<td>Rubella</td>
<td>47,745</td>
<td>12</td>
<td>&gt;99.9</td>
</tr>
<tr>
<td>Congenital rubella</td>
<td>825</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>H. influenzae (&lt;5yrs)</td>
<td>20,000 (est)</td>
<td>202</td>
<td>99</td>
</tr>
</tbody>
</table>

Sources
Be on the lookout for measles! You might be aware of recent clusters of measles cases. DHMH urges MD providers to be on the alert for possible measles cases. This highly infectious disease can result in severe illness and death. Measles (also known as "morbilli") is a contagious disease caused by a virus. It is spread through respiratory droplets from an infected person. The disease begins with a high fever, cough, runny nose, and red eyes followed within 3-7 days by a maculopapular rash that begins on the face and can generalize to the rest of the body. It is estimated that in 2008 there were 10 million cases and 164,000 measles deaths worldwide. Close to 90% of the measles cases reported in the U.S. during 2008, were either acquired abroad or linked to imported cases. More than 90% of those infected had not been vaccinated, or their vaccination status was unknown. Of those cases, 11 were laboratory confirmed, and two were in household contacts of confirmed cases and met the clinical case definition for measles in a Hennepin County resident aged 9 months.

Leading cause of vaccine-preventable disease among young infants. 

DHMH recommends: rash illnesses. If you have a patient you suspect might have measles, DHMH recommends:

1. Do not allow the patient or any family member of the patient with a generalized rash to remain in your waiting area. Instead, provide the patient with a surgical mask and place the patient in a separate room with a closed door if no negative pressure rooms are available.
2. Use standard and airborne precautions.
3. Permit only healthcare workers known to be immune to measles to care for the patient.
4. Notify your local health department immediately for coordination of testing, exclusions, and contact follow-up.
5. Collect serum for IgM and IgG testing and urine and/or a buccal swab for viral testing at DHMH.

As always, the best way to prevent measles is to ensure that you, your staff, and your patients (including those with international travel) are adequately vaccinated.
Measles in 2011

- D. R. Congo (MNN) — More than 100 children are dead as health officials in the Democratic Republic of Congo scramble to address an outbreak of measles.

- Aid group Medecins Sans Frontieres (Doctors without Borders) reports there have been 21,000 cases in five provinces in the giant Central African nation.

Mission Network News - 4/6/2011

Mumps

Rubella
How Safe Is the H1N1 Vaccine? Other vaccines? MMR?

Following the judgment of the UK General Medical Council’s Fitness to Practice Panel on Jan 28, 2010, it has become clear that several elements of the 1998 paper by Wakefield et al (1) are incorrect, contrary to the findings of an earlier investigation. (2) In particular, the claims in the original paper that children were “consecutively referred” and that investigations were “approved” by the local ethics committee have been proven to be false. Therefore we fully retract this paper from the published record.

The Editors of The Lancet, February 10, 2010; The Lancet, London NW1 7BY, UK


Vaccines and Vaccine Development

• Events documenting the need for new vaccine technologies.
  – 1997
    • Emergence of H5N1 avian influenza
    • Infection documented in humans; threat of pandemic
  – 2001
    • Anthrax attacks in USA
    • Real threat of bioterrorism
    • Multiple agents easily obtainable and lethal
  – 2004
    • Significant influenza vaccine shortage
    • Contamination of production plant in UK
    • Clear demonstration of fragility of egg-based production
    • Faster, safer vaccines
  – 2009
    • H1N1 pandemic
    • Began in April; insufficient time to produce sufficient vaccine before flu season


Vaccines and Vaccine Development: Goals

Develop faster, safer vaccines. Develop vaccines for diseases that currently have no effective vaccine.

• Improvement of existing production technology:
  – Egg based vs cell culture
    • Both require growth of virus
    • More controlled in cell cultures
    • Most how very pure cell lines
    • Data of cells that can be stored
    • Cell culture faster
    • Bats like to nowrap and swallow
    • Surge capacity more flexible

• New vaccine platforms
  – DNA based vaccines
  – Microbial vector Vaccines
  – Virus like particles
  – Synthetic peptide vaccines

• Dose optimization

• Use of adjuvants, usually aluminum gels or salts

• Universal influenza vaccine


Influenza Virus Proteins: Possible Universal Influenza Vaccine

• Surface
  – Hemagglutinin:
    • Initiates infection
  – Neuraminidase:
    • Allows virus to penetrate into respiratory secretions

• Structure/membrane:
  – M proteins
    • Modulates environment (pH) to facilitate viral uncoating
  – RNP
    • Viral ribonucleoproteins

http://www.cdc.gov/flu/humangene/3D_Influenza_black_key_pie_slice_lrg.jpg

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WHO 2011-2012 Influenza Vaccine: Northern Hemisphere

- WHO recommends that vaccines for use in the 2011-2012 influenza season (Northern Hemisphere) contain the following:
  - an A/California/7/2009 (H1N1) - like virus,
  - an A/Perth/16/2009 (H3N2) - like virus, and
  - a B/Brisbane/60/2008 - like virus.


CDC’s Advisory Committee on Immunization Practices (ACIP) Recommends Universal Annual Influenza Vaccination

- February 24, 2010
  - A panel of immunization experts voted today to expand the recommendation for:

  **Annual influenza vaccination to include: all people aged 6 months and older.**

http://www.cdc.gov/media/pressrel/2010/r100224.htm

Develop Rapid Screening and Diagnostic Tests for Emerging & Reemerging Diseases

- There is a need for fast, accurate, in-office diagnostic tests for both for existing diseases and new emerging diseases.
  - Rapid, non-invasive test desirable.
  - Use of oral fluids (saliva).
- Tests must have both high sensitivity and specificity.
  - Sensitivity:
    - The percentage of persons who have a disease will be correctly identified by a clinical screening test as having the disease.
    - The results that will be positive when a disease is present.
    - Predict all people with a disease as having the disease.
    - No false negatives.
  - Specificity:
    - The percentage of persons without disease who are correctly identified by a clinical/screening test as not having disease.
    - The percentage of the results that will be negative when a disease is not present.
    - No false positives.
Develop Rapid Screening and Diagnostic Tests for Emerging & Reemerging Diseases

- **OraQuick® Advance Rapid HIV-1/2 Antibody Test**
  - FDA approved in October 2004.
  - New rapid test that can detect antibodies to both HIV-1 and HIV-2.
  - Results in 20 min.
  - Can use saliva, blood, or plasma.
  - High sensitivity and specificity.

- **OraQuick® HCV test** is FDA approved for detecting HCV antibodies in venipuncture whole blood.
  - FDA approved.
  - Test results in 20 minutes.
  - Can use saliva, blood, or plasma.
  - High sensitivity and specificity.

Influenza Testing

<table>
<thead>
<tr>
<th>Method</th>
<th>Sensitivity</th>
<th>Time</th>
<th>Advantages/Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIDT</td>
<td>Most detect Influenza A &amp; B; Some just A; Some just B</td>
<td>30-70%</td>
<td>30-90%</td>
</tr>
<tr>
<td>Immunofluorescence: Direct Fluorescent Antibody (DFA) or Indirect Fluorescent Antibody (IFA) Staining</td>
<td>50-90%</td>
<td>1-4 hr</td>
<td>Widely available</td>
</tr>
<tr>
<td>RT-PCR: (reverse transcription polymerase chain reaction)</td>
<td>&gt;90%</td>
<td>1-6 hr</td>
<td>Highest specificity</td>
</tr>
<tr>
<td>Viral culture</td>
<td>3-10 days</td>
<td>Expensive</td>
<td>Takes days</td>
</tr>
</tbody>
</table>

Ebola Virus

Image courtesy of CDC/Frederick Murphy

Shiga toxin-producing E. coli O104:H4

Image courtesy of USDA

Infection Control is Everyone’s Responsibility

In the end; Nature may be the ultimate bioterrorist!
Chocolate Linked to Lower Stroke and Stroke Mortality Risk
American Academy of Neurology 62nd Annual Meeting, Saposnik G et al., April, 2009

Dark Chocolate Shown to Have A Cardiovascular Benefit in Hypertensive Patients

Thank You
Have a great day!

Questions?
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