Emerging Respiratory Infections

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Infectious Diseases Unit
SQUH

Respiratory Emergencies Symposium
## Humans vs. Microbes

<table>
<thead>
<tr>
<th></th>
<th>Humans</th>
<th>Bacteria</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number on earth</td>
<td>6*10^9</td>
<td>5*10^{31}</td>
<td>10^{22}</td>
</tr>
<tr>
<td>Mass (metric tons)</td>
<td>3*10^8</td>
<td>5*10^{16}</td>
<td>10^8</td>
</tr>
<tr>
<td>Generation time</td>
<td>30 y</td>
<td>30 min</td>
<td>5*10^5</td>
</tr>
<tr>
<td>Time on earth</td>
<td>4*10^6</td>
<td>3.5*10^9</td>
<td>10^3</td>
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</tbody>
</table>

Microbiology in the 21st century, ASM, 2004

Respiratory Emergencies Symposium
We are **10% human**!

Your Body Has
10 Times As Many Microbe Cells As Human Cells

Inclusion of Microbiome Will Radically Change Medicine
Infectious Diseases
The Most Endlessly Fascinating Specialty
Emerging Infections: IOM Definition

“New, re-emerging or drug-resistant infections whose incidence in humans has increased within the past 2 decades or whose incidence threatens to increase in the near future.”

Previously unknown
Previously unknown in humans
Previously unknown in a given area
Previously non pathogenic or less pathogenic
Previously non resistant to antibiotics

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Emerging & Re-emerging Infections
Human-Microbe Interplay
Global Examples of Emerging & Re-emerging Infectious Diseases

- Cryptosporidiosis
- Ebola hemorrhagic fever
- Drug-resistant malaria
- Diphtheria
- MERS-CoV
- Rift Valley fever
- Typhoid fever
- SFTSV bunyavirus
- E. coli O157:H7
- H7N9 influenza
- H5N1 influenza
- SARS
- Nipah virus
- Hendra virus
- Enterovirus 71
- Human African trypanosomiasis
- Marburg hemorrhagic fever
- MDR/XDR tuberculosis
- HIV
- Plague
- Chikungunya fever
- Yellow fever
- Cholera
- Dengue

Legend:
- Newly emerging
- Re-emerging/resurging
- “Deliberately emerging”

September 2013

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Emerging Infectious Diseases are Only a Plane Ride Away

Speed of Global Travel in Relation to World Population Growth

Murphy and Nathanson Sem Virology 5, 87, 1994

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Emerging Respiratory Viral Infections

15 Years of Surprises

- 2001: hMPV
- 2003: SARS-CoV
- 2004: NL63/HKU1 CoV
- 2005: Bocavirus
- 2005: A/H5N1
- 2007: WU/KI Polyomavirus
- 2009: A(H1N1)pdm09
- 2011: A(H3N2)v
- 2012: MERS-CoV
- 2013: A(H7N9)
Pandemics of influenza

Recorded human pandemic influenza
(early sub-types inferred)

H2N2 → H1N1 → H3N8


1889 Russian influenza H2N2
1900 Old Hong Kong influenza H3N8
1918 Spanish influenza H1N1
1957 Asian influenza H2N2
1968 Hong Kong influenza H3N2
2009 Novel influenza H1N1

Recorded new avian influenzas

H9* 1999
H5 1997 2003
H7 1980

## Cumulative number of confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2017

<table>
<thead>
<tr>
<th>Country</th>
<th>2003-2009* cases</th>
<th>2003-2009* deaths</th>
<th>2010-2014** cases</th>
<th>2010-2014** deaths</th>
<th>2015 cases</th>
<th>2015 deaths</th>
<th>2016 cases</th>
<th>2016 deaths</th>
<th>2017 cases</th>
<th>2017 deaths</th>
<th>Total cases</th>
<th>Total deaths</th>
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<tr>
<td><strong>Total</strong></td>
<td>468</td>
<td>282</td>
<td>233</td>
<td>125</td>
<td>145</td>
<td>42</td>
<td>10</td>
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<td>856</td>
<td>452</td>
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</tbody>
</table>
Global Impact of the H1N1 Pandemic

Infections:
24% [20–27%] of the world population

Global mortality [Laboratory confirmed]
18,449 deaths

Estimated global mortality
284,000 [151,700 and 575,400]
Confirmed global cases of MERS-CoV

Reported to WHO as of 10 Feb 2017 (n=1905)

Other countries: Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman, Philippines, Qatar, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States of America, Yemen

Please note that the underlying data is subject to change as the investigations around cases are ongoing. Onset date estimated if not available.

1,905
Since September 2012, WHO has been notified of 1,905 laboratory-confirmed cases of infection with MERS-CoV.

677
WHO has been notified of 677 deaths related to MERS-CoV since September 2012.

27
Since September 2012, 27 countries have reported cases of MERS-CoV.
Number of Confirmed Human H7N9 Cases and Deaths by week as of 2017-1-13

- **918** laboratory-confirmed cases of human infection
- **359** deaths
Global Burden of Tuberculosis

2 BILLION
PEOPLE INFECTED WITH TB
1/3 OF WORLD POPULATION

9.6 MILLION
SICK WITH ACTIVE TB
480,000
NEW CASES OF MULTIDRUG-RESISTANT TB (MDR TB)

1.5 MILLION
DEATHS

1,000
5,000
10,000
20,000

Estimated number of MDR-TB cases among all notified pulmonary TB cases, 2013

Russia 41,000
China 54,000
India 62,000
United States 110

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ED is the Center Stage for Emerging Infections

• EDs serve as the **frontline** for patients with emerging infections.

**Key challenges:** EDs are..

• Overwhelmed [number and acuity of the patients].
• Overcrowded with long wait times.
• Limited to meet surges in demand [emerging infections/outbreaks].
Emerging Respiratory Infections
The role of the ED as a safety net

Early detection:
• Use of clinical prediction/decision rules.
• Use of syndromic surveillance.

Minimization of transmission risk:
• Compliance with infection control standards.
• Accurate and fast triage for patients with suspected emerging respiratory infection.
• Isolation of patients on suspicion.
IDENTIFY
ISOLATE
INFORM
Will We Ever Eliminate Emerging Infectious Diseases?

The battle against emerging infectious diseases is a continual process; winning does not mean stamping out every last disease, but rather getting out ahead of the next one.