EMERGING AND RE-EMERGING INFECTIOUS MICROBES

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Objective
Overview of emerging and remerging infectious disease microbes as the cause of pandemics,
- Including today’s Coronavirus pandemic as a continuation of the never-ending war between humans and infectious microbes.
Why be concerned about Infectious Microbes

- Today’s SARS-CoV-2 is one of the many infectious microbes that have caused pandemics since the beginning of civilization.
- These microbes remain as one of the greatest threats to society, why?
  - they were here on earth 2 billion years before humans arrived,
  - learning every trick for survival, and likely that they will be here 2 billion years after we depart.

Viruses  Bacteria  Protozoa  Fungi  Helminths
Examples of the human disease burden caused by infectious microbes

- **Black Death** 14th century was the most devastating pandemic in human history killing 75 to 200 million people in Eurasia & North Africa*. 

- **Smallpox/measles** 15th and 16th century destroyed the South American Aztec civilization.

- **Spanish flu** in 1918 infected 500 million, caused 50 - 100 million deaths, including 675,000 Americans.

- As of May 26, SARS-CoV-2 had caused 5.6 million cases & 346,700 deaths world wide & 1.7 million cases & 98,223 deaths in U.S.

* - killed 50% of the population in Europe
What is causing these pandemics?

- **Emerging infectious microbes** – new microbes, never recognized before.
- **Re-emerging infectious microbes** – been around for decades and have come back to cause an increase in incidence of disease.

### Examples of Emerging Microbes
- SARS-Corona virus - 2
- SARS-Corona-virus - 1
- SARS – MERS Corona virus
- Swine Influenza H1N1
- Nipah virus
- Ebola virus
- Human Immunodeficiency virus (HIV)

### Examples of Re-emerging Microbes
- Dengue viruses
- Zika fever virus
- Drug resistant Malaria
- Trypanasoma cruzi (Chagas)
- Mycobacterium tuberculosis
- Bordetella pertussis
- Measles virus
Microbes found throughout the world, constantly mutating & adapting to new hosts, and spreading to all regions of the planet, and for most, **there are no prevention and treatment measures** - as we are now experiencing for this Coronavirus pandemic.
Just how many unknown microbes are there and where are they coming from?

- In addition to the known microbes, estimates suggest that are about one million unknown microbes, mainly viruses that exist among vertebrates.

  WITH MORE TO COME!

- Most are viruses from wildlife and livestock.
  - SARS - CoV-1 - Civet cats $\rightarrow$ humans
  - SARS - CoV-2 - Bats $\rightarrow$ ant-eaters? $\rightarrow$ Humans
  - SARS - Middle East Respiratory Syndrome (MERS) $\rightarrow$ camels $\rightarrow$ humans
What is contributing to the emergence & spread of microbes

- Frequent travel of humans and animals by rapid modes of transportation.
- Globalization and urbanization – increases international interactions & more people are living closer together to enables the global spread of microbes.
- Agricultural, land & water use practices – increases breeding habitat to produce more mosquitoes, ticks and other vectors.
- Wildlife habitat destruction and trafficking of wildlife for food and pets.

**Air Traffic Over 24 hours**

**Urban growth Asian & American cities**

![Mosquitoes]

![Maps and charts showing air traffic and urban growth]

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions of People</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>1.2</td>
</tr>
<tr>
<td>1980</td>
<td>4.7</td>
</tr>
<tr>
<td>2010</td>
<td>12.4</td>
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</tbody>
</table>

[Bar chart showing increase in urban growth and air traffic over the years]
Examples of microbes that are **impacting** or **threatening** the health of the El Paso community

<table>
<thead>
<tr>
<th>Microbes impacting human health</th>
<th>Threat Microbes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS-Corona virus - 2</td>
<td>Dengue viruses</td>
</tr>
<tr>
<td>Human Immunodeficiency (HIV)</td>
<td>Chikungunya virus</td>
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<tr>
<td>Mycobacteria tuberculosis (TB)</td>
<td>Zika Fever virus</td>
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<td>Swine Flu H1N1 virus</td>
<td>Novel Avian Influenza A H7N9</td>
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<td>West Nile virus (encephalitis)</td>
<td>Novel Avian Influenza A H5N1</td>
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<tr>
<td>Trypanosomi cruzi (Chagas)</td>
<td>St. Louis encephalitis virus</td>
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<tr>
<td>Chlamydia trachomatis (STD)</td>
<td>Western equine encephalitis virus</td>
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</tbody>
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Conclusion

- Yesterday’s threats of pandemics were by infectious microbes that seldom spread from the continent in which they existed,
- Today’s threat is any microbes, regardless of their original existence, because they can be microbes of any country or region inhabited by humans, animals and plants.
- As we anticipate the next pandemic to come, complacency is not an option, the world must be better prepared as never before in history,
  - with novel & improved diagnostics, therapeutics & vaccines to prevent the devastating health impact of emerging and re-emerging infectious microbes.
END