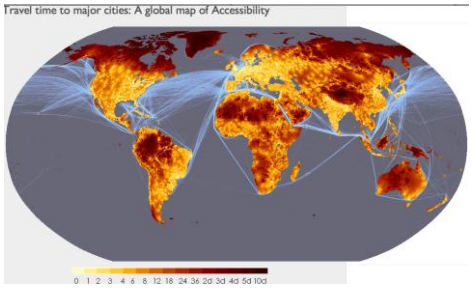
Emerging Infectious Diseases

Dr Arthur Jackson
Consultant in Infectious Diseases
September 2014

- "The time has come to close the book on infectious diseases. We have basically wiped out infection in the United States."
  - Dr William Stewart, Surgeon General , USA, 1967



Globalisation … global health

- Recent issue of connectedness
- Problems *and* solutions can travel rapidly
- Networking is important
- Information sharing is paramount

Internet traffic … note Africa ….

Emerging infections

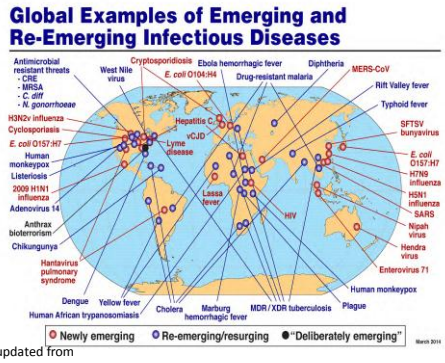
- Newly identified, previously unknown infections causing public health problems
- Re-emerging
  - … perhaps an old infection in a new locality …
  - Infection which had fallen to such low levels but now are rising again in incidence/prevalence

Reasons for emergence …

- Microbial adaptation/change
  - Resistance
    - Pathogen resistance to antimicrobials
    - Vector resistance to control methods
- New/increased co-existence of humans and pathogens/vectors
  - Encroachment of farming and housing territories
    - Climate change
    - Increased need to provide food (urbanisation, deforestation)
  - Increased travel opportunites
  - Displaced people: war, natural disasters
- Immunosupression (eg HIV)
- Mechanised food industry – handling and processing

Emerging infections

- 2/3 have animal reservoirs
  - Influenza
  - Lassa
  - Malaria, dengue …

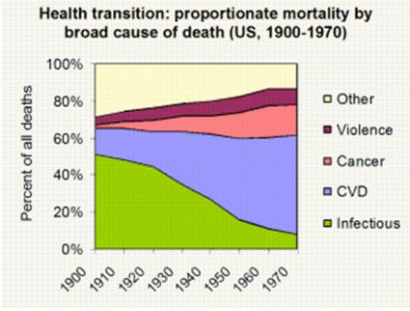


FAUCI – updated from Nature article 2004

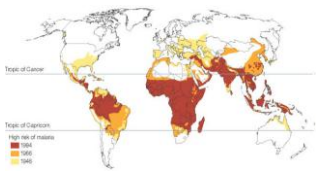
Progress in control of Infections

- Recognition of microbes as pathogens
- Sanitation, hygiene, vector control
- Antimicrobials
- Vaccines
- Advances in detection
- Communications
- Nutrition

Declining infections as a cause of mortality in richer settings



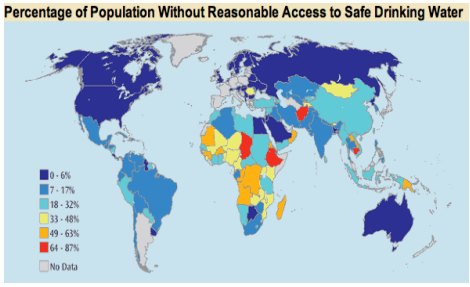
Global distribution of per capita GDP.



Global distribution of malaria.

Poverty

- approximately 1.4 billion people in the world live in extreme poverty, with incomes so low that they cannot fill their basic needs
- If population increases so does the number living in poverty and ill health



Source:
http://www.theglobaleducationproject.org
UNDP, UNICEF

Connected world

- Global health becomes local health
  - Returning travellers
- Local problems become global problems
  - Global economy, globalization …
- Local economy determines income group
- Income group affects health (as seen with mortality data)

ProMED mail

International Society for Infectious Diseases

ProMED-mail
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Latest Posts on ProMED-mail

24 Oct 2012 **E. coli EHEC - UK (09): (N Ireland) O157, restaurant**
24 Oct 2012 Ebola virus disease - Congo DR (21): (OR)
23 Oct 2012 Newcastle disease, wild birds - USA (03): (TX) dove
23 Oct 2012 Japanese encephalitis & other - India (18): (UP)
23 Oct 2012 Antibiotic resistance - USA: (IA) MRSA, wildlife
23 Oct 2012 Chikungunya (21): Philippines (AL)

22 Oct 2012 Hemorrhagic fever w/renal synd - Russia: (SA)
22 Oct 2012 Undiagnosed deaths, porcine - Ukraine: RFI

WHO: Ebola outbreak in Democratic Republic of Congo stabilises

An outbreak of Ebola virus disease in the Democratic Republic of Congo [Congo DR] has stabilised, with no new deaths or cases in more than a week, the World Health Organization (WHO) stated on Tue 23 Oct 2012. For the past 10 days, the death toll from the haemorrhagic fever has remained at 36 and no new cases have been registered, the WHO said in a bulletin. The last case of hospitalisation dates back to 11 Oct 2012, according to the statement released to the press on Tuesday [23 Oct 2012]. A total of 75 people are believed to have been infected and the fatality rate in the outbreak was/is 48 percent.

"We are very, very vigilant," WHO/Kinshasa representative Leodegar Bazira told AFP. "It takes just one case to start up a cycle of transmission." The fact that the disease had been confined to the town of Isiro and its neighbourhood was a positive factor, he added. The epidemic was declared in mid-August [2012] in the northeastern Orientale Province. But researchers have dated the outbreak back to May.

The Ministry of Health, the WHO, the Centers for Disease Control and Prevention (CDC) based in Atlanta, Georgia, Medecins Sans Frontieres (MSF), [and the USAID PREDICT project] have been working in close cooperation to combat the outbreak. To date, there is no treatment or vaccine for Ebola [virus disease], which kills between 25 and 90 percent of those who fall sick, depending on the strain of virus, according to the WHO. The disease is transmitted by direct contact with blood, faeces, and sweat, by sexual contact and by unprotected handling of contaminated corpses.

Congo DR has recorded 6 outbreaks of Ebola virus disease, one of the world's most virulent diseases, since the virus was first reported near a Congolese river that gave the disease its name in 1976.

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Communicated by:
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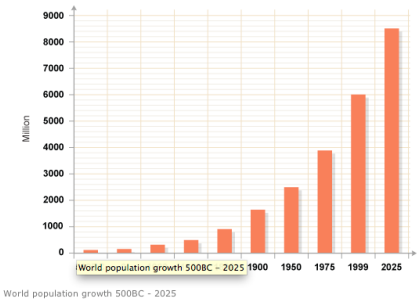
<promed@promedmail.org>

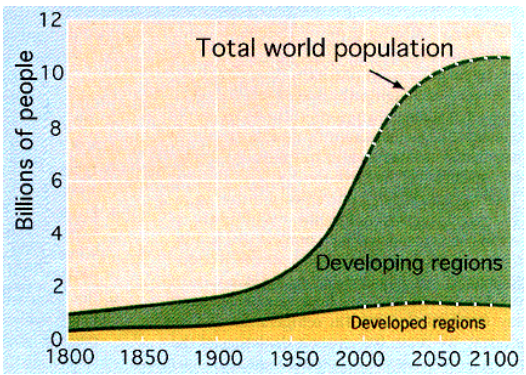
[The previous confusion over the extent of the outbreak and the numbers of cases and fatalities, is now resolved. A total of 75 people believed to have been infected, 36 of whom have died, giving a fatality rate of 48 percent.

A map of the provinces of DRC is available at http://www.mapsofworld.com/democratic-republic-of-congo/democratic-republic-of-congo-political-map.html and the interactive ProMED-mail/HealthMap of Congo DR can be accessed at http://healthmap.org/r/3>.] - Mod.LL

Increasing population, globalization, and Climate change



World population growth 500BC - 2025

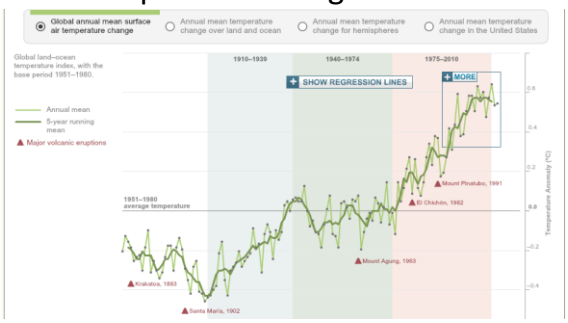


Globalization, Climate Change, and Human Health

Anthony J. McMichael, M.B., B.S., Ph.D.

N Engl J Med 2013; 368:1335-1343 | April 4, 2013 | DOI: 10.1056/NEJMra1109341

Temperature rising over time



Globalisation and Health

- Interconnectedness
  - Economic intensity
  - Consequent environmental and social changes
- Interrelated pressures, stresses, and tensions arising from an overly large world population
- environmental impact of
  - Economic activies
  - Urbanization
  - Consumerism
- Widening gap between rich and poor

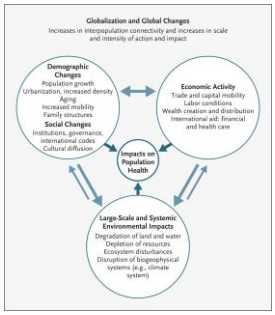
Changes

- Population migrations
- Trading
- Cultural diffusion

Physical flows as well as INFORMATION FLOW

- Pushing or distorting natural global systems beyond boundaries considered to be safe for continued human social and biologic well-being

- The loss of biodiversity
- human-induced climate change



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Environment change

- Excessive population pressure on regional environments
  - soil exhaustion
  - water depletion
  - loss of various wild animal and plant food species

- Exacerbates various environmental changes
  - Potentiates poverty/disadvantage
    - Poverty assoc with high birth rate

- Is technology just
  - "kicking the can down the street"?
  - Need education
  - Need societal change

Infections and globalisation

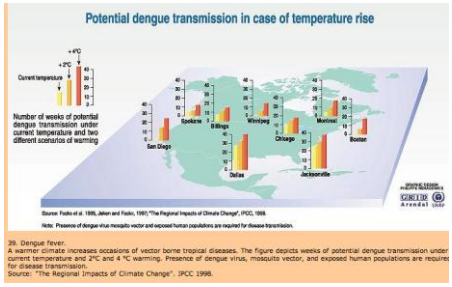
- Globally important infections: (quasi-Malthusian), SARS, influenza …
  - new strains of influenza virus in Southeast Asia and East Asia?
  - risk increases with population growth; backyard animal farming and intensified commercial poultry production

Infections and globalisation

- Freshwater shortages
  - River flows threatened with climate change and industrialisation of rivers/diversions
- Growing food/crops to feed an increasing world population:
  - land degradation, water shortages, and climate change
  - rising demand for animal foods methane producing and requiring more space)

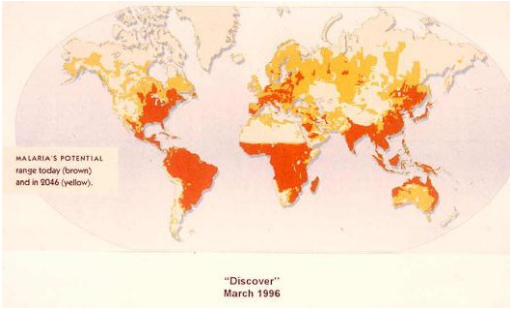
Climate change and infections

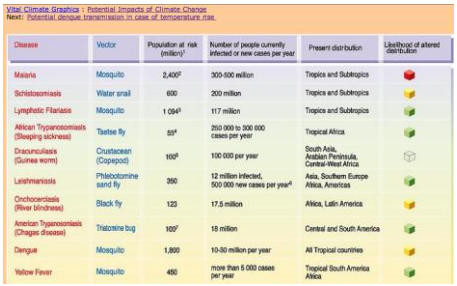
- Example
  - China:
    - medium-scenario warming model
      - schistosomiasis will extend northward
      - 20 million MORE people at risk by 2050
  - Dengue



39. Dengue fever.
A warmer climate increases occasions of vector borne tropical diseases. The figure depicts weeks of potential dengue transmission under current temperature and 2°C and 4 °C warming. Presence of dengue virus, mosquito vector, and exposed human populations are required for disease transmission.
Source: "The Regional Impacts of Climate Change". IPCC 1998.

Global Warming and Malaria





Vital Climate Graphics | Potential Impacts of Climate Change
Next: Potential dengue transmission in case of temperature rise

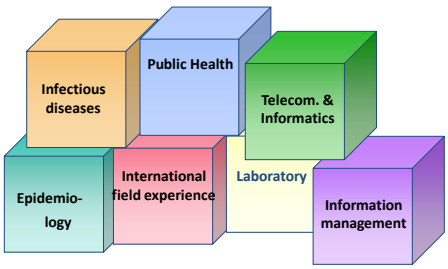
Disease	Vector	Population at risk (million)[1]	Number of people currently infected or new cases per year	Present distribution	Likelihood of altered distribution
Malaria	Mosquito	2,400[2]	300-500 million	Tropics and Subtropics	
Schistosomiasis	Water snail	600	200 million	Tropics and Subtropics	
Lymphatic Filariasis	Mosquito	1 094[2]	117 million	Tropics and Subtropics	
African Trypanosomiasis (Sleeping sickness)	Tsetse fly	55[4]	250 000 to 300 000 cases per year	Tropical Africa	
Dracunculiasis (Guinea worm)	Crustacean (Copepod)	100[5]	100 000 per year	South Asia, Arabian Peninsula, Central-West Africa	
Leishmaniasis	Phlebotomine sand fly	350	12 million infected, 500 000 new cases per year[6]	Asia, Southern Europe Africa, Americas	
Onchocerciasis (River blindness)	Black fly	123	17,5 million	Africa, Latin America	
American Trypanosomiasis (Chagas disease)	Triatomine bug	109[7]	18 million	Central and South America	
Dengue	Mosquito	1,800	10-30 million per year	All Tropical countries	
Yellow Fever	Mosquito	450	more than 5 000 cases per year	Tropical South America Africa	

Key Tasks in Dealing with Emerging Diseases

- Surveillance at national, regional, global level
  - epidemiological,
  - laboratory
  - ecological
  - anthropological
- Investigation and early control measures
- Implement prevention measures
  - behavioural, political, environmental
- Monitoring, evaluation

Dr. KANUPRIYA CHATURVEDI

What skills are needed?



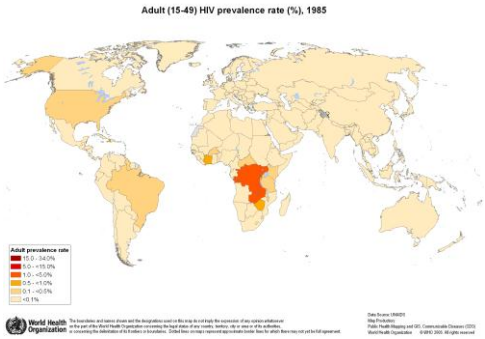
Multiple expertise needed !

Dr. KANUPRIYA CHATURVEDI

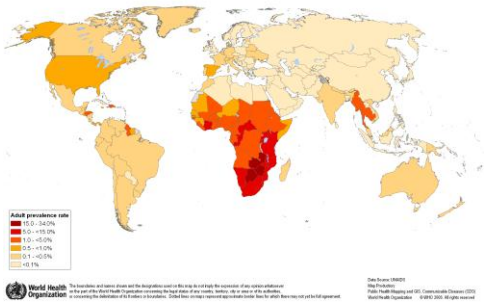
Examples of Emerging infections

HIV

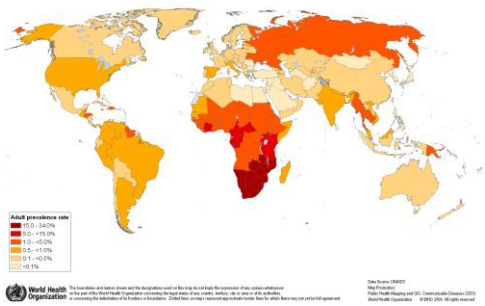
- Worldwide disease



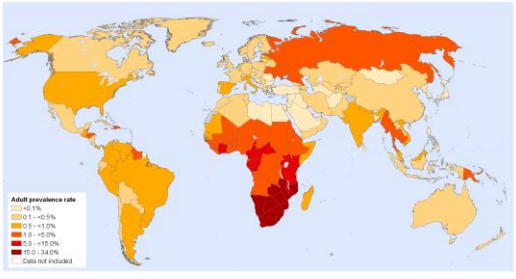
Adult (15-49) HIV prevalence rate (%), 1995



Adult (15-49) HIV prevalence rate (%), 2005



A global view of HIV infection
39.5 million people [34.1-47.1] living with HIV in 2006

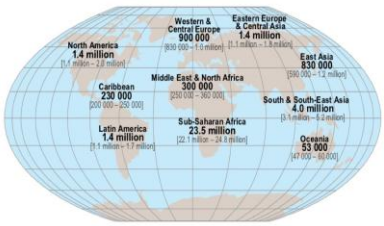


Global summary of the AIDS epidemic | 2011

Number of people living with HIV	Total	**34.0 million** [31.4 million–35.9 million]
	Adults	**30.7 million** [28.2 million–32.3 million]
	Women	**16.7 million** [15.4 million–17.6 million]
	Children (<15 years)	**3.3 million** [3.1 million–3.8 million]
People newly infected with HIV in 2011	Total	**2.5 million** [2.2 million–2.8 million]
	Adults	**2.2 million** [1.9 million–2.4 million]
	Children (<15 years)	**330 000** [280 000–390 000]
AIDS deaths in 2011	Total	**1.7 million** [1.5 million–1.9 million]
	Adults	**1.5 million** [1.3 million–1.7 million]
	Children (<15 years)	**230 000** [200 000–270 000]

World Health Organization UNAIDS

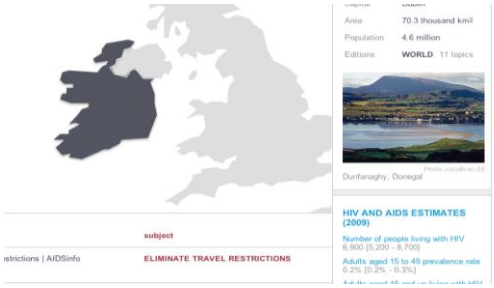
Adults and children estimated to be living with HIV | 2011



Total: 34.0 million [31.4 million – 35.9 million]

World Health Organization UNAIDS

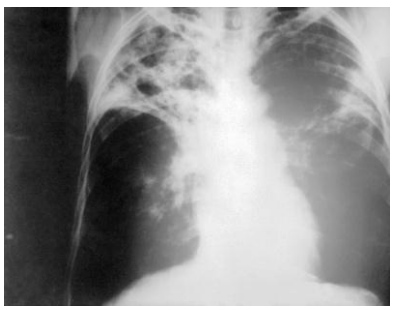
UNAIDS



Irish UNAIDS data (2009)

- Number of people living with HIV
  - 6,900 [5,200 - 8,700]
- Adults aged 15 to 49 prevalence rate
  - 0.2% [0.2% - 0.3%]
- Women aged 15 and up living with HIV
  - 2,000 [1,500 - 2,600]
- Deaths due to AIDS
  - <100

TUBERCULOSIS!!



The TB Epidemic in the Western World

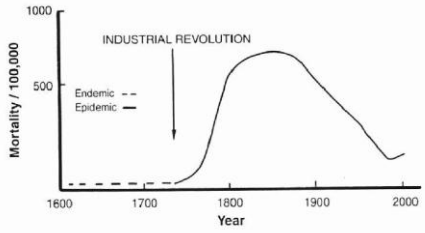


Figure 2. Tuberculosis morbidity as it changes from an endemic infection to an epidemic disease, as it did in Europe during the Industrial Revolution.

Stead, WW. THE ORIGIN AND ERRATIC GLOBAL SPREAD OF TUBERCULOSIS. How the Past Explains the Present and Is the Key to the Future. Clinics in Chest Medicine 1997; 18: 65-77

- In 2011, there were 8.7 million new cases of active tuberculosis worldwide.
- Recent advances in diagnostics, drugs, and vaccines and enhanced implementation of interventions are helping to improve the prospects for global tuberculosis control.

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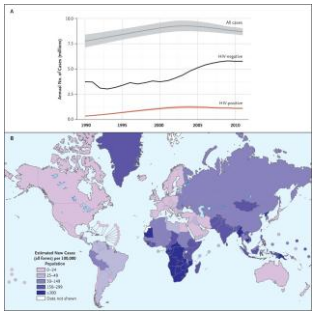
Tuberculosis

- 95% of all TB cases occur in developing countries
- 9-43% of the world's population is infected
- 8 million new cases/year
  - 3 million deaths/yr
  - 7% of total worldwide mortality rate
- 23% of active cases are estimated to receive appropriate anti-TB treatment



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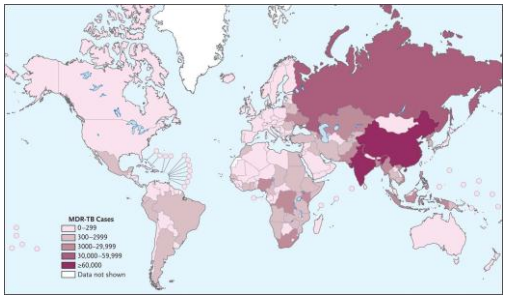

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Tuberculosis

- Ireland
  - 230 notifications per 100,000 population in 1952 (first records kept)
  - 9.7 per 100,000 in 2001
  - 11.3 per 100,000 in 2007
  - 9.2 per 100,000 in 2010
- In 2010, 40.7% of cases were born outside Ireland compared to 43.0% in 2009 and 43.3% in 2008
  - GLOBAL INTERCONNECTEDNESS
- WHO:
  - Reduce the global incidence of active TB to less than 1 case per million by 2050

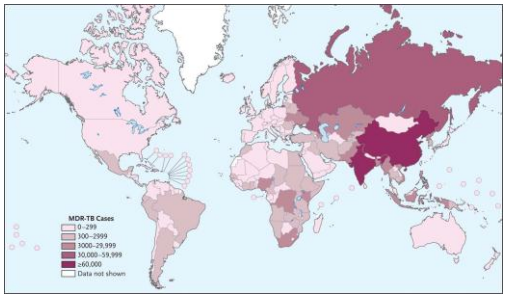
Resurgence Of Tuberculosis

Factors leading to an increase in TB:

- **Failure to tackle poverty in society** and . . .
- **HIV** **Africa**
- Decaying Pubic Health Infrastructure Eastern Europe
- Migration Ireland / Europe

MultiDrug Resistant Tuberculosis (MDR TB)

- *Acquired drug resistance*: found in a patient who has received at least 1 month of prior antiTB drug treatment
- *Primary resistance*: presence of resistant strains of M Tuberculosis in a patient with no history of such prior treatment
- *Multidrug resistance* (MDR): resistance to at least Isoniazid and Rifampicin.



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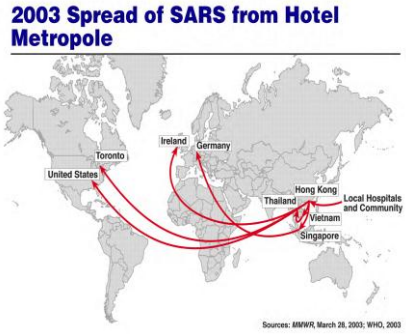
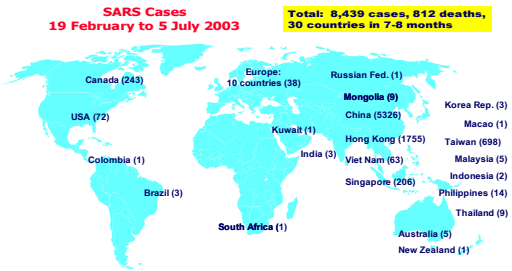
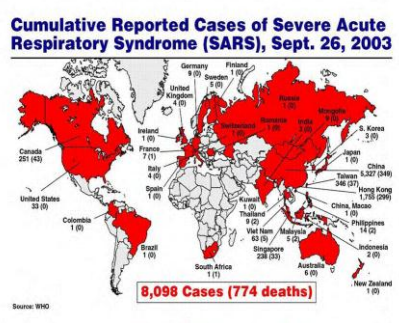
Other Viral diseases



SARS: The First Emerging Infectious Disease Of The 21st Century



Source: www.who.int.csr/sars

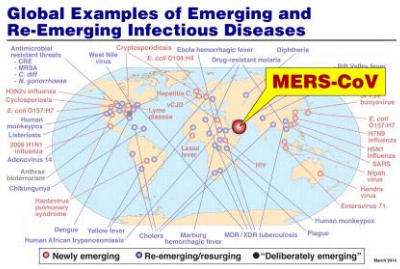


Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia

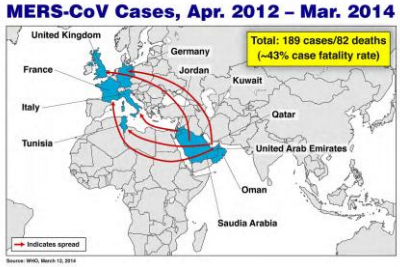
Ali M. Zaki, M.D., Ph.D., Sander van Boheemen, M.Sc., Theo M. Bestebroer, B.Sc., Albert D.M.E. Osterhaus, D.V.M., Ph.D., and Ron A.M. Fouchier, Ph.D.

N Engl J Med 2012; 367:1814-1820 | November 8, 2012 | DOI: 10.1056/NEJMoa1211721

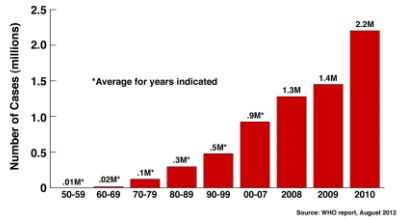
MersCoV



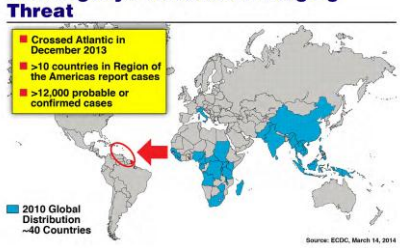
MERS-CoV Cases, Apr. 2012 – Mar. 2014

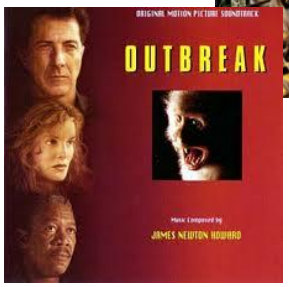


Number of Dengue and Severe Dengue Cases Reported to WHO Annually, 1950-2010



Chikungunya Virus: An Emerging Threat





What is Viral Hemorrhagic Fever?

- Severe multisystem syndrome
- Damage to overall vascular system
- Symptoms often accompanied by hemorrhage
  - Rarely life threatening in itself
  - Includes conjunctivitis, petechia, echymosis

Common process - multifactorial

- Vascular damage
  - Viral invasion
  - Complement/cytokine activation
  - Immune complex deposition
- Coagulation problems
  - Low platelets
  - Reduced clotting factors
  - DIC
- Immune failure
- End organ damage
  - Viral cytopathy
  - Host response

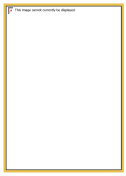
Hemorrhagic Fever Symptoms

If you have recently developed the following symptoms, go to the hospital now:

- Marked Fever
- Muscle Aches
- Fatigue
- Loss of Strength
- Dizziness
- Exhaustion

Viral Hemorrhagic Fever

- Viruses of four distinct families
  - Arenaviruses
  - Filoviruses
  - Bunyaviruses
  - Flaviviruses
- RNA viruses
  - Enveloped in lipid coating
- Either insect vector or transmitted in excreta of animals (e.g. rats)



Classification

Arenaviridae	Bunyaviridae	Filoviridae	Flaviviridae
Junin	Crimean-Congo H.F.	Ebola	Kyasanur Forest Disease
Machupo	Hantavirus	Marburg	Omsk H.F.
Sabia	Rift Valley fever		Yellow Fever
Guanarito			Dengue
Lassa			

Arenaviridae

Junin virus
Machupo virus
Guanarito virus
Lassa virus
Sabia virus

Lassa fever – West Africa

- 1969 - nurse in Lassa, Nigeria died with LF
- 2 more nurses developed illness
  - Isolated the virus from them
  - Initially suspected to be much worse mortality
  - Mouse host – chronic asymptomatic infection
    - Urine and saliva
    - Aerosol infectiousness

Lassa fever

- Often asymptomatic
- 100000 cases/yr; 5000 deaths/yr
- Nosocomial spread is possible and does happen
- Most common directly transmissible VHF of international travellers
  - Facilitated by long incubation period (5d – 3 wks)

Lassa Fever

- Incubation 5 days – 3 wks
- Classical features of vhf
  - Fever, myalgia, conjunctival injection, pharyngitis, chest pain, abdo pain, D+V
- Deafness can occur in 30%
- 15% of hospitalised cases die
  - If fever, pharyngitis, vomiting – high risk of death

Lassa fever - treatment

- IV ribavirin – high dose for 6 days
- Oral ribavirin for contacts
- Convalescent serum can be used!
  - High antibody titres
- ?role for monoclonal antibody
- No vaccine

Bunyaviridae

Rift Valley Fever virus
Crimean-Congo Hemorrhagic Fever virus
Hantavirus

Flaviviridae

Dengue virus
Yellow Fever virus
Omsk Hemorrhagic Fever virus
Kyassnur Forest Disease virus

Filoviridae

Marburg virus
Ebola virus

Filoviridae History

- 1967: Marburg virus
  - European laboratory workers – Germany
    - Traced to a vervet monkey from Uganda
- 1976: Ebola virus
  - Ebola Zaire
  - Ebola Sudan
- 1989 and 1992: Ebola Reston
  - USA and Italy
  - Imported macaques from Philippines
- 1994: Ebola Côte d'Ivoire

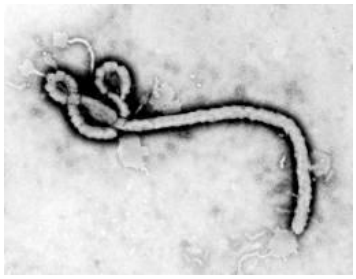
- Nosocomial spread was a major feature
  - Marburg
  - Ebola
- Outbreaks
- Funerals and body preparation can predispose to infection spread

Filoviridae Transmission

- Reservoir is UNKNOWN
  - Bats implicated with Marburg and probably Ebola
  - 3000 animals tested; 500 bats, 30000 arthropods
- Nosocomial transmission
  - Reuse of needles and syringes
  - Exposure to infectious tissues, excretions, and hospital wastes
- Aerosol transmission
  - Primates

Filoviridae Epidemiology

- Marburg – Africa
  - Case fatality – 23-33%
- Ebola - Sudan, Zaire and Côte d'Ivoire
  - Case fatality – 53-88%
- Ebola – Reston – Philippines
- Pattern of disease is UNKOWN



Filoviridae Humans

- Most severe hemorrhagic fever
- Incubation period: 4–10 days
- Abrupt onset
  - Fever, chills, malaise, and myalgia
- Hemorrhage and DIC
- Death around day 7–11
- Painful recovery

Ebola

- 1976
  - First documented outbreaks
  - Simultaneously in Zaire (=Congo) and Sudan
- Subsequently
  - Rare/intermittent outbreaks in Africa
    - Mainly central Africa
    - <500 cases
  - 30% cases were healthcare workers in Zaire, 1995
  - 7% in Uganda, 2000

Current Ebola Outbreak

- August 8: WHO:
  - "International Public Health Emergency"
  - "the outbreak is an extraordinary event and a public health risk to other states"
  - …serious in view of the virulence of the virus, the intensive community and health facility transmission patterns and the weak health systems in the currently affected countries
  - a coordinated international response is deemed essential to stop the spread of ebola"

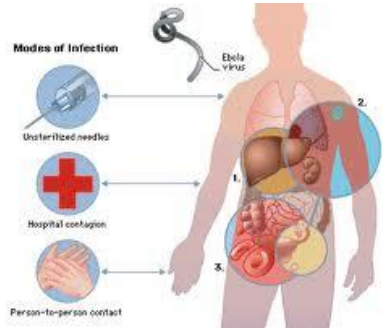
Current Ebola outbreak

- Initial cases noted:
  - February 2014:
    - in forested areas of Southwestern Guinea
    - Spread to Liberia, Sierra Leone
    - (Nigeria – fewer cases)
  - Mainly rural, but including some large, densely populated cities (e.g. Monrovia)
  - Many healthcare workers infected
    - Compounding problem – patients not wishing to attend hospitals

Ebola outbreak – as of Aug 26, CDC

- 3069 suspect and confirmed cases of EVD
  - 1752 laboratory-confirmed cases
- 1552 deaths
- In Nigeria:
  - 17 suspect cases
    - 13 laboratory-confirmed
  - 6 deaths.

- No definite treatment – (serum a possibility)
  - Possible use of experimental agents
    - Monoclonal antibodies – Zmapp
    - Vaccines
- Ethical questions regarding use of experimental agents and fast-tracking possible therapeutics



Ebola

- Incubation 4 – 10 days
  - Death at around Day 10 if fatal

- Fever
- Headache
- Myalgia
- Abdo pain
- Diarrhoea
- Sore throat
- Conjunctival injection
- Bleeding
- Neurological manifestations
  - Hemiplegia, convulsions, psychosis

- Mortality
  - Zaire – 60-90%
  - Sudan 50-60%
- Diagnose – Grade 4 lab
  - Isolate virus
    - Cell culture
    - PCR
    - Antigen capture ELISA
  - Rarely serology

Recent outbreaks

- Uganda - 2012
- West Africa – 2013/4
  - Difficult to control
    - Connectedness
    - Education
    - Communication

Levels of PPM

Treatment

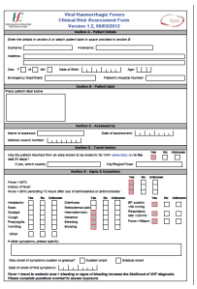
- Returning traveller is different from patient in an outbreak
- Main principles
  - Identify, diagnose and treat patient
  - Limit further spread
  - Identify other at-risk patients

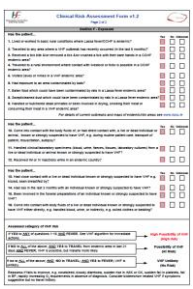
Case identification

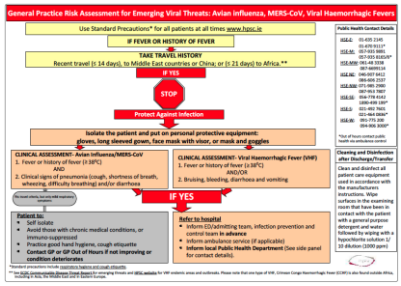
- Travel history – very specific
- Exposures
  - Caving/bats, rats, monkeys
- Timing
  - Under 3 weeks ago
- Clinical
  - Pharyngitis
  - Conjunctival injection
  - Chest pain
  - Bleeding

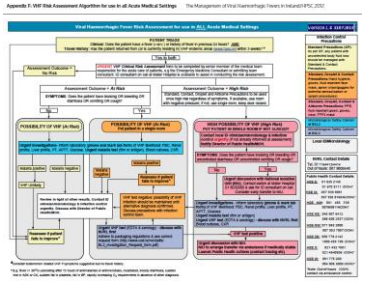
Diagnosis

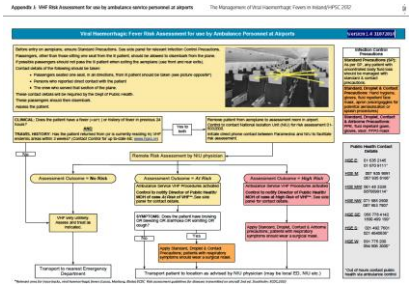
- Beware of the samples!
- Label them as highly dangerous
- Liase with the lab first
- Aim for Biosafety level 4 facilities
- Can make the samples non-infectious with gamma-radiation but still analyse with ELISA






General Practice Risk Assessment for Emerging Viral Threats: Avian Influenza, MERS-CoV, Viral Haemorrhagic Fevers
Use Standard Precautions* for all patients at all times www.hpsc.ie
IF FEVER OR HISTORY OF FEVER
TAKE TRAVEL HISTORY
Recent travel (≤ 14 days), to Middle East countries or China; or (≤ 21 days) to Africa.**
IF YES
STOP
Protect Against Infection
Isolate the patient and put on personal protective equipment: gloves, long sleeved gown, face mask with visor, or mask and goggles
CLINICAL ASSESSMENT- Avian Influenza/MERS-CoV
1. Fever or history of fever (≥ 38°C)
AND
2. Clinical signs of pneumonia (cough, shortness of breath, wheezing, difficulty breathing) and/or diarrhoea
CLINICAL ASSESSMENT- Viral Haemorrhagic Fever (VHF)
1. Fever or history of fever (≥ 38°C)
AND/OR
2. Bruising, bleeding, diarrhoea and vomiting
IF YES
Patient to:
Self isolate
Avoid those with chronic medical conditions, or immuno-suppressed
Practice good hand hygiene, cough etiquette
Contact GP or GP Out of Hours if not improving or condition deteriorates
Refer to hospital
Inform ED/admitting team, infection prevention and control team in advance
Inform ambulance service (if applicable)
Inform local Public Health Department (See side panel for contact details).
Public Health Contact Details
Cleaning and Disinfection after Discharge/Transfer
Clean and disinfect all patient care equipment and the environment with the manufacturers instructions. Wipe surfaces in the examining room that have been in contact with the patient with a general purpose detergent and water followed by wiping with a hypochlorite solution (1/10 dilution (1000 ppm)


Appendix 1: VHF Risk Assessment Algorithm for use in all Acute Medical Settings
The Management of Viral Haemorrhagic Fevers in Ireland HPSC 2012
Viral Haemorrhagic Fever Risk Assessment for use in ALL Acute Medical Settings
Assessment Outcome = At Risk
Assessment Outcome = High Risk
POSSIBILITY OF VHF (At Risk)
HIGH POSSIBILITY OF VHF (High Risk)
Standard Infection Control Precautions
Local EID/Virology
Public Health Contact Details


Appendix 2: VHF Risk Assessment for use by ambulance service personnel at airports
The Management of Viral Haemorrhagic Fevers in Ireland/HPSC 2012
Viral Haemorrhagic Fever Risk Assessment for use by Ambulance Personnel at Airports
Standard Infection Control Precautions
Public Health Contact Details
Remote Risk Assessment by NIU physician
Assessment Outcome = No Risk
Assessment Outcome = At Risk
Assessment Outcome = High Risk
Transport to nearest Emergency Department
Transport patient to location as advised by NIU physician

- National Centre for VHF
  - Mater Misericordiae Hospital
  - Contact regarding possible cases for transfer/advice

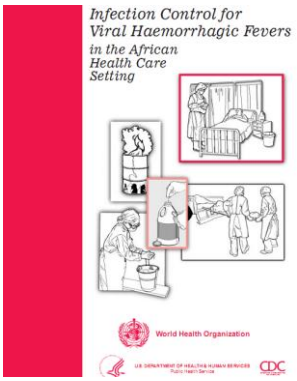
Management

- Strict isolation of affected patients is required
  - Especially if suspected to have direct spreading dx
  - Gowns, goggles, gloves, masks for staff – single use unless disinfected
  - Patient to use chemical toilet
  - If patient dies – rapid disposal/burial/cremation of body
- Report to health authorities
  - May use a health coordinator/outbreak coordinator

Contact tracing

- High risk
  - Exposed to blood, secretions, fluids
  - Close physical contact
- Check temp x2/day for 3 weeks
- If febrile (>38.5) isolate in hospital and give ribavirin if likely susceptible virus
- Lower risk
  - Advise to present if fever develops
- Educate community leaders
- Media management

Prevention and Control



Prevention and Control

- Avoid contact with host species
  - Rodents
    - Control rodent populations
    - Discourage rodents from entering or living in human populations
    - Safe clean up of rodent nests and droppings
  - Insects
    - Use insect repellents
    - Proper clothing and bed nets
    - Window screens and other barriers to insects

Prevention and Control

- Protective clothing
  - Disposable gowns, gloves, masks and shoe covers, protective eyewear when splashing might occur, or if patient is disoriented or uncooperative
- WHO and CDC developed manual
  - "Infection Control for Viral Hemorrhagic Fevers In the African Health Care Setting"

Prevention and Control

- Anyone suspected of having a VHF must use a chemical toilet
- Disinfect and dispose of instruments
  - Use a 0.5% solution of sodium hypochlorite (1:10 dilution of bleach)

Conclusion

- Emerging infections are likely to remain a feature in a globally connected world with an increasing population
  - Multifactorial
  - Far reaching consequences
- Complex, resource-intense, multifaceted management required
  - for individual cases and overall control

Is there hope in a connected world?

- Connectedness makes all infectious diseases applicable to all of us
- It also makes scientific advances applicable to all, even remote, populations
- And facilitates coordination of efforts