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**Ralph Huits, MD PhD**

- Dept. Infectious Tropical Diseases and Microbiology  
IRCCS Sacro Cuore Don Calabria Hospital, Negrar, Italy
- Research lead, GeoSentinel  
(Emerging Infectious Diseases network of US CDC/ISTM)



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**Disclosures**

Research support/ speaker fees

- Takeda
- Bavarian Nordic
- Valneva

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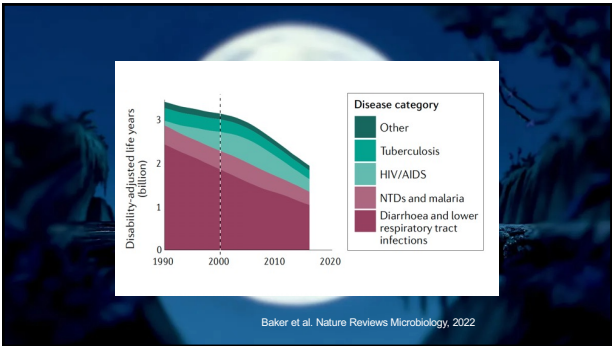
**Content**

- What is an outbreak?
- Distribution of EID events
- Zoonoses
- Investigating outbreaks
- Outbreak control strategies
- The Future



Spernovasilis Microorganisms 2022

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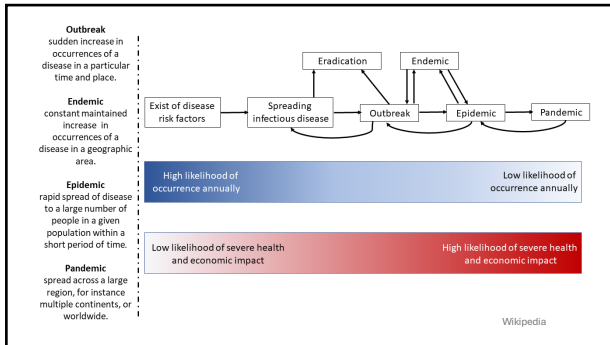


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... when the number of cases of a disease is greater than what is normally expected for a specific time, place, or population

**Outbreaks**

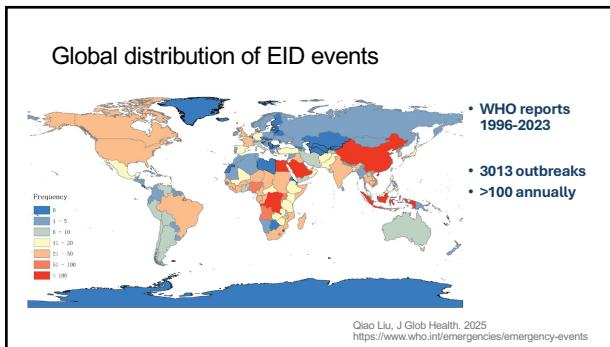
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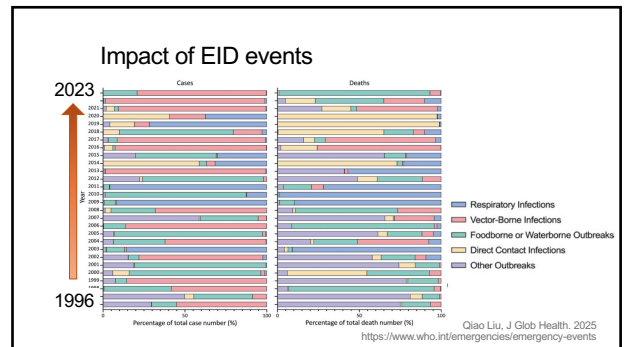
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### Impact of EID events

Outbreaks' name	Reported	Cases	Deaths	CFR (%)
<b>Respiratory infections</b>				
Influenza	771	3285450	577523	17.58
MERS-CoV	305	6418	1793	27.94
SARS	123	306203	22928	7.49
Measles	43	755799	2110	0.28
nCoV	24	327	147	44.95
<b>Vector-borne infections</b>				
Yellow fever	164	779323	3434	0.44
Dengue	73	12977361	12327	0.09
Zika	47	317	0	0.00
Rift Valley fever	38	7315	1959	26.78
Plague	36	10492	1004	9.57
<b>Foodborne or waterborne infections</b>				
Cholera	289	4904288	149988	3.06
Poliovirus	112	5569	91	1.63
Diarrhoea†	13	246619	504	0.20
Enterovirus	13	2056	260	12.65
Legionellosis	12	2189	63	2.88

Outbreaks' name	Reported	Cases	Deaths	CFR (%)
<b>Direct contact infection</b>				
Ebola	942	226701	142813	63.00
Lassa fever	44	8934	1617	18.10
Marburg virus	28	795	611	76.86
Monkeypox	26	23062	840	3.64
Andria	18	932	42	4.51
<b>Other outbreaks</b>				
Meningitis	178	609772	60299	9.89
Haemorrhagic fever	68	8095	5151	63.63
Unknown	23	16478	1182	7.09
Acute hepatitis	18	16952	338	1.99
Encephalitis	12	4250	763	17.95

Qiao Liu, J Glob Health, 2025  
<https://www.who.int/emergencies/emergency-events>

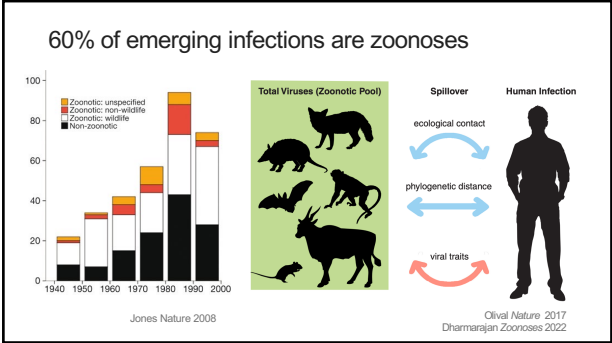
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### Global outbreak landscape 2025 (Oct. 10)

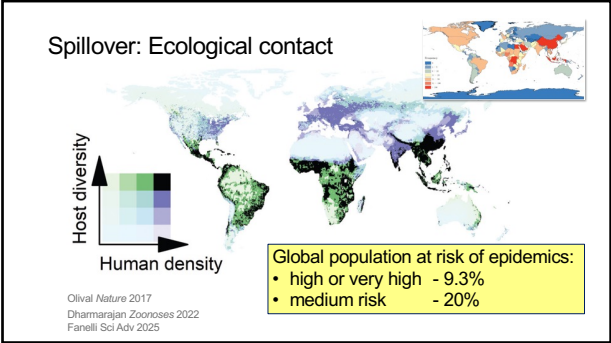
- 102 disease outbreaks with human transmission
- 66 countries:
  - sub-Saharan Africa (33 countries)
  - Western Hemisphere (15)
  - East Asia and the Pacific (7)
  - South and Central Asia (6)
  - Near East (Middle East and North Africa) (5).
- 20 different infectious diseases:
  - including avian influenza (H5N1), chikungunya, cholera, Ebola, Marburg, measles, mpox, Nipah, Rift Valley fever, yellow fever, and Zika

www.kff.org

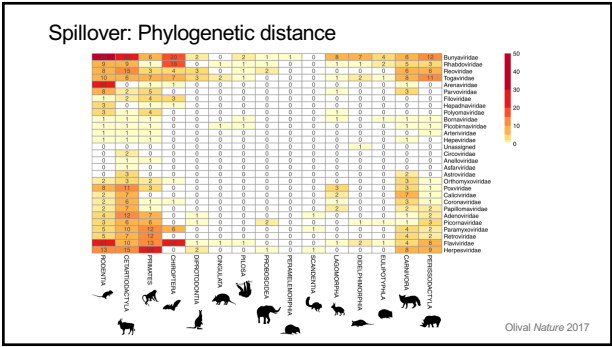
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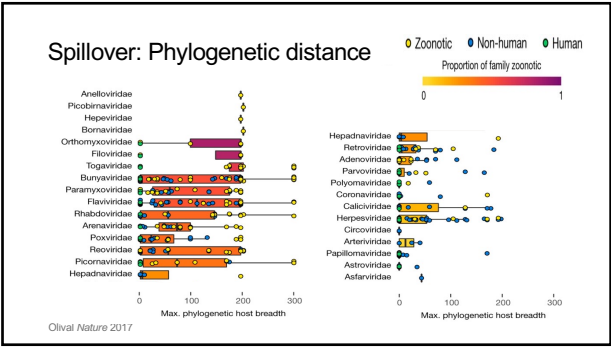
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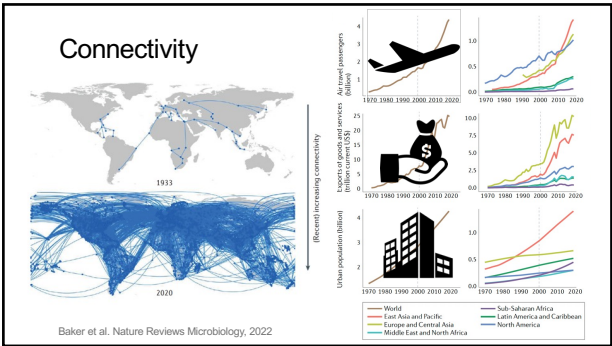
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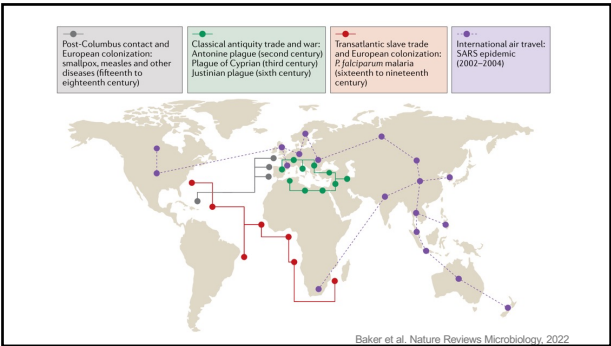
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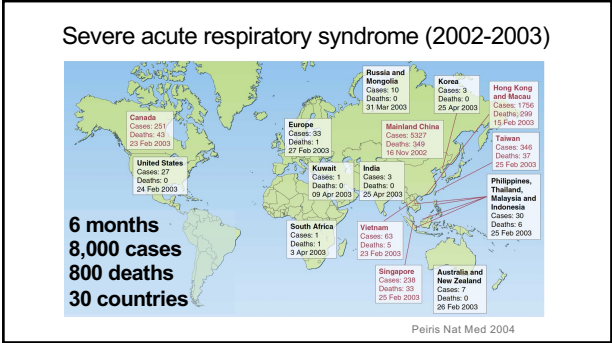
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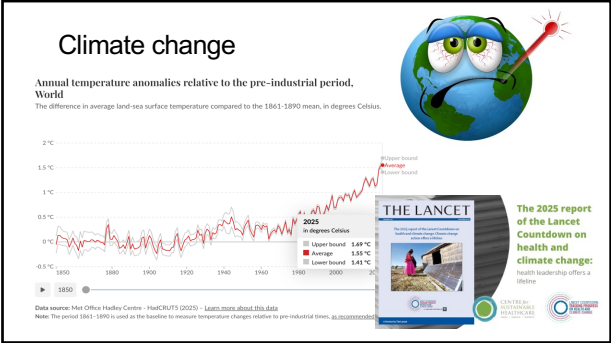
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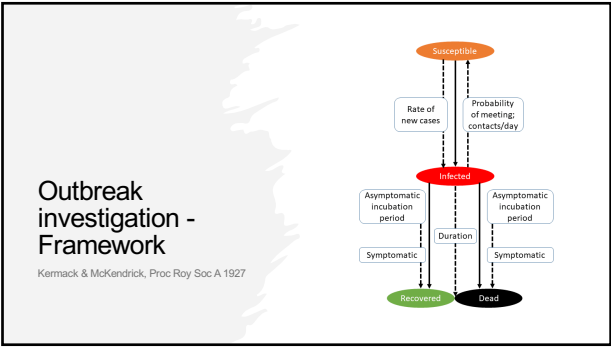
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### Outbreak investigation - purpose

- Identifying and eliminating the source of infection
- Lessons for future outbreaks
- Evaluate control strategies
- Learn about new or reemerging diseases
- Teach (and learn) epidemiology
- Address public concern about the outbreak

Reingold EID 1998

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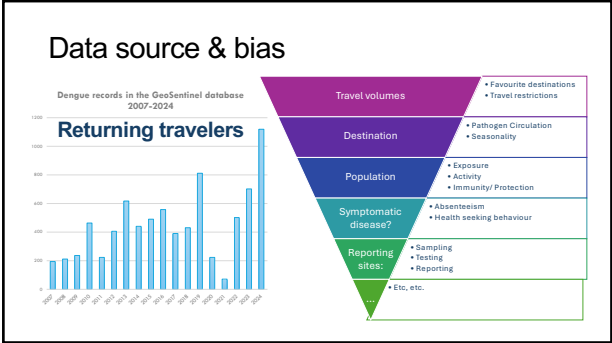
### Identifying an outbreak

<https://revistapesquisa.fapesp.br/>

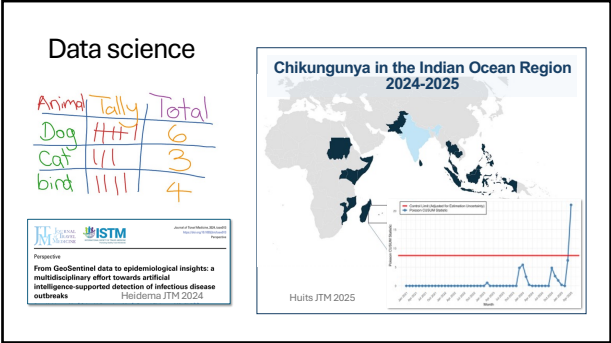
Sources: WHO, CDC, GPEI (Polio), ProMEDmail, BEACON, GeoSentinel, etc. etc.

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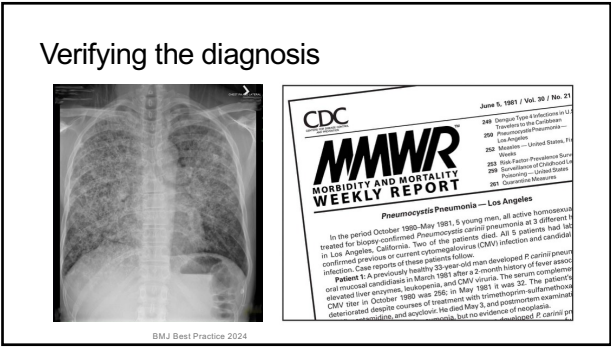
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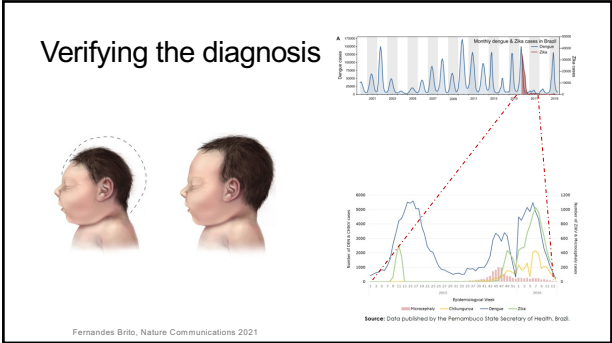
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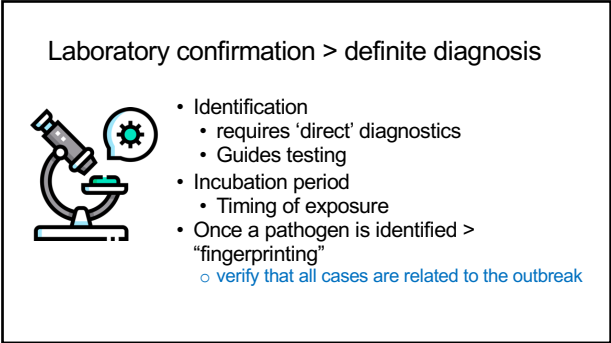
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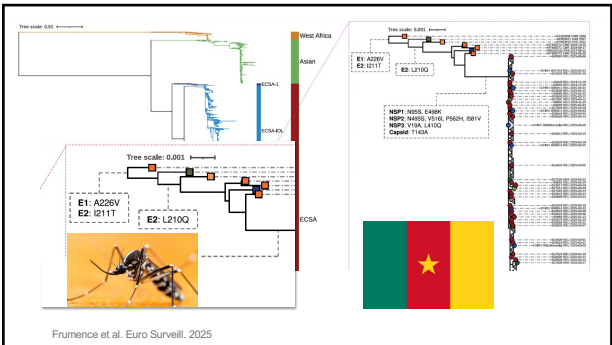
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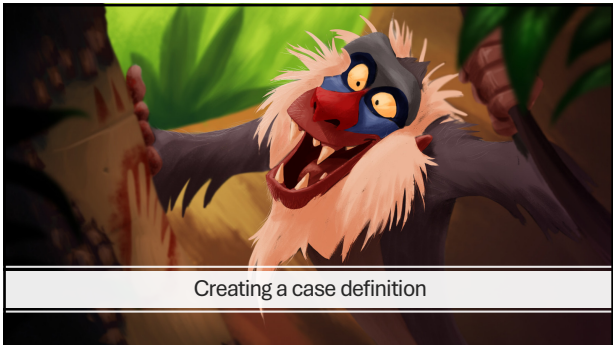
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Creating a case definition

1. Clinical criteria (signs & symptoms)
  - Suspected
2. Person, place and time
  - Probable
3. Laboratory test
  - Proven



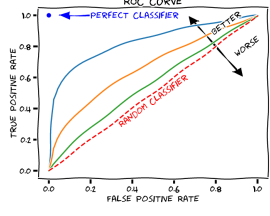

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World Health Organization

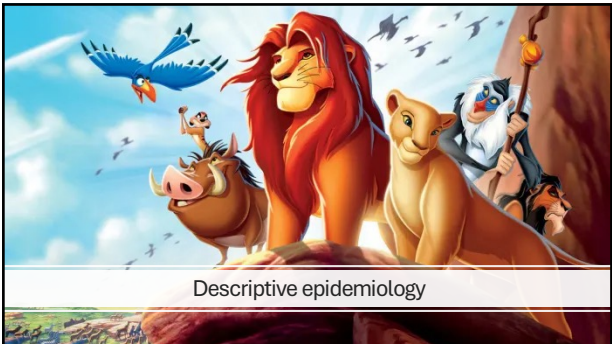
ILI case definition

An acute respiratory infection with:

- measured fever of  $\geq 38^{\circ}\text{C}$
- and cough;
- with onset within the last 10 days.



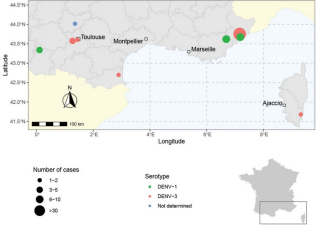
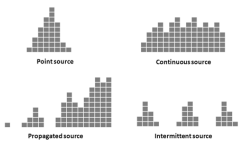
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Descriptive epidemiology: Mapping

- Person, place and time
- Characterizing the outbreak
- Identifying population at risk

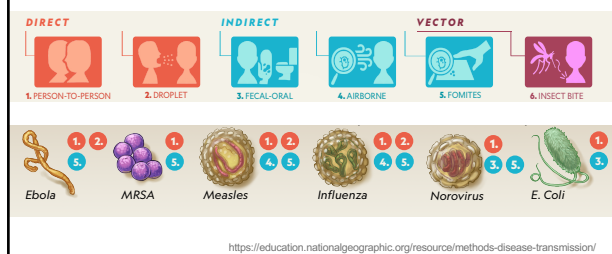


<https://outbreaktools.ca/>

Cochet, Euro Surveill. 2022

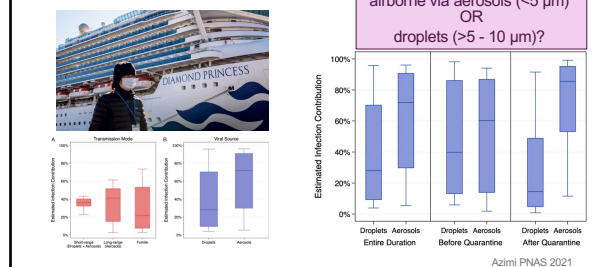
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## Descriptive epidemiology: further clues



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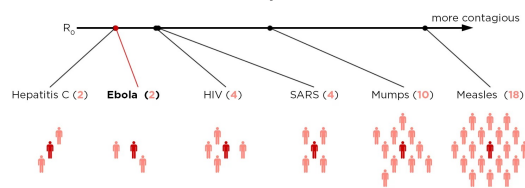
## Descriptive epidemiology:



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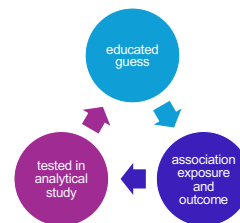
## Basic Reproductive number

The number of **people** that **one sick person** will infect (on average) is called  $R_0$ .  
Here are the maximum  $R_0$  values for a few viruses.



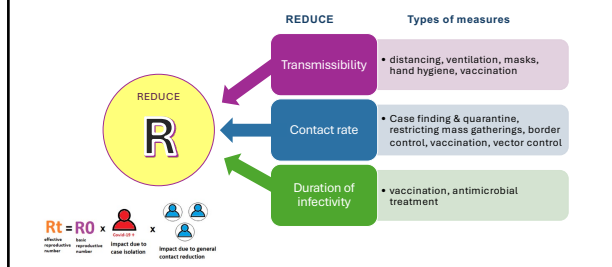
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## Developing and testing a hypothesis



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## Outbreak control strategies



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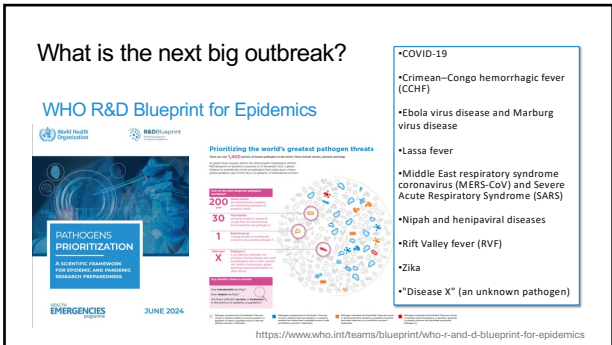
## Outbreak communication

- Disseminate factual and science-based information.
  - Counter misinformation and myths.
  - Encourage preventive measures
- 
- Improve patient outcomes by ensuring people understand:
    - symptoms, treatments, and recovery expectations.
  - Reduce anxiety and fear by providing reassurance and clear guidance.

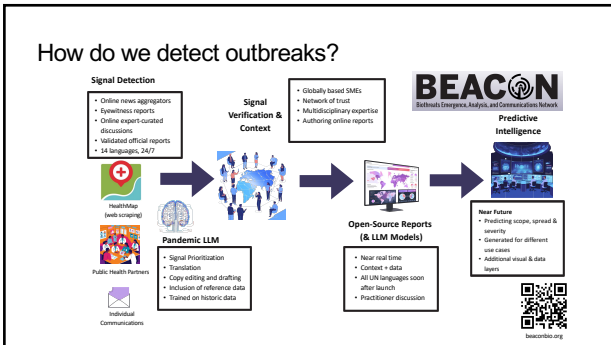
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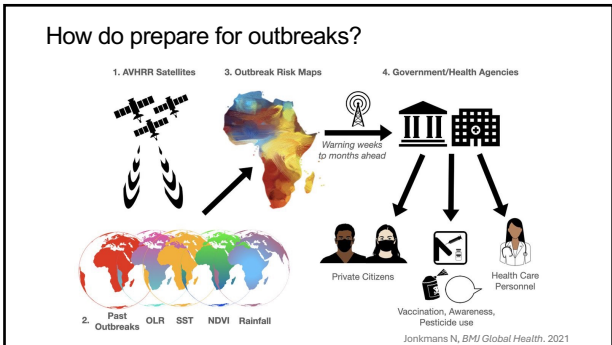
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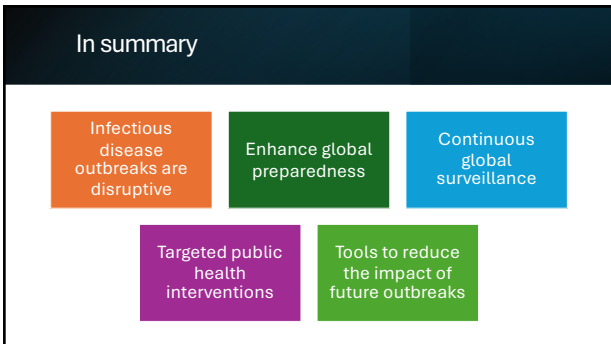
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