APIC GREAT LAKES

2025 EDUCATIONAL WEBINAR SERIES

Health Security: Changing Perceptions Over Time

March 11, 2025

Housekeeping

- Please mute your line
- Have questions for our speaker? Drop it in the chat to be asked!

Continuing Education (CE)

- There are no CEs available for today's session

Welcome
David Heymann, MD
London School of Hygiene and Tropical Medicine

Health security: changing perceptions over time

Learning objectives

- Understand the concept of health security – why and how it has evolved during the 20th and 21st centuries, and especially after the Ebola outbreaks in West Africa and the COVID-19 pandemic

- Understand that risk assessment and management of health security are an essential component of human security alongside disarmament and geopolitical conflict management

- Understand the similarities between the public health response to deliberately caused and naturally occurring infectious disease outbreaks, and how investment of defence funding can strengthen public health

Breaches in species barrier: emerging infections in humans

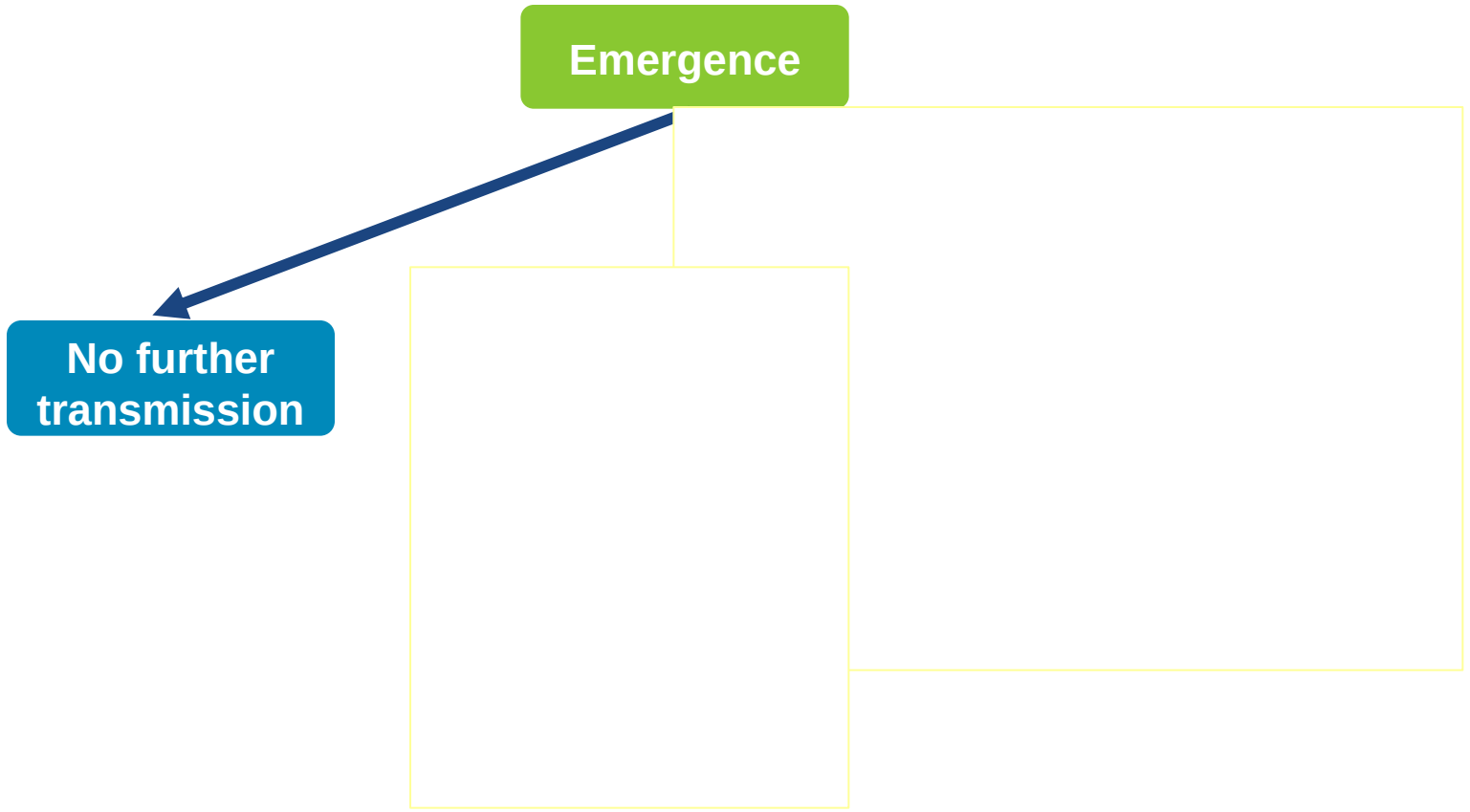




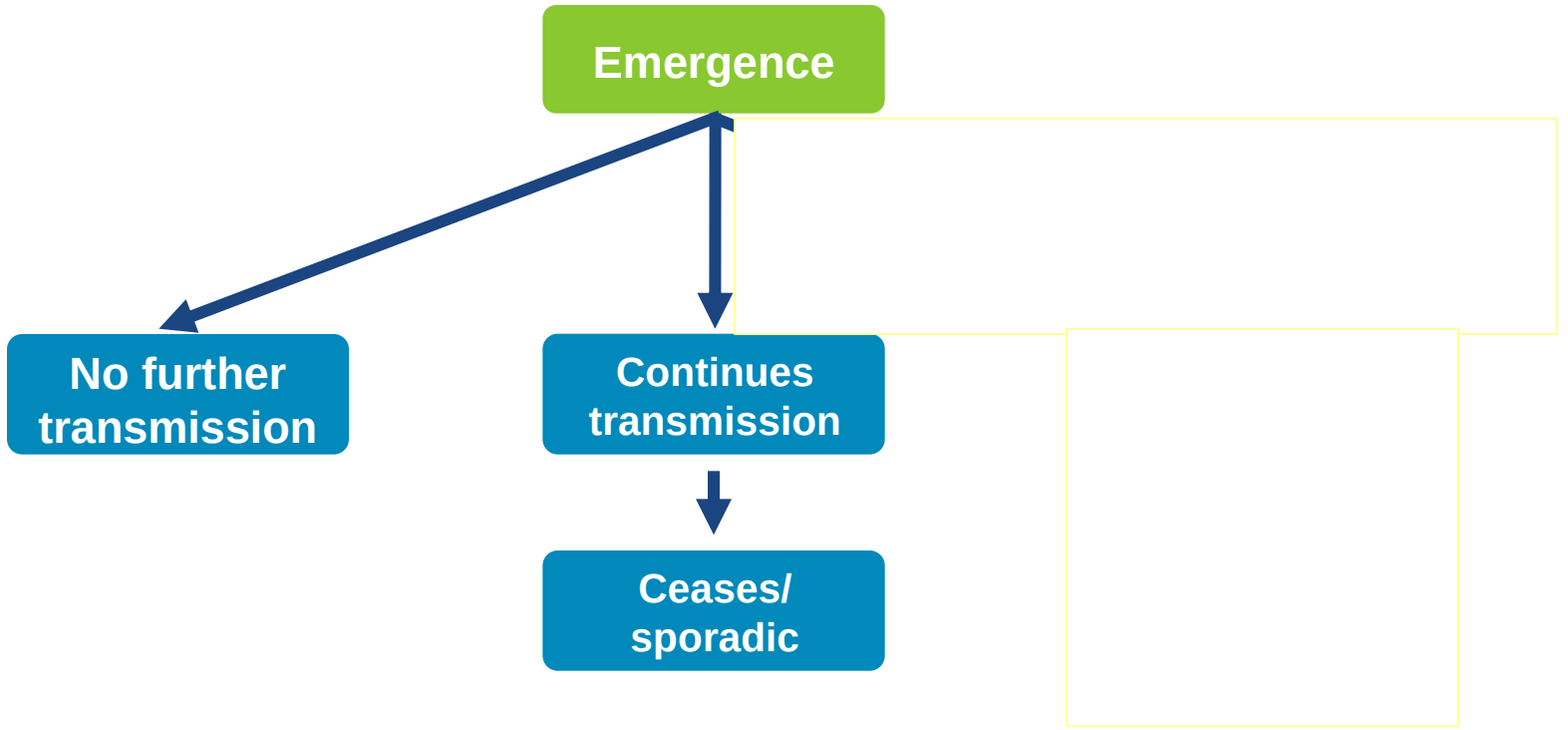


Infection	Animal linked to transmission	Year infection first reported
Ebola virus	Bats	1976
HIV-1	Primates	1981
E. coli O157:H7	Cattle	1982
Borrelia burgdorferi	Rodents	1982
HIV-2	Primate	1986
Hendra virus	Bats	1994
BSE/vCJD	Cattle	1996
Australian lyssavirus	Bats	1996
Influenza A (H5N1)	Chickens	1997
Nipah virus	Bats	1999
SARS coronavirus	Palm civets	2003
Zika virus	Monkey	2007
Influenza A (H1N1)	Swine	2009
MERS coronavirus	Bat/ Dromedary	2012
Influenza A (H7N9)	Poultry	2013
SARS coronavirus 2	?	2019

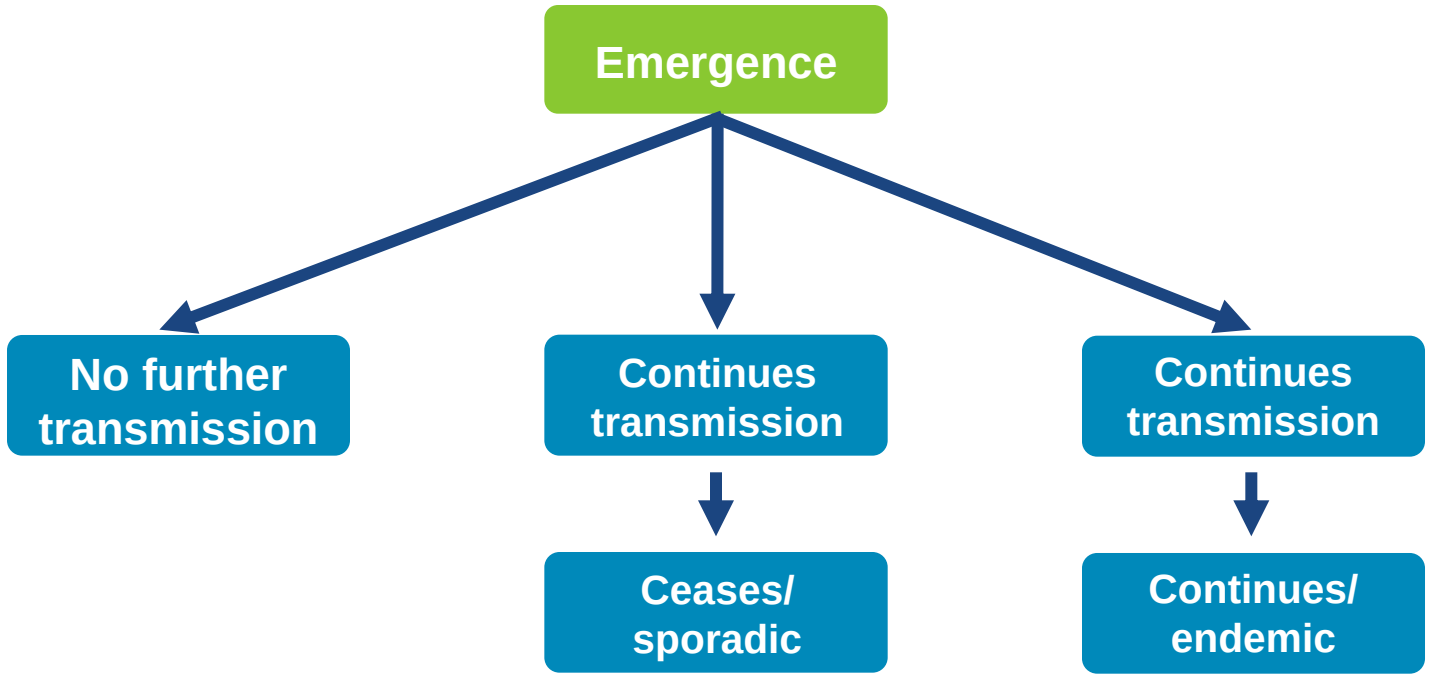
Potential transmission pathways, emerging infectious diseases



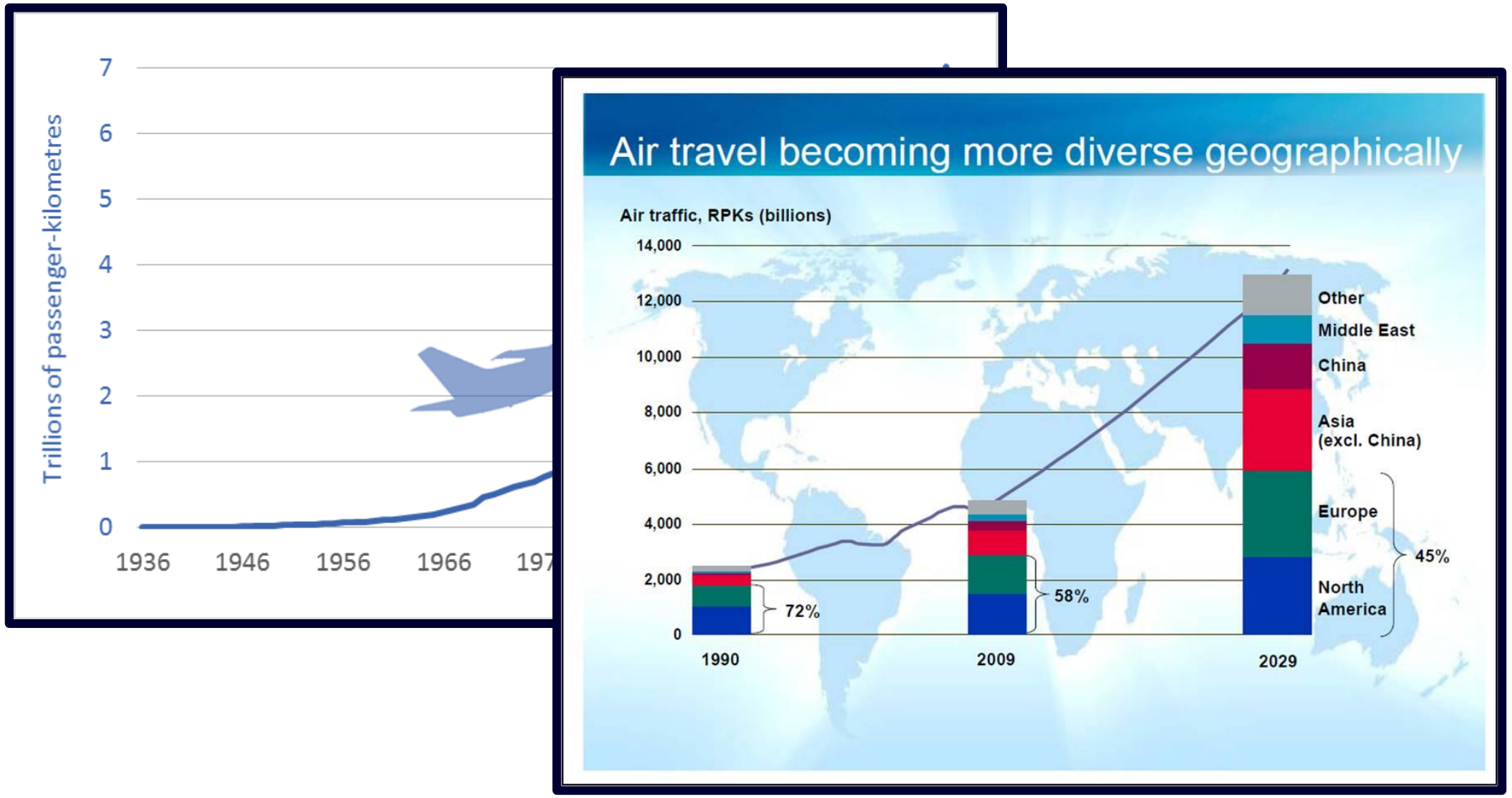
Potential transmission pathways, emerging infectious diseases



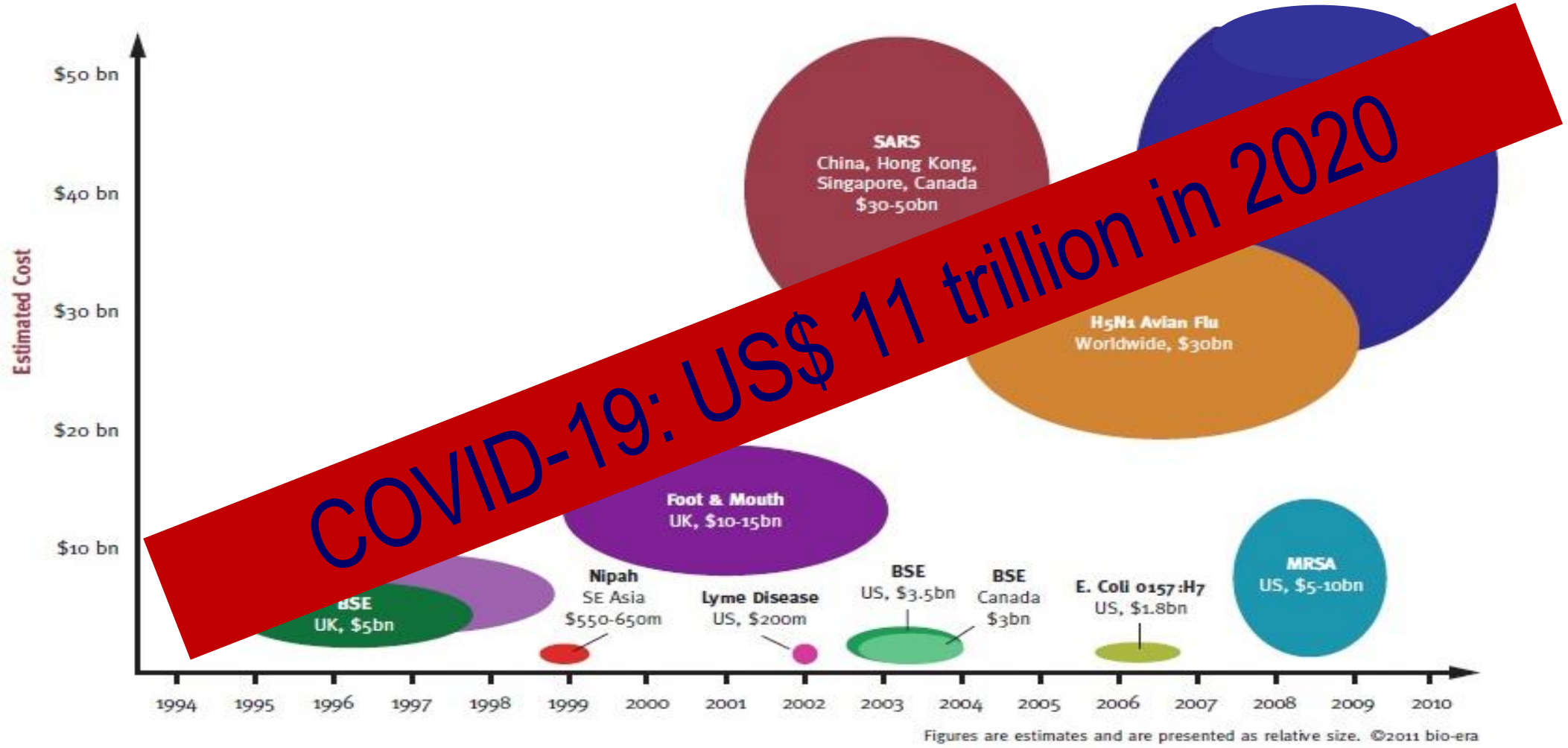
Potential transmission pathways, emerging infectious diseases



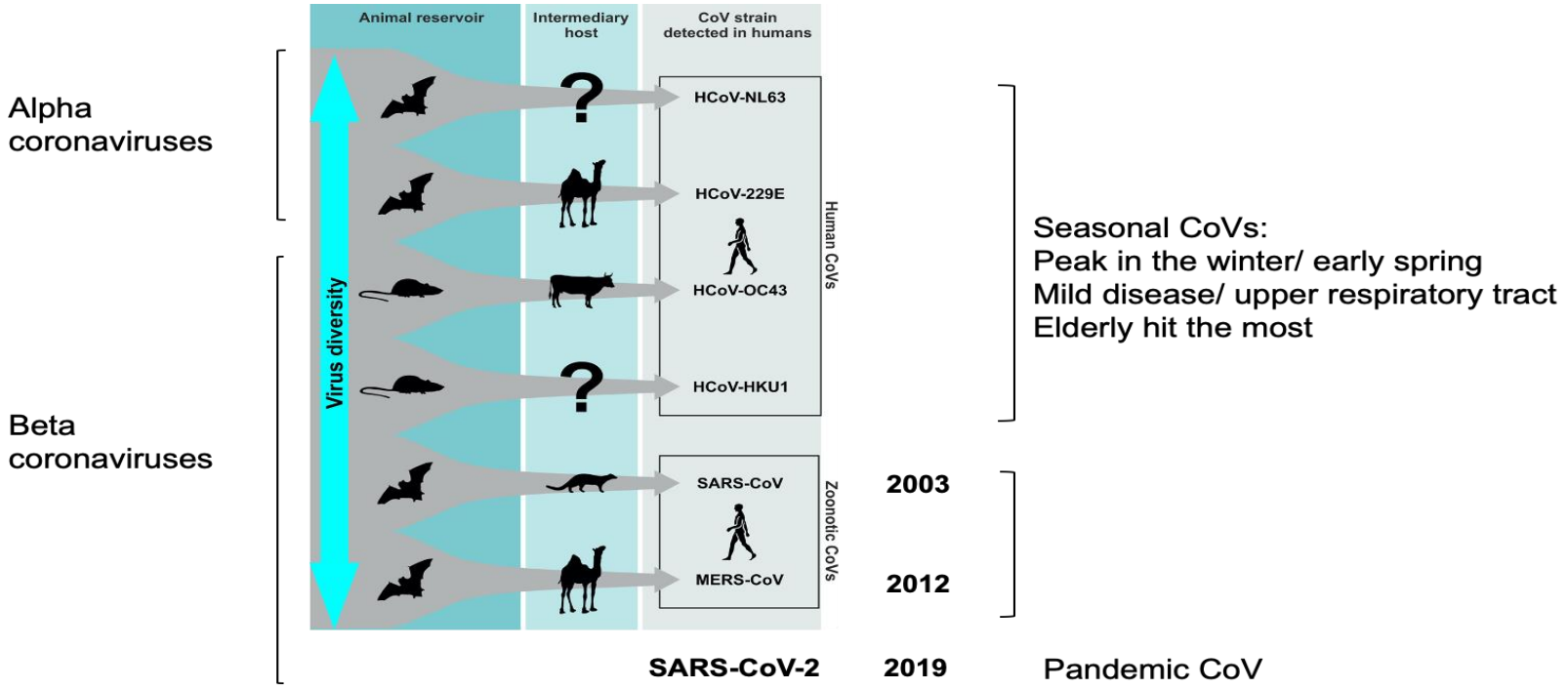
Air travel worldwide, 1936 – 2016



Emerging infections: important economic loss



Human Coronavirus Infections: varied outcomes after emergence

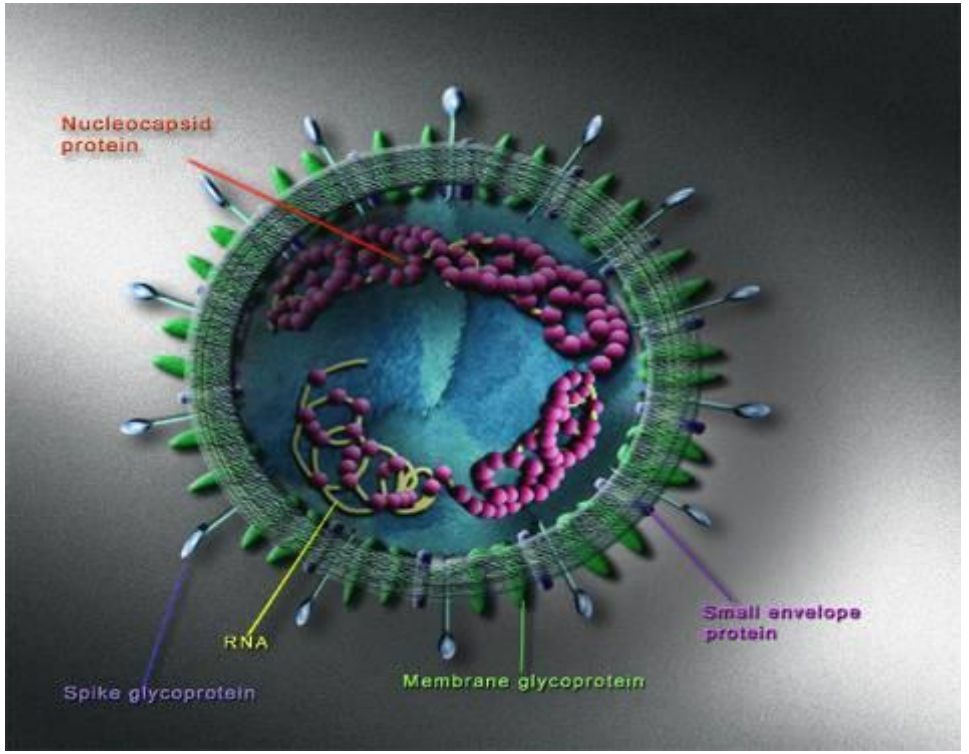


Source:. Corman VM, Muth D, Niemeyer D, Drosten C. Hosts and Sources of Endemic Human Coronaviruses. *Adv Virus Res*. 2018;100:163–188.

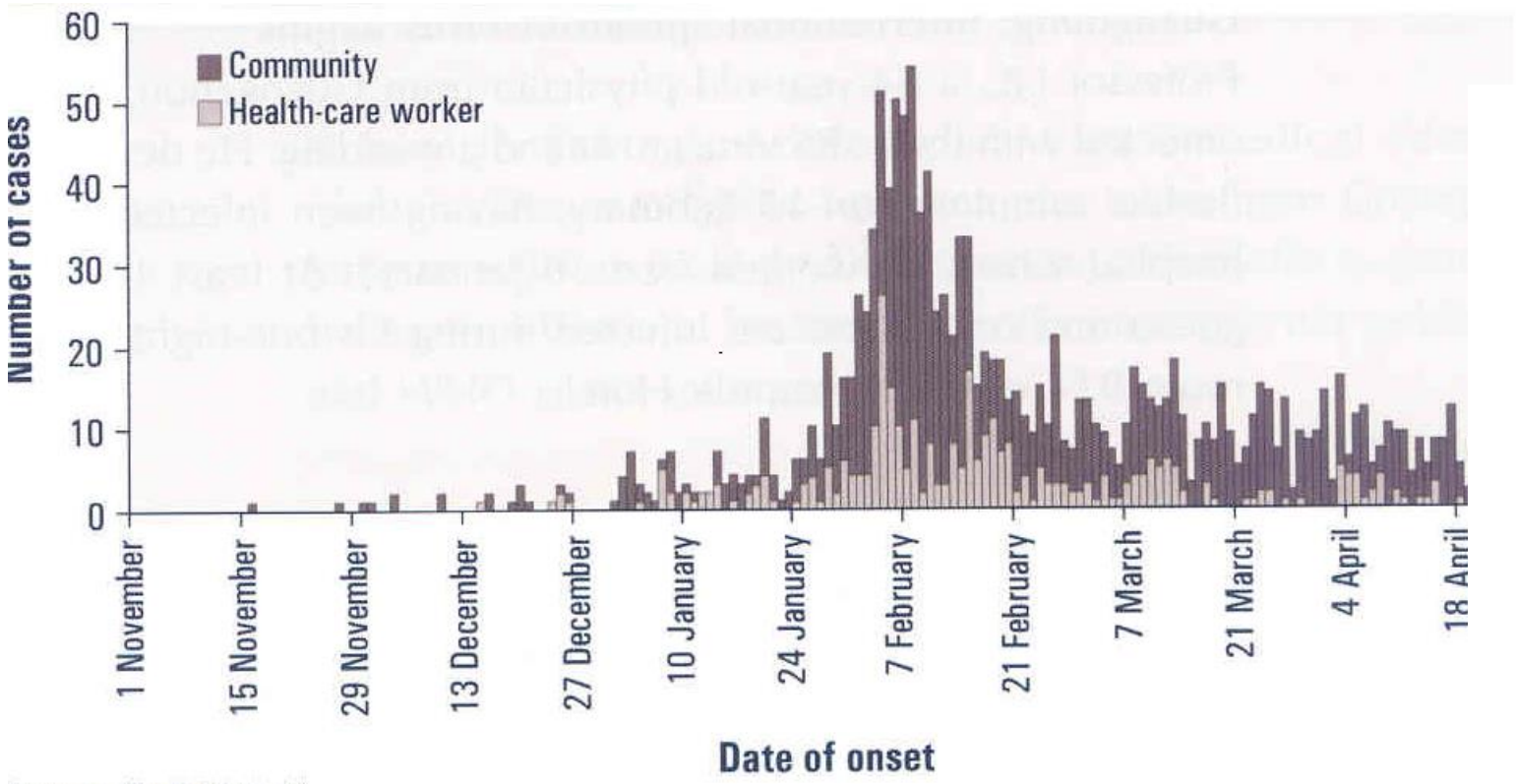
SARS 2003: a mutated virus that circled the globe

Suspected wet market animals in the chain of transmission

The SARS Coronavirus

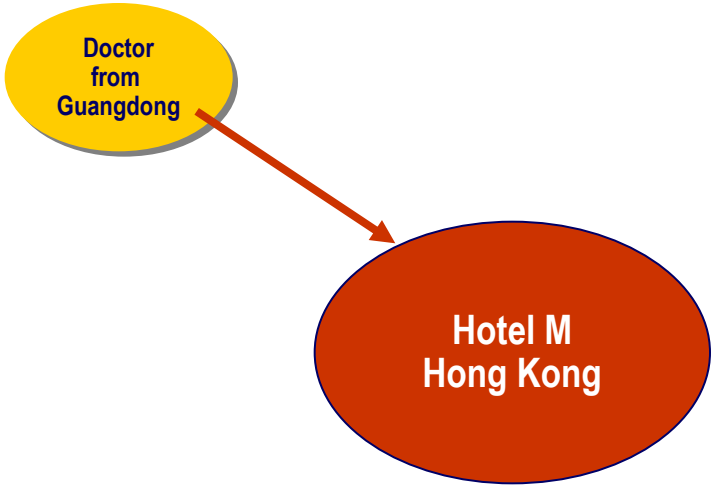


SARS China, 2002 - 2003



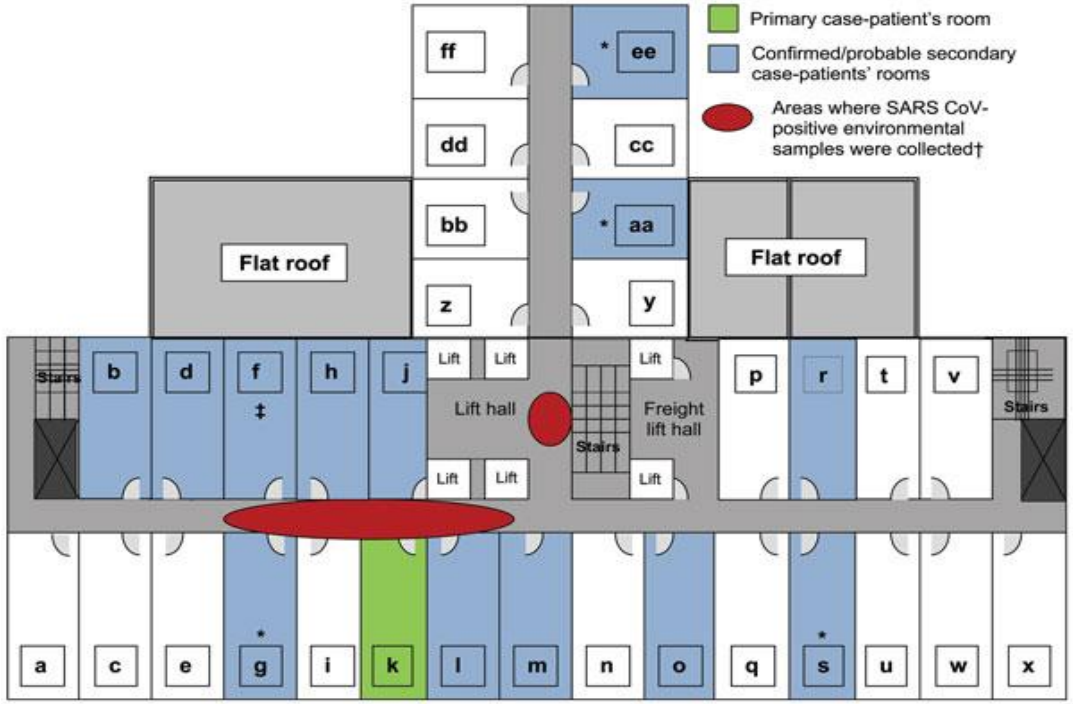
Source: Xu R-H et al[1]

SARS: international spread from Hong Kong, 21 February – 12 March, 2003



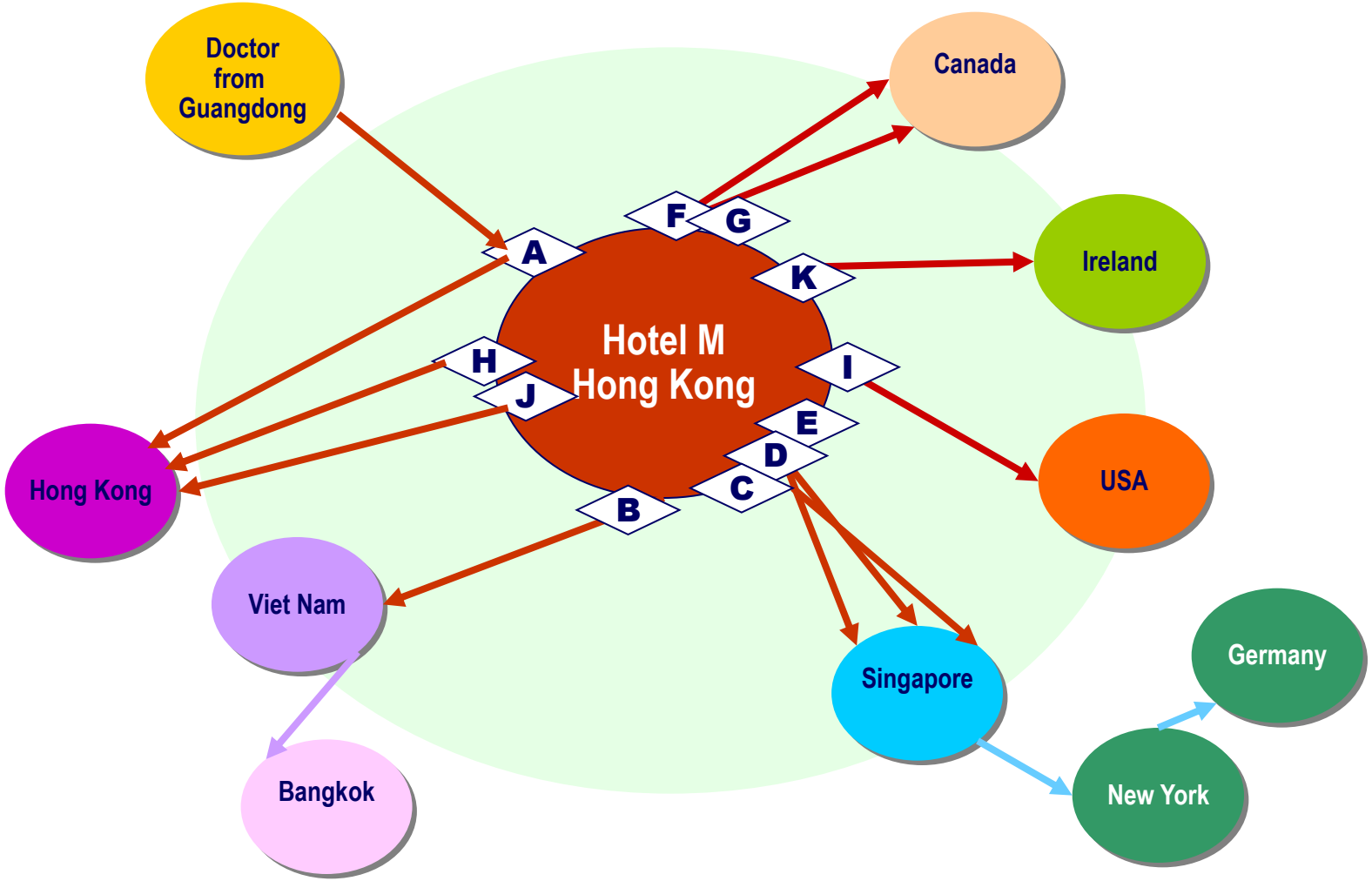
Source: CDC/WHO

SARS: Hotel M, Hong Kong, 21 February, 2003



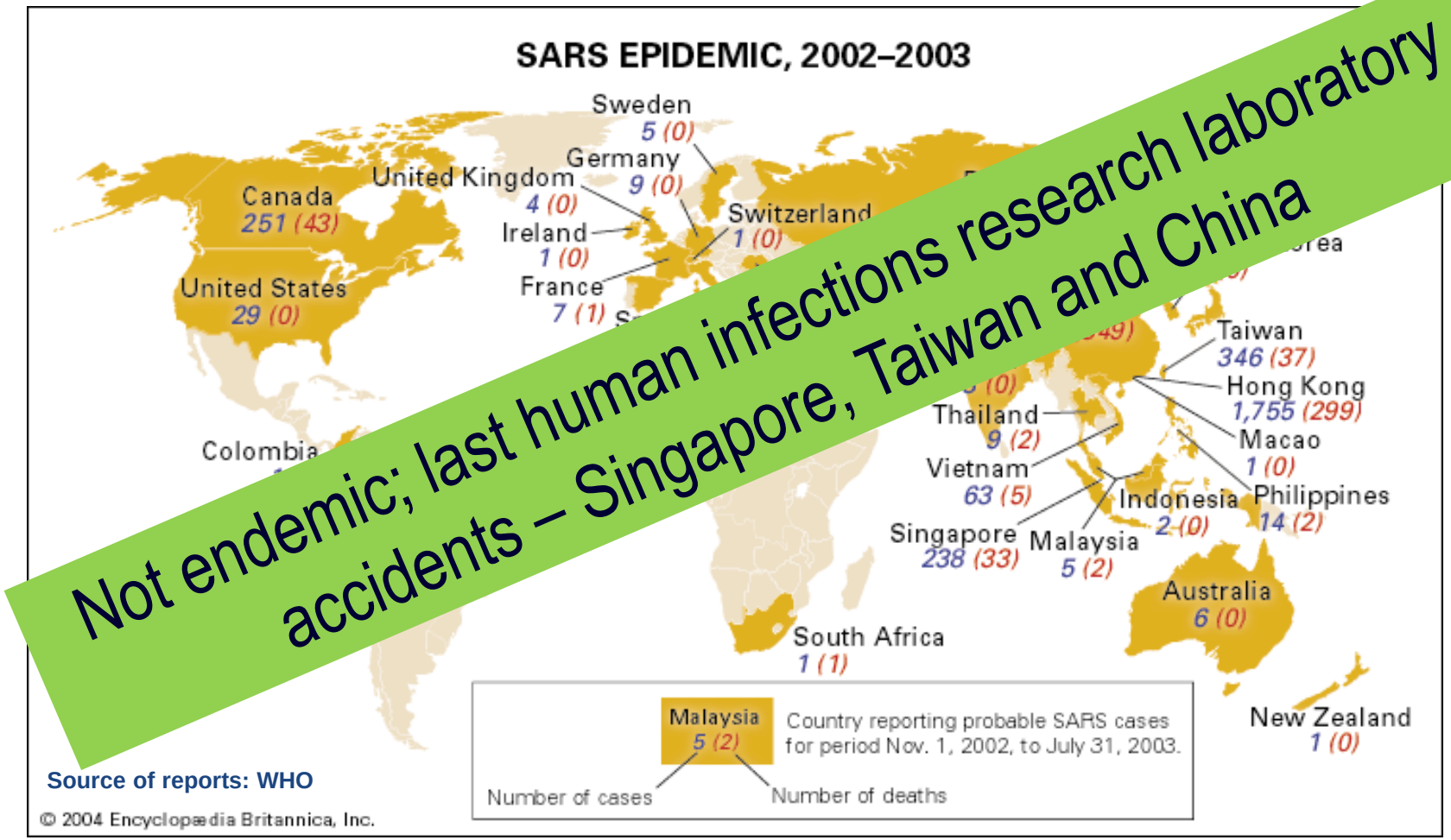
Source: CDC/WHO

SARS: international spread from Hong Kong, 21 February – 12 March, 2003



Source:
WHO/CDC

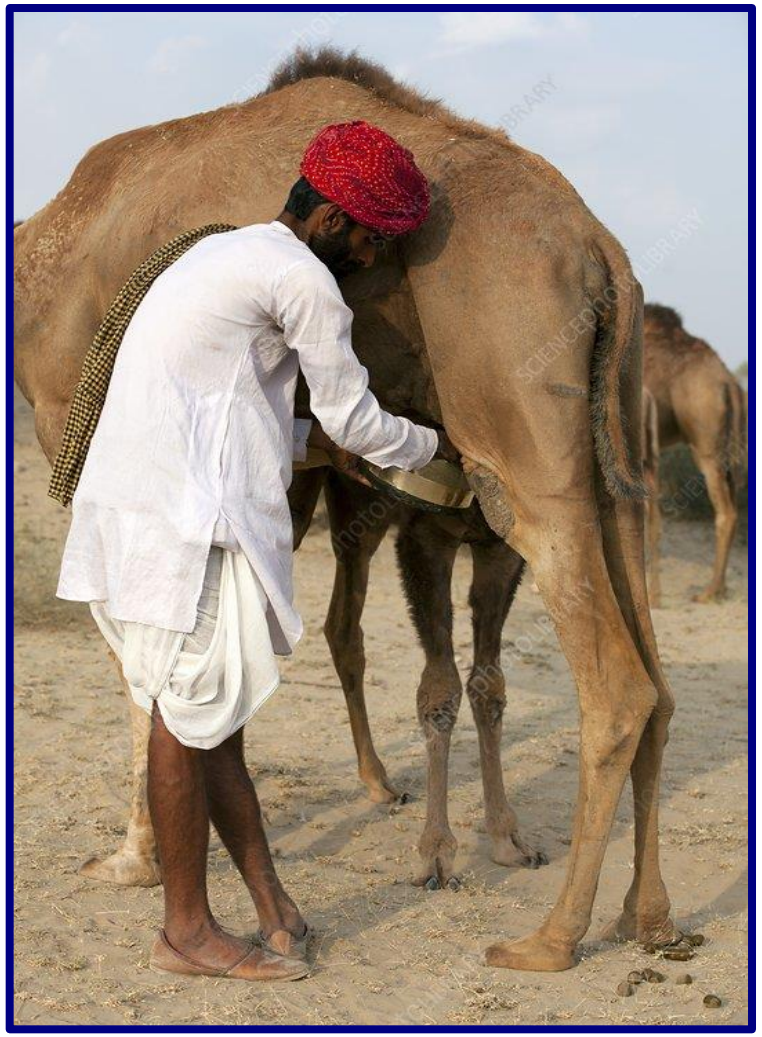
SARS 2002-2003: worldwide spread



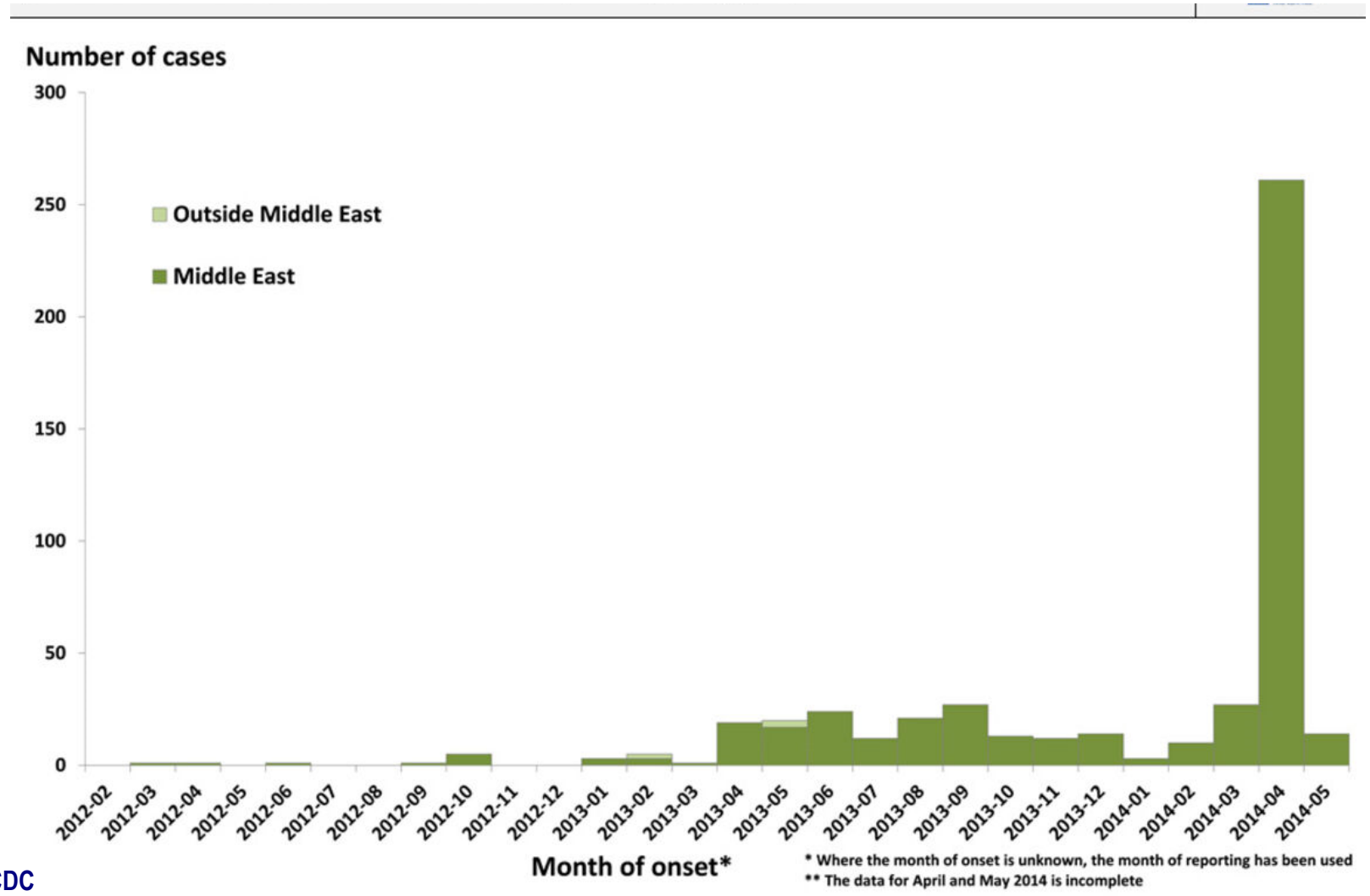
Not endemic; last human infections research laboratory accidents – Singapore, Taiwan and China

8096 probable cases and 774 deaths

MERS Coronavirus: emergence 2012

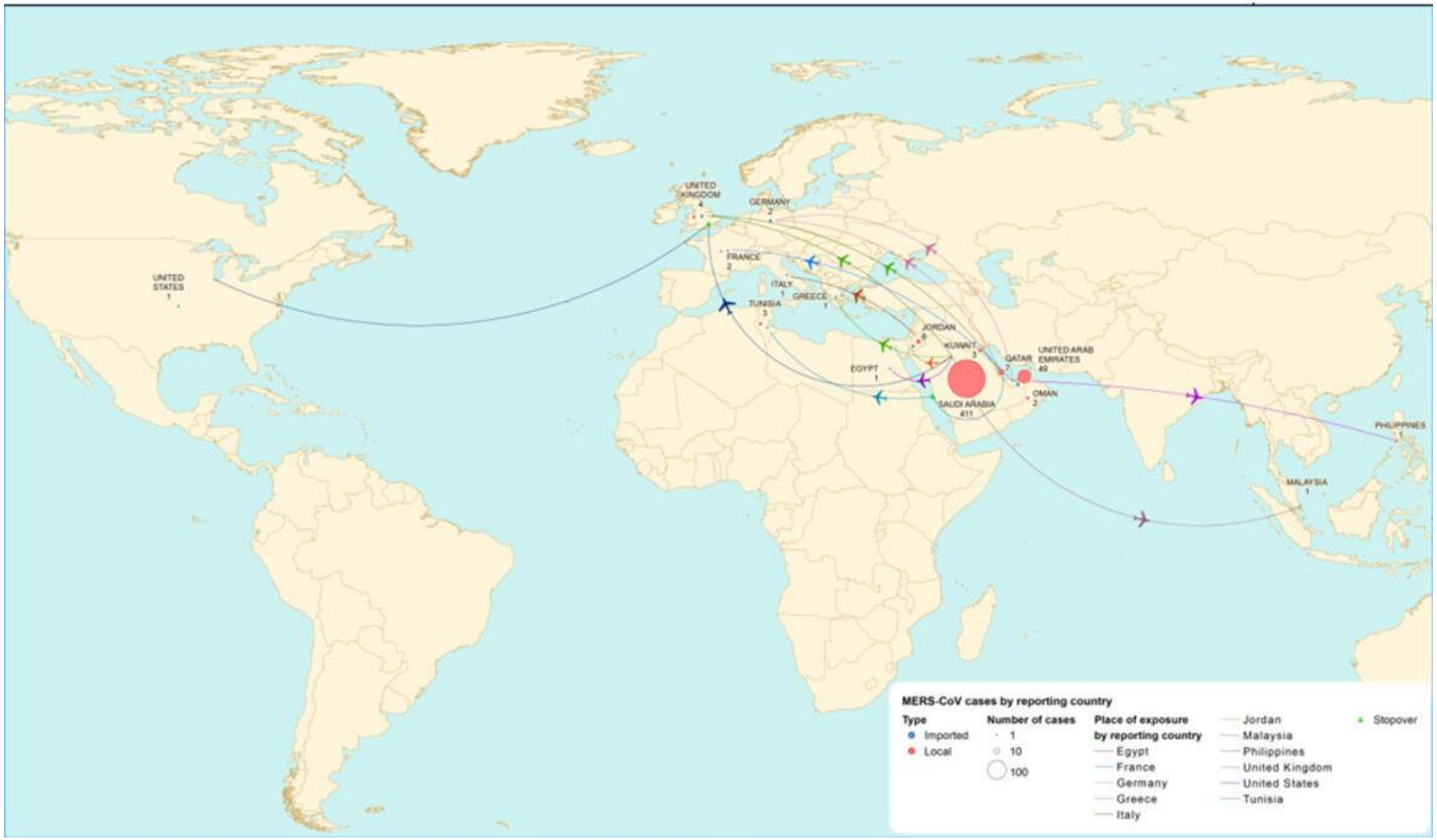


MERS CoV, initial reported cases, 2012 - 2014



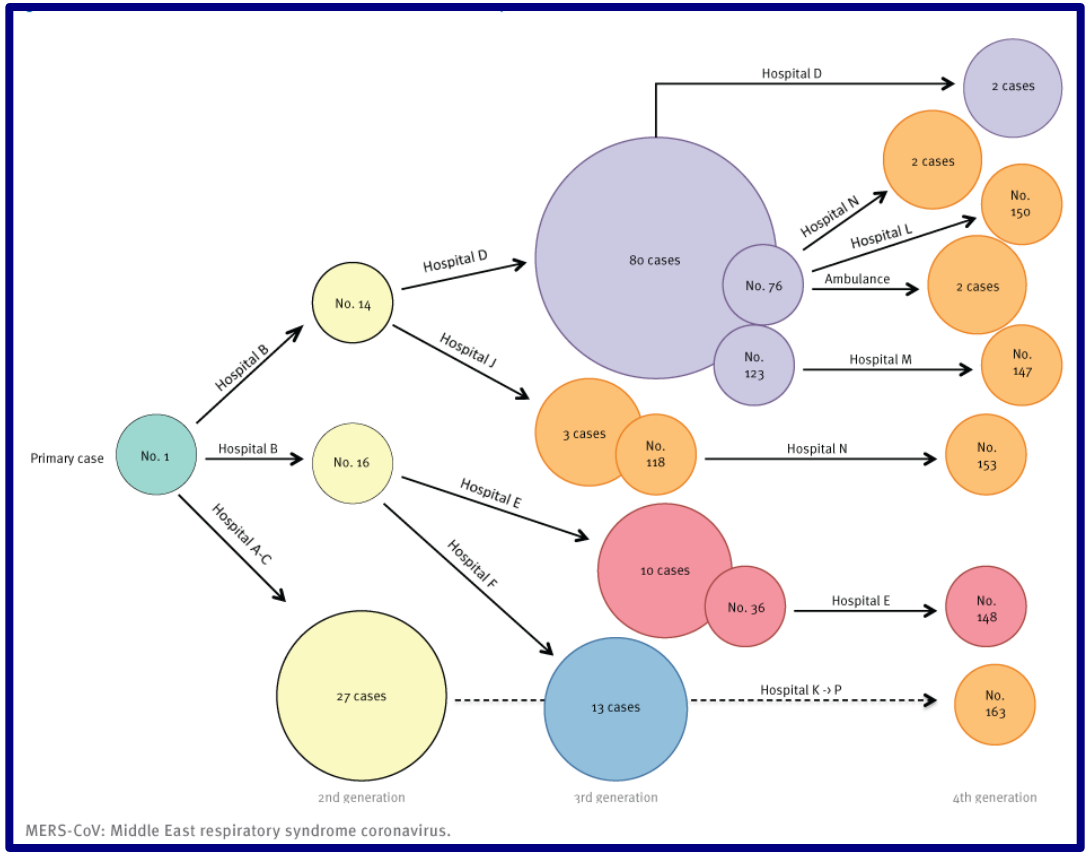
Source: ECDC

Initial international spread, MERS Coronavirus, ECDC 2012 - 2014



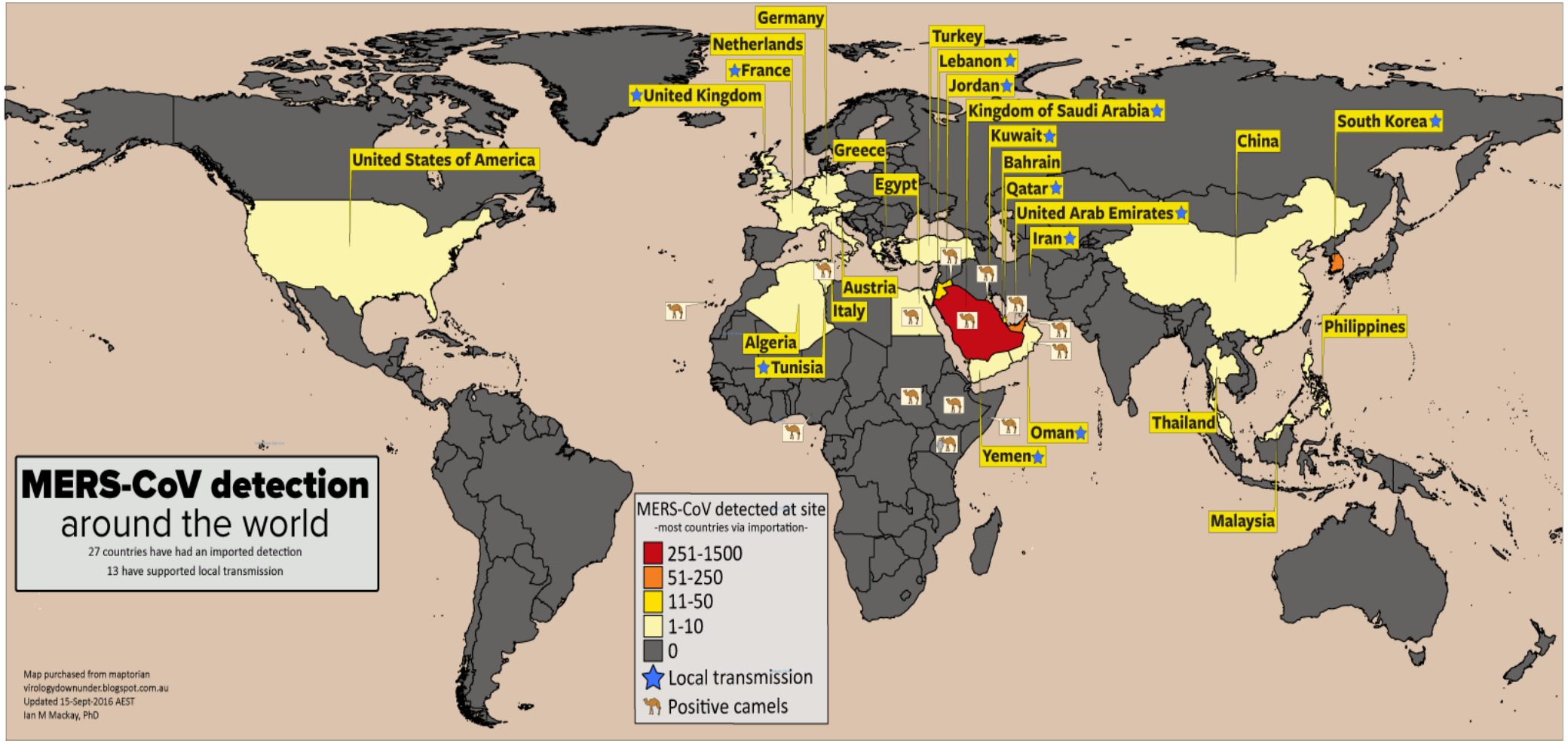
Source: ECDC

Nosocomial outbreak MERS Coronavirus, Korea, 2015

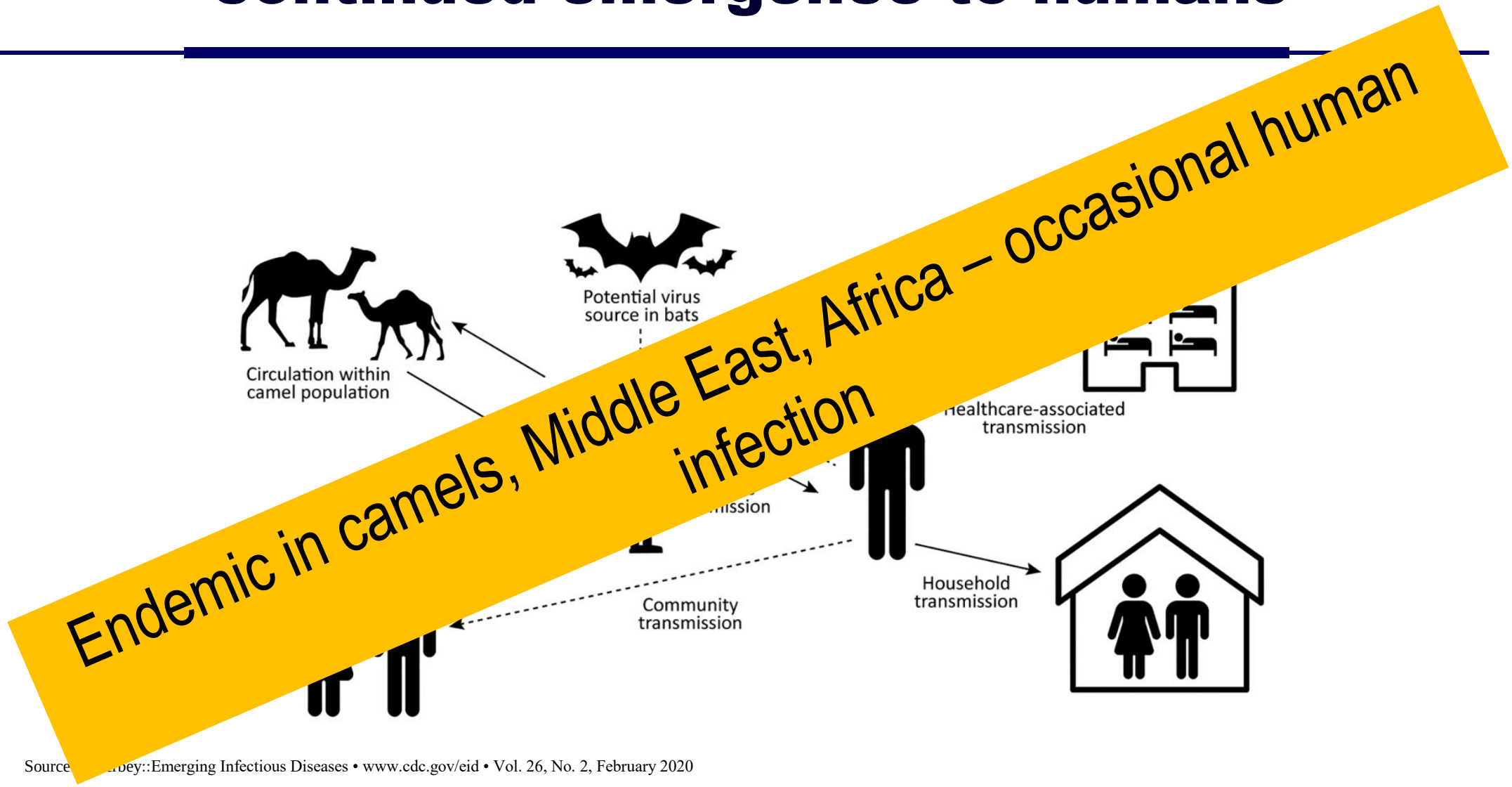


Source:: Ministry of Health South Korea

MERS Coronavirus worldwide, September 2016

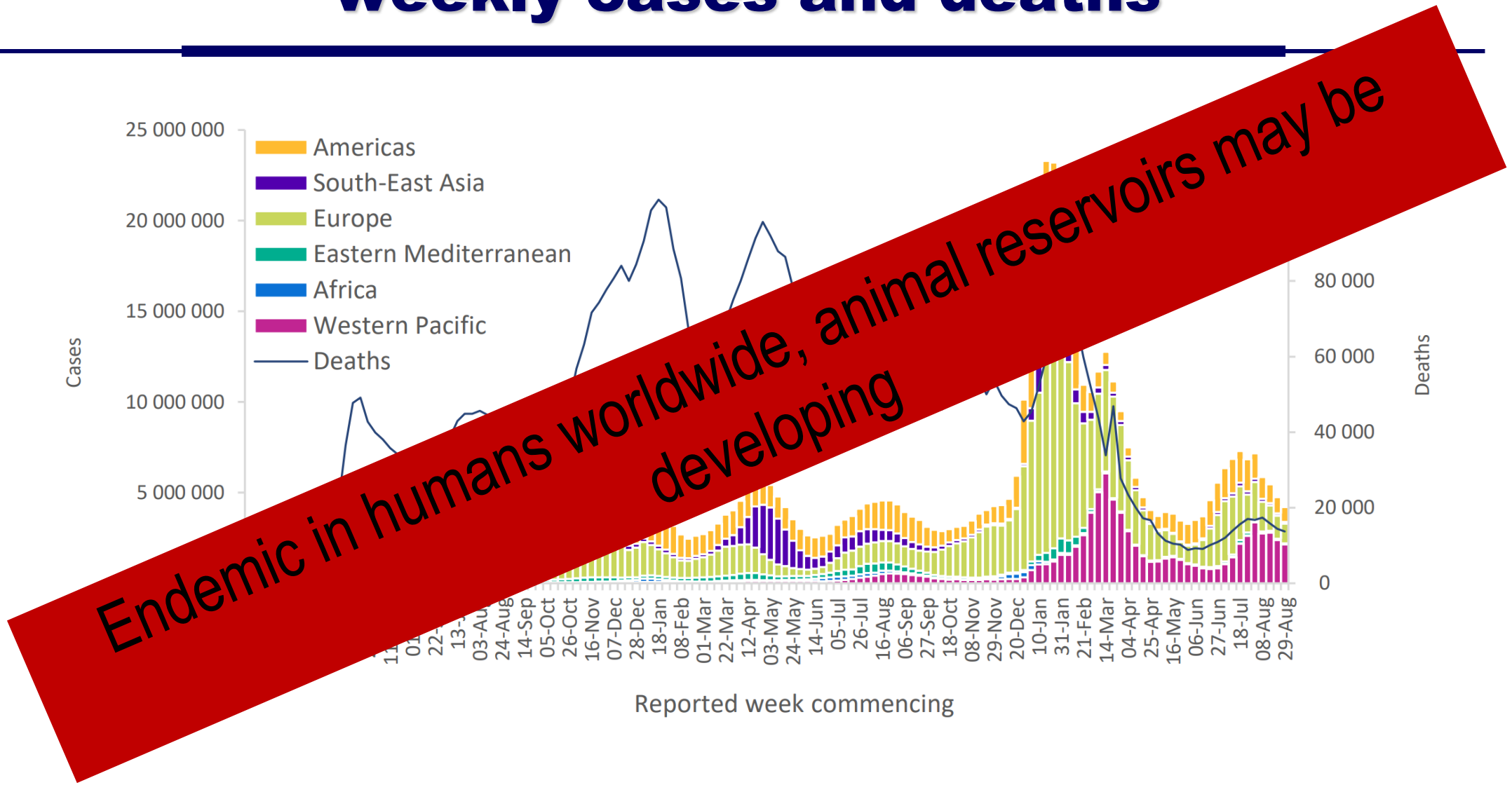


MERS Coronavirus: continued emergence to humans



Source: Abbey::Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 26, No. 2, February 2020

Reported COVID-19: weekly cases and deaths

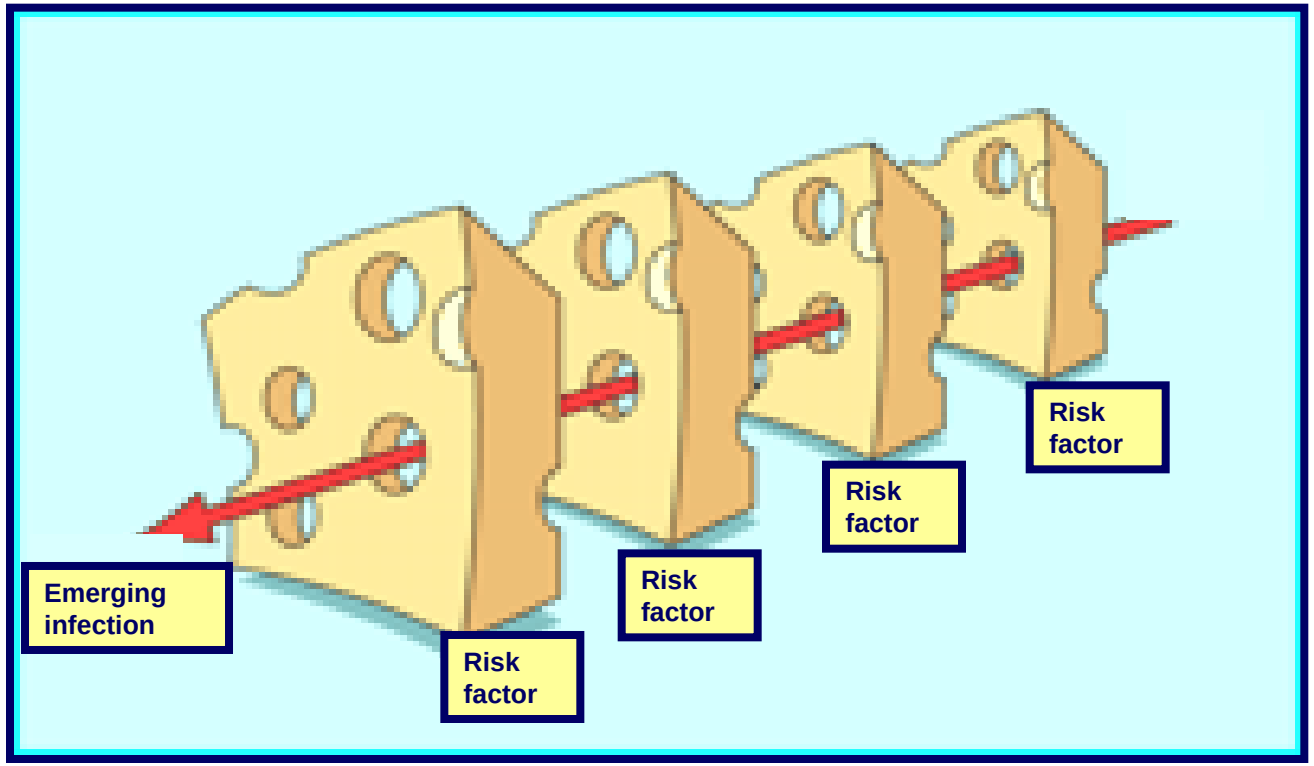


Source: WHO

Risk assessment:

identifying the factors that lead to emergence of infections at the animal/human interface

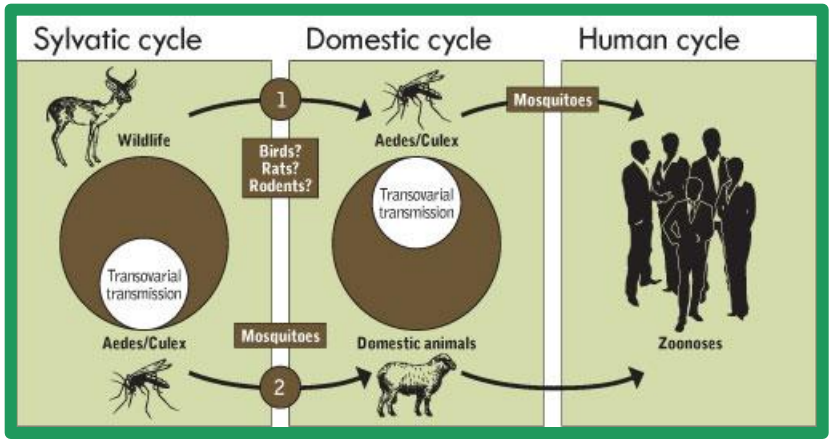
Swiss cheese events and emerging infections



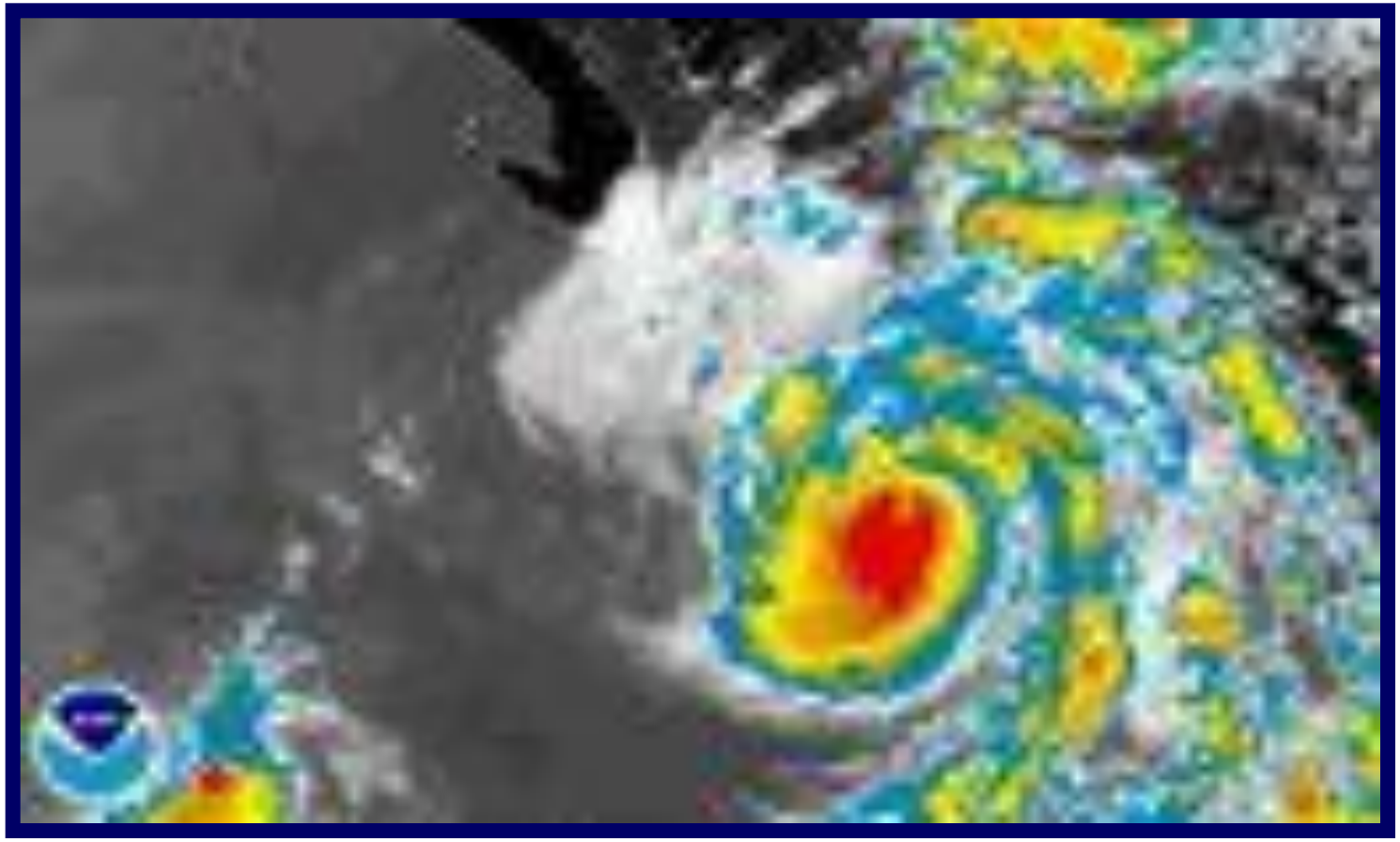
James Reason: BMJ 2000;320:768-770

Animal husbandry, Sudan and trade associated with religious festivals

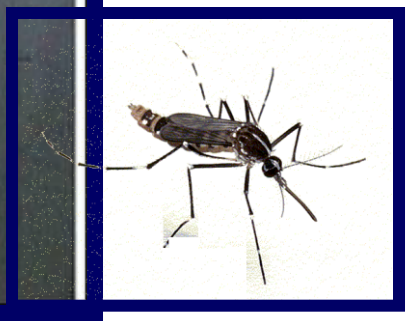
Routine vaccination of cattle against Rift Valley Fever, East Africa



Climate change and health: extreme weather events

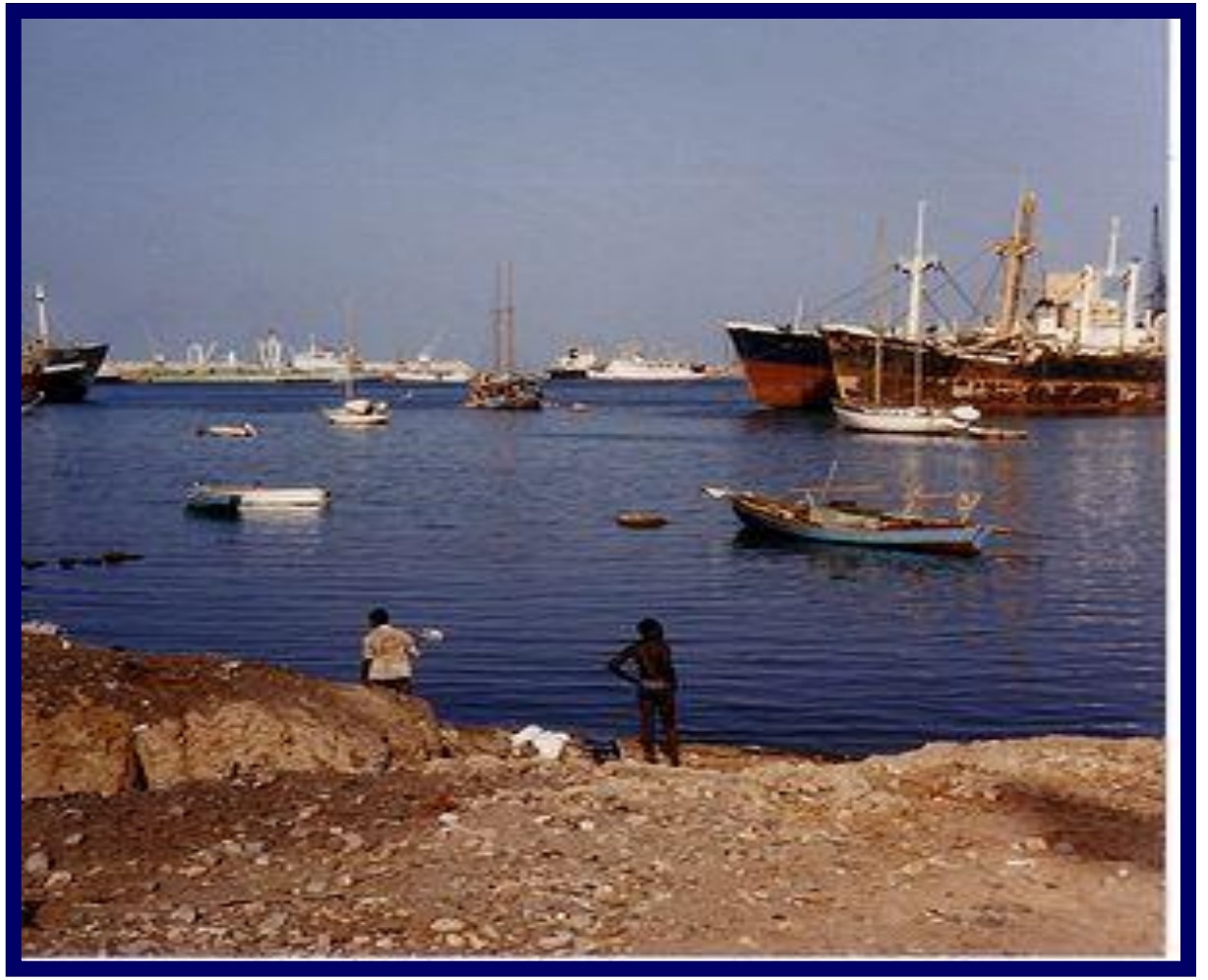


El Nino-associated flooding, East Africa, 1998



Rift Valley Fever, human infection, Sudan, 1998

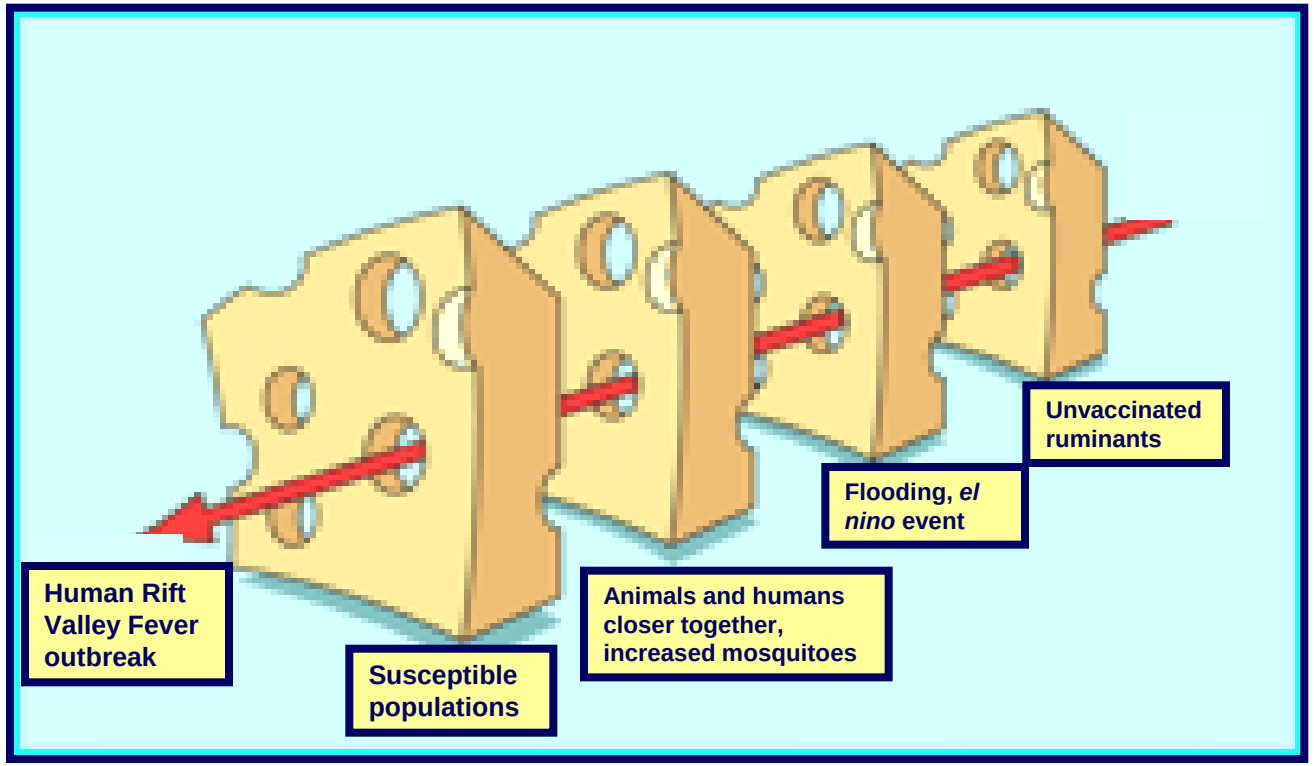
Animal husbandry and trade, Sudan



Rift Valley Fever, Sudan and Arabian peninsula

Source: WHO

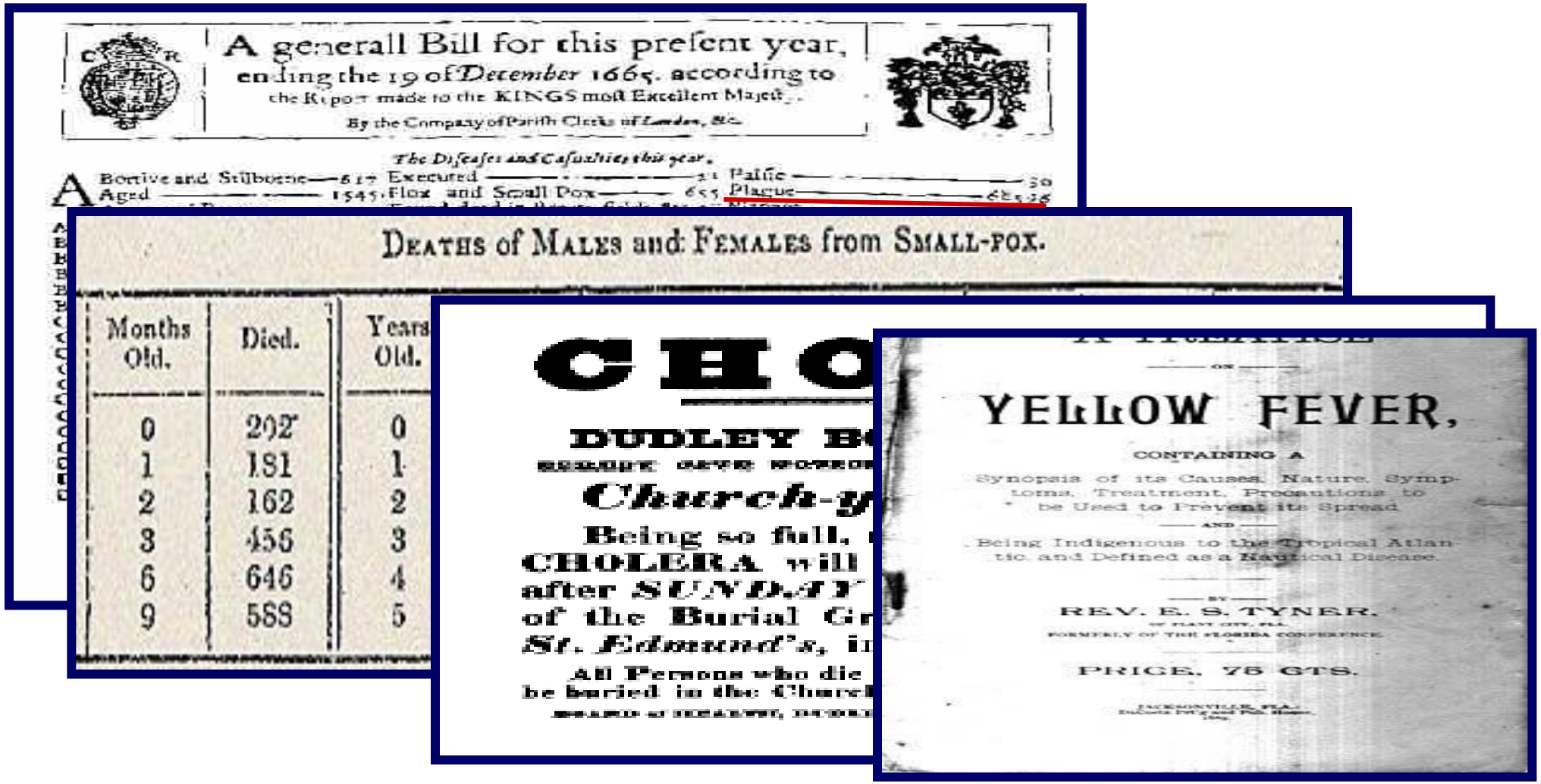
Swiss cheese events and emerging infections



James Reason: BMJ 2000;320:768-770

Health security:
Changes in understanding since the 14th century

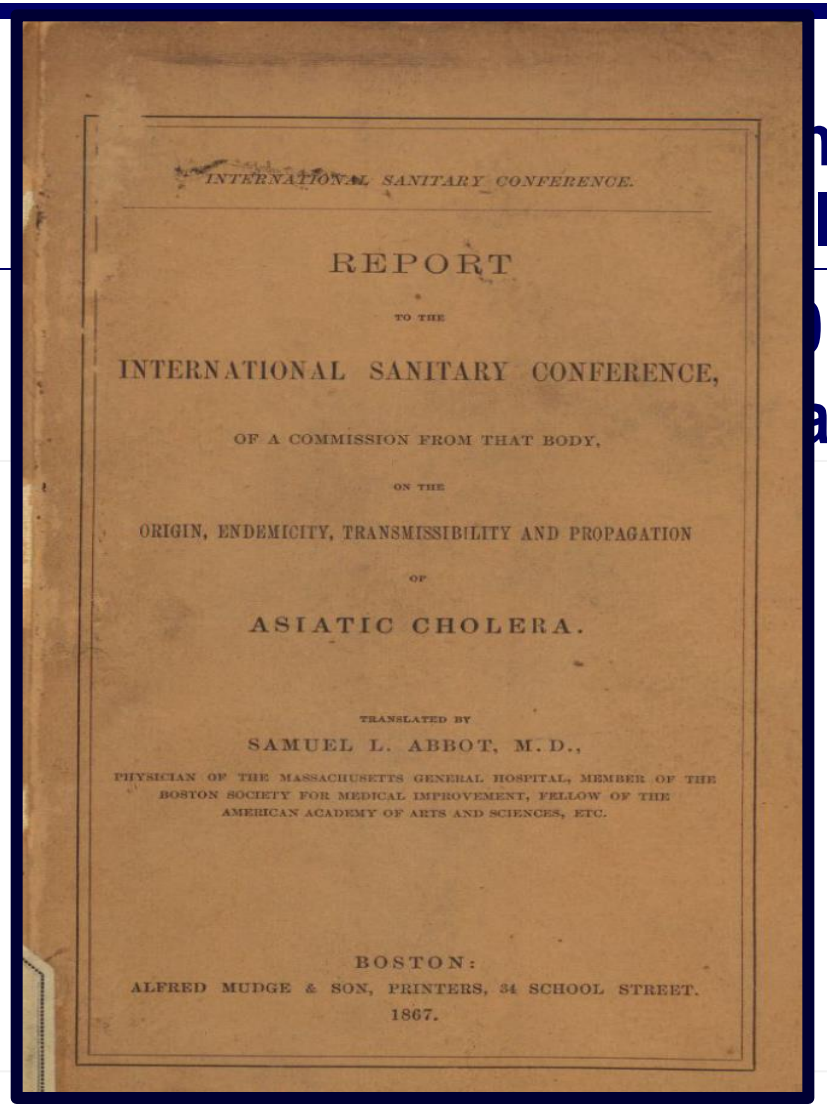
Emerging infectious disease concerns over the centuries



Concern about public health security: plague, cholera, yellow fever and smallpox

1374 — …hip Quarantine for …lague only

1851 - 1902 — …) International …anitary Conferences



INTERNATIONAL SANITARY CONFERENCE.

REPORT

TO THE

INTERNATIONAL SANITARY CONFERENCE,

OF A COMMISSION FROM THAT BODY,

ON THE

ORIGIN, ENDEMICITY, TRANSMISSIBILITY AND PROPAGATION

OF

ASIATIC CHOLERA.

TRANSLATED BY

SAMUEL L. ABBOT, M. D.,

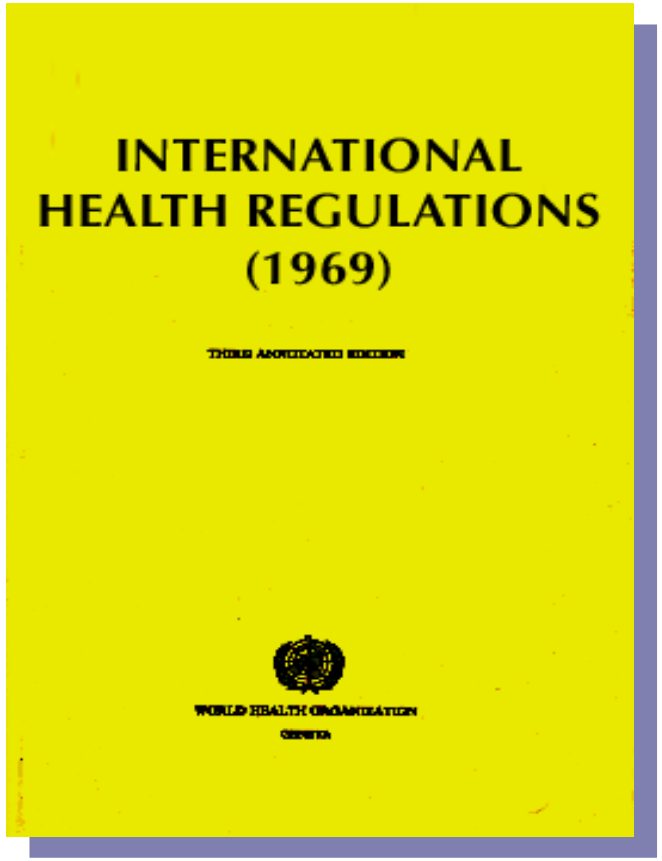
PHYSICIAN OF THE MASSACHUSETTS GENERAL HOSPITAL, MEMBER OF THE BOSTON SOCIETY FOR MEDICAL IMPROVEMENT, FELLOW OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES, ETC.

BOSTON:
ALFRED MUDGE & SON, PRINTERS, 34 SCHOOL STREET.
1867.

Concern about public health security: plague, cholera, yellow fever and smallpox

1374	Venice	Ship Quarantine for Plague only
1851 - 1902	Europe/Americas	10 International Sanitary Conferences
1920	Geneva	League of Nations Health Organization
1951	Geneva	International Sanitary Regulations
1969 and 2005	Geneva	International Health Regulations

Content of International Health Regulations 1969

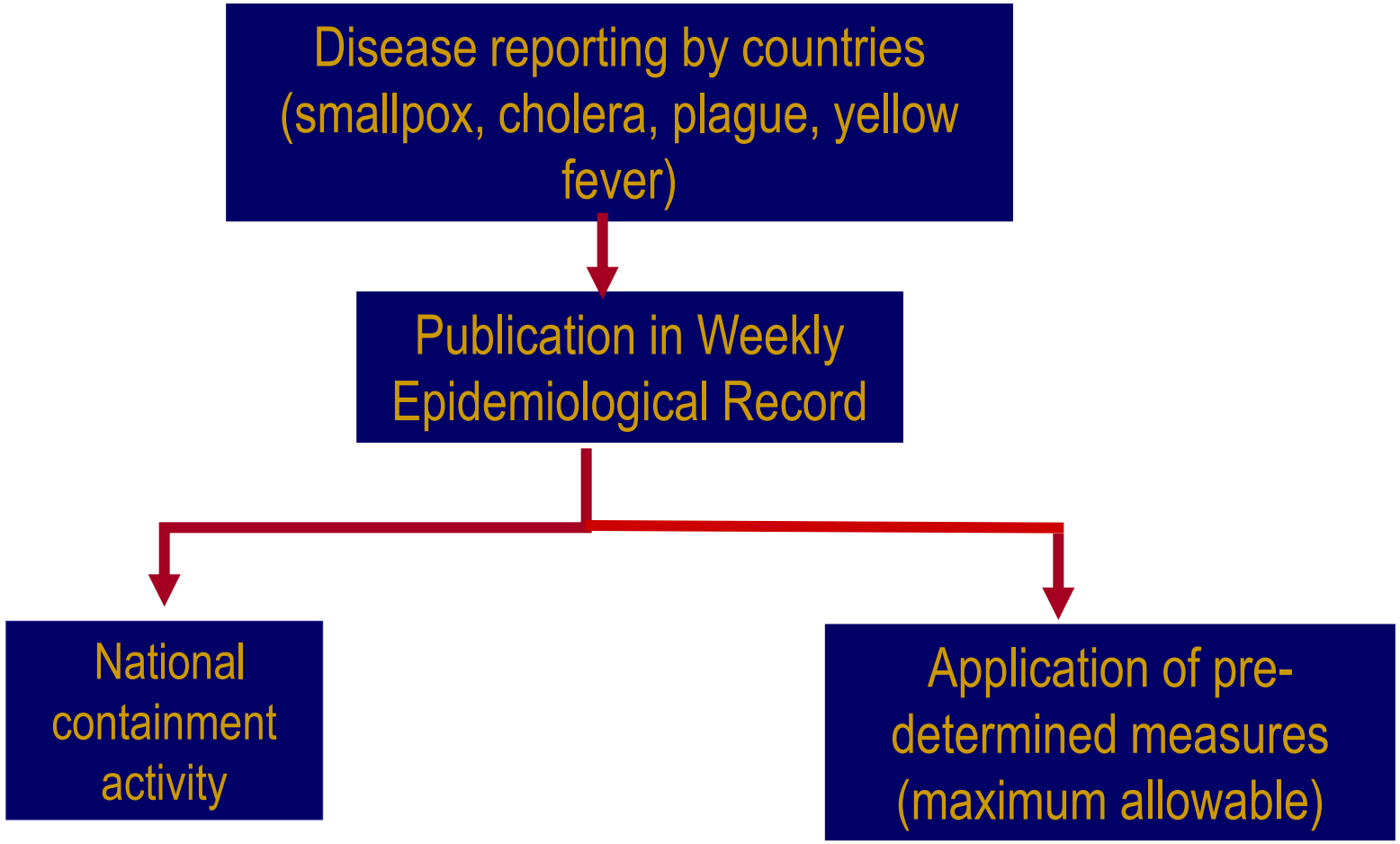


"Maximum protection against the international spread of infectious diseases with minimal interruption of international travel and trade."

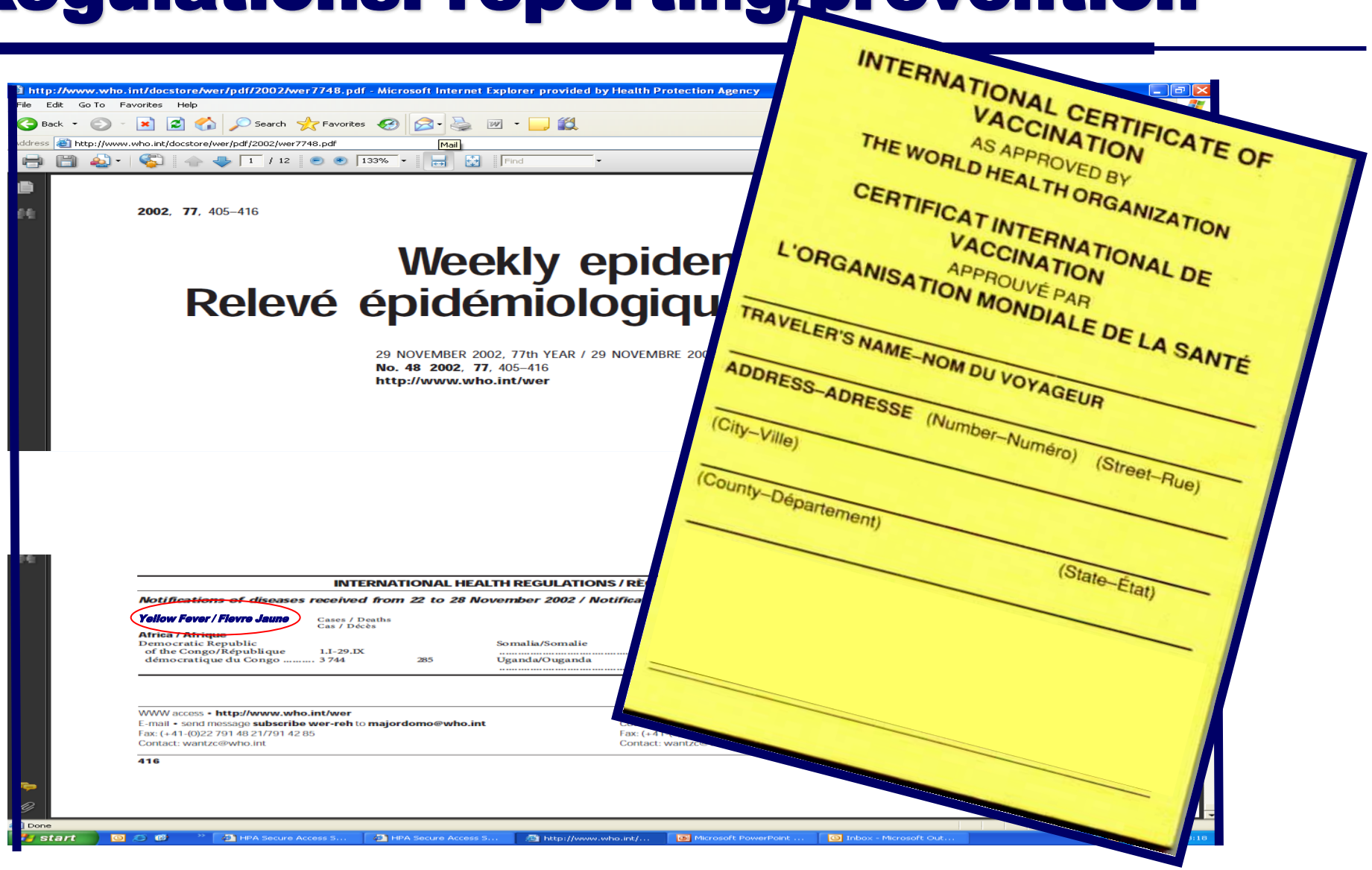
Content of International Health Regulations 1969: requirements

- Notification to WHO: cholera, plague, yellow fever or smallpox – reports only accepted from countries where event is occurring
- Health Measures: describe maximum measures that a country may require to protect against cholera, plague, smallpox and yellow fever (e.g. yellow fever vaccination card)
- Health Organization at borders: ports, airports and frontier posts adequately equipped to prevent vector proliferation

Application of International Health Regulations, 1969

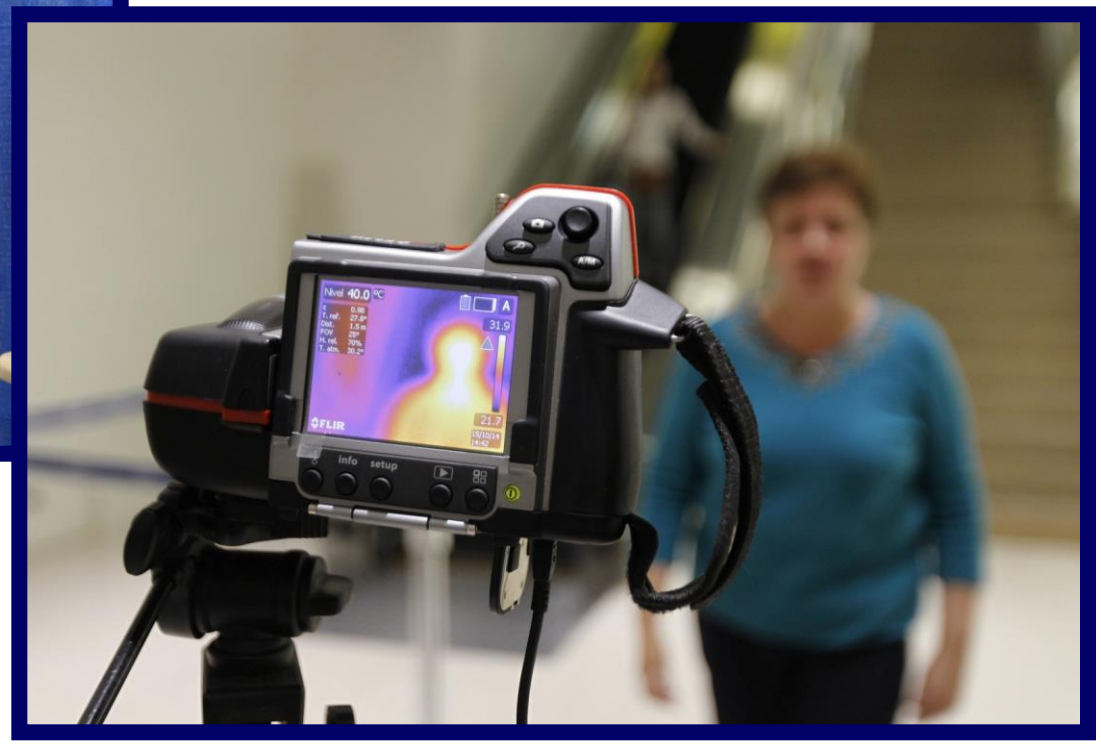


Application of International Health Regulations: reporting/prevention



International Health Regulations: vector control at seaports and on airplanes

International Health Regulations: disease detection at borders

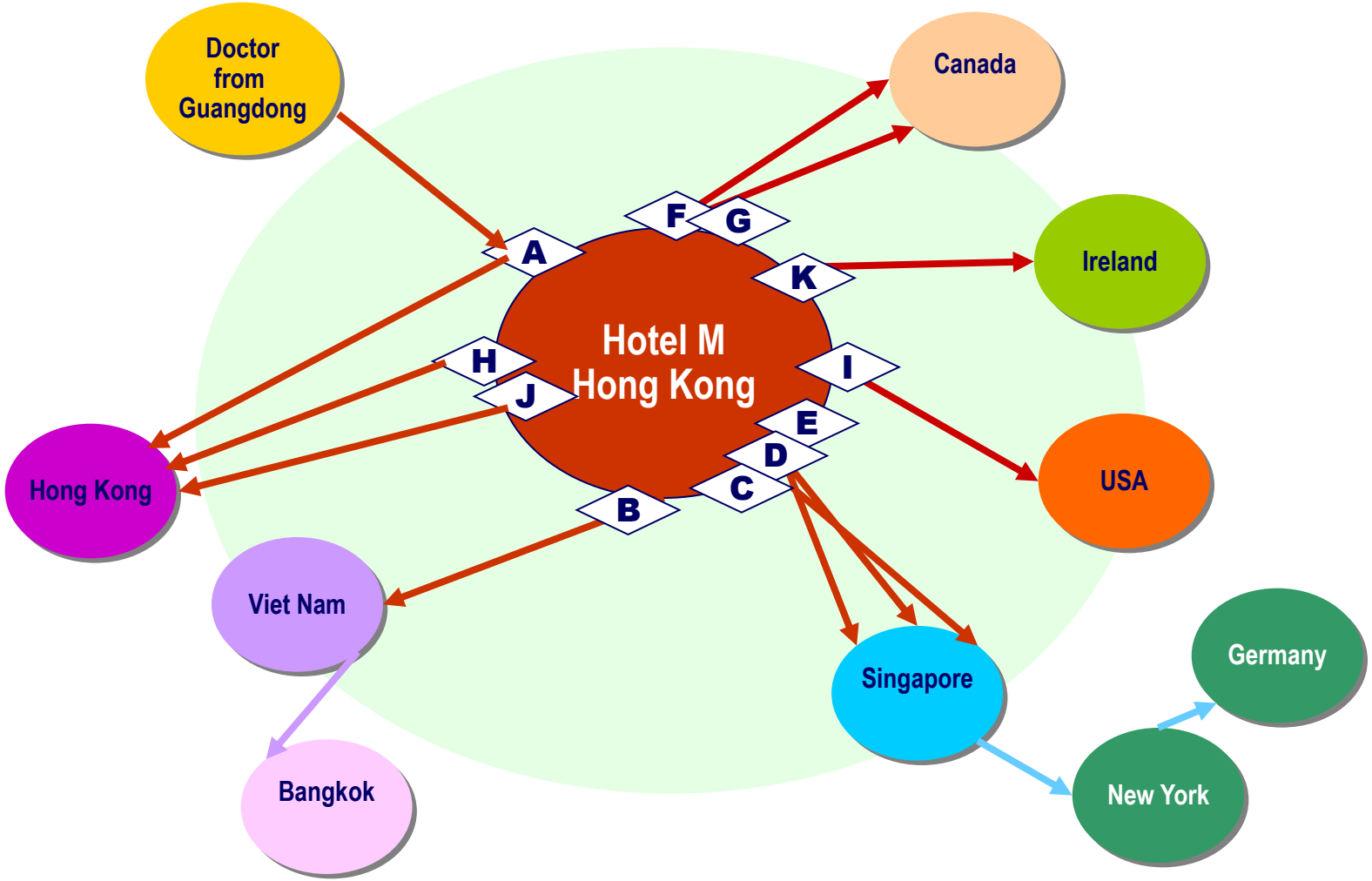


Application of International Health Regulations: quarantine

Health security 14th – 21st century

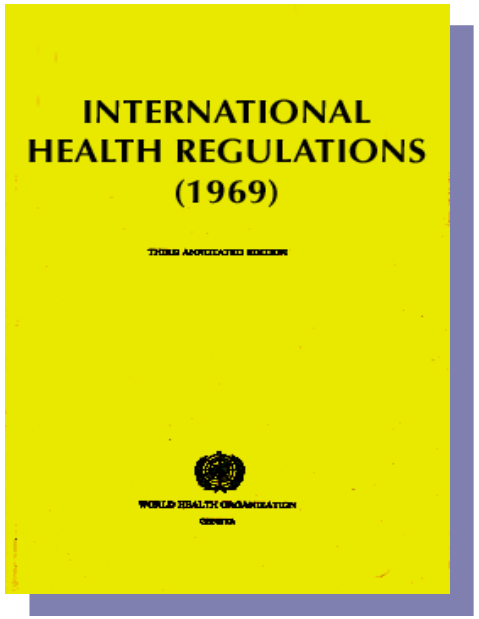
- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection

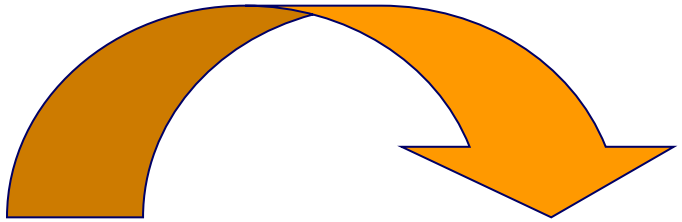
SARS: international spread from Hong Kong, 21 February – 12 March, 2003

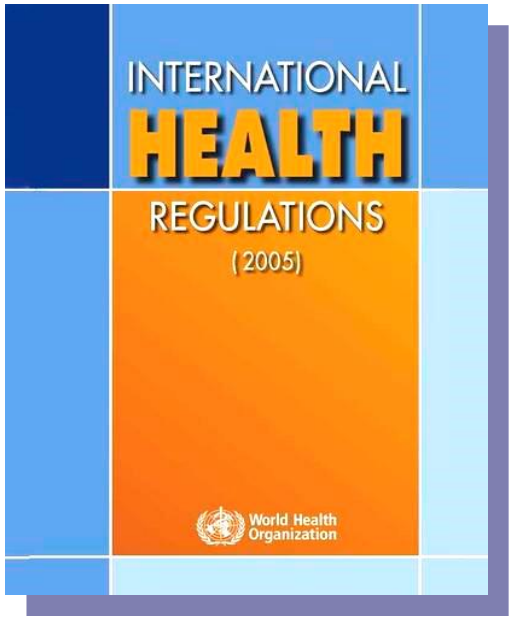


Source:
WHO/CDC

International Health Regulations 2005





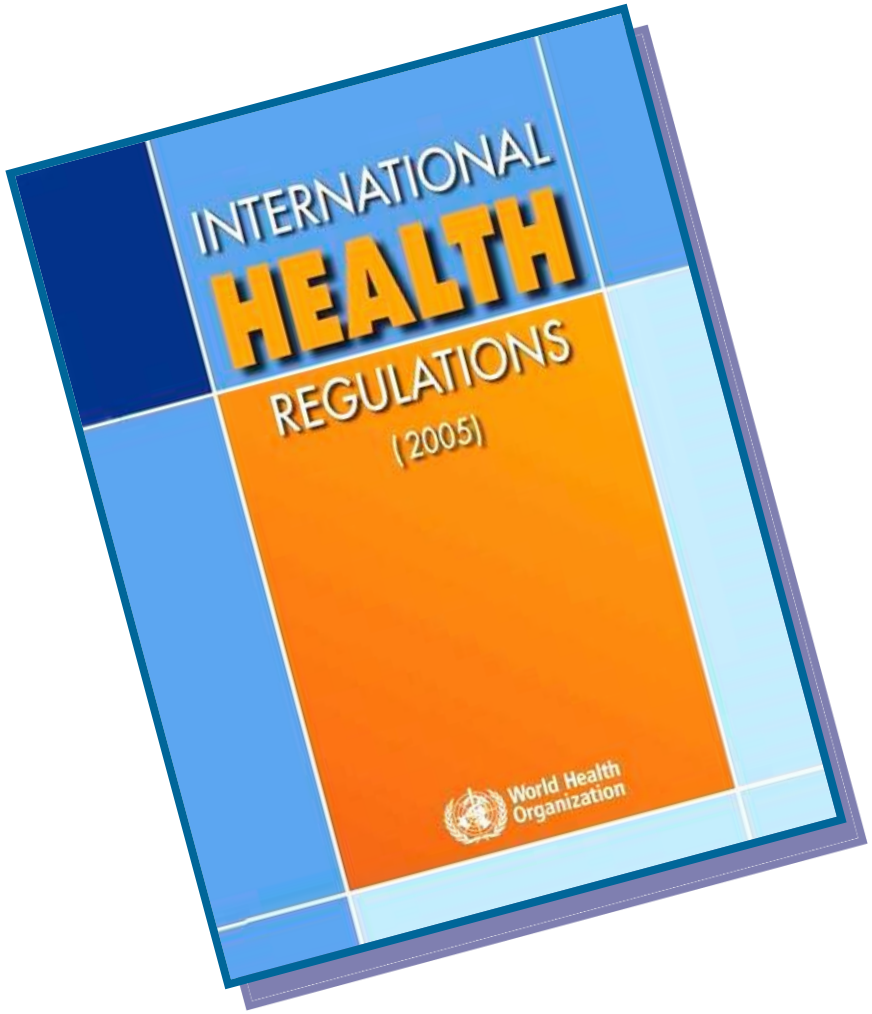


From **four diseases** to **all public health threats**

From **passive to pro-active using real time surveillance/evidence**

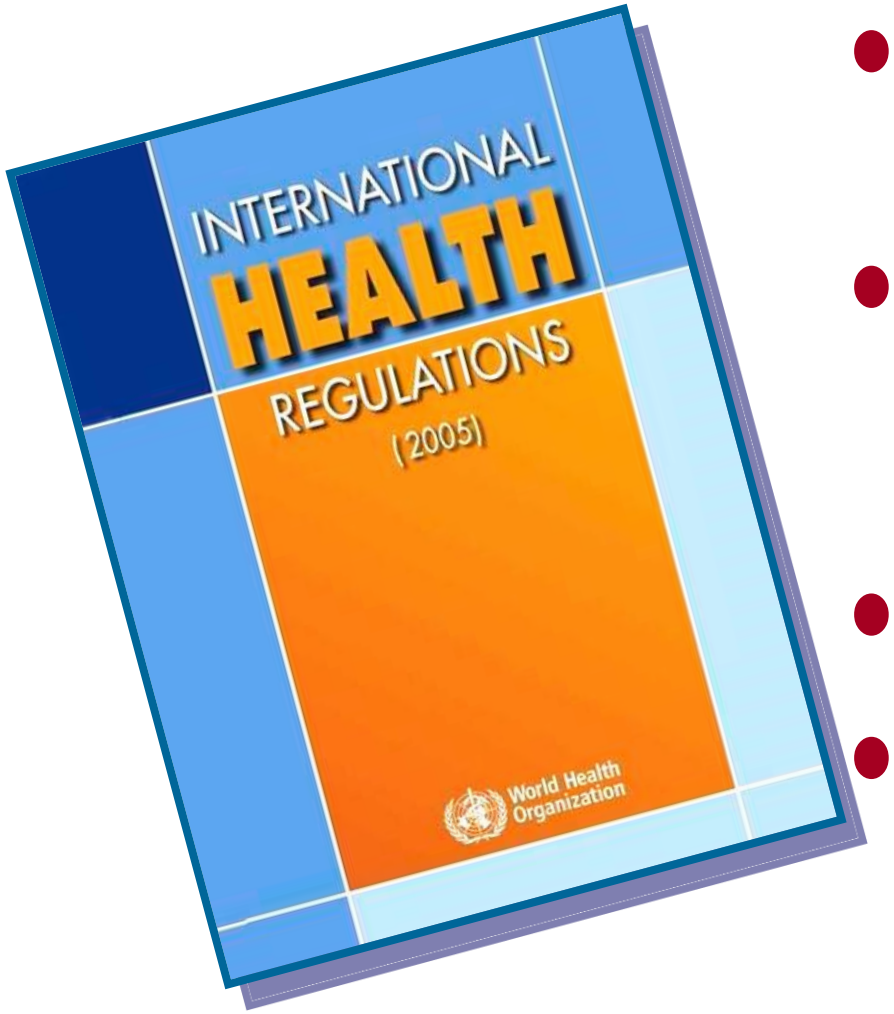
From **control at borders** to **detection and containment at source**

Requirements, International Health Regulations



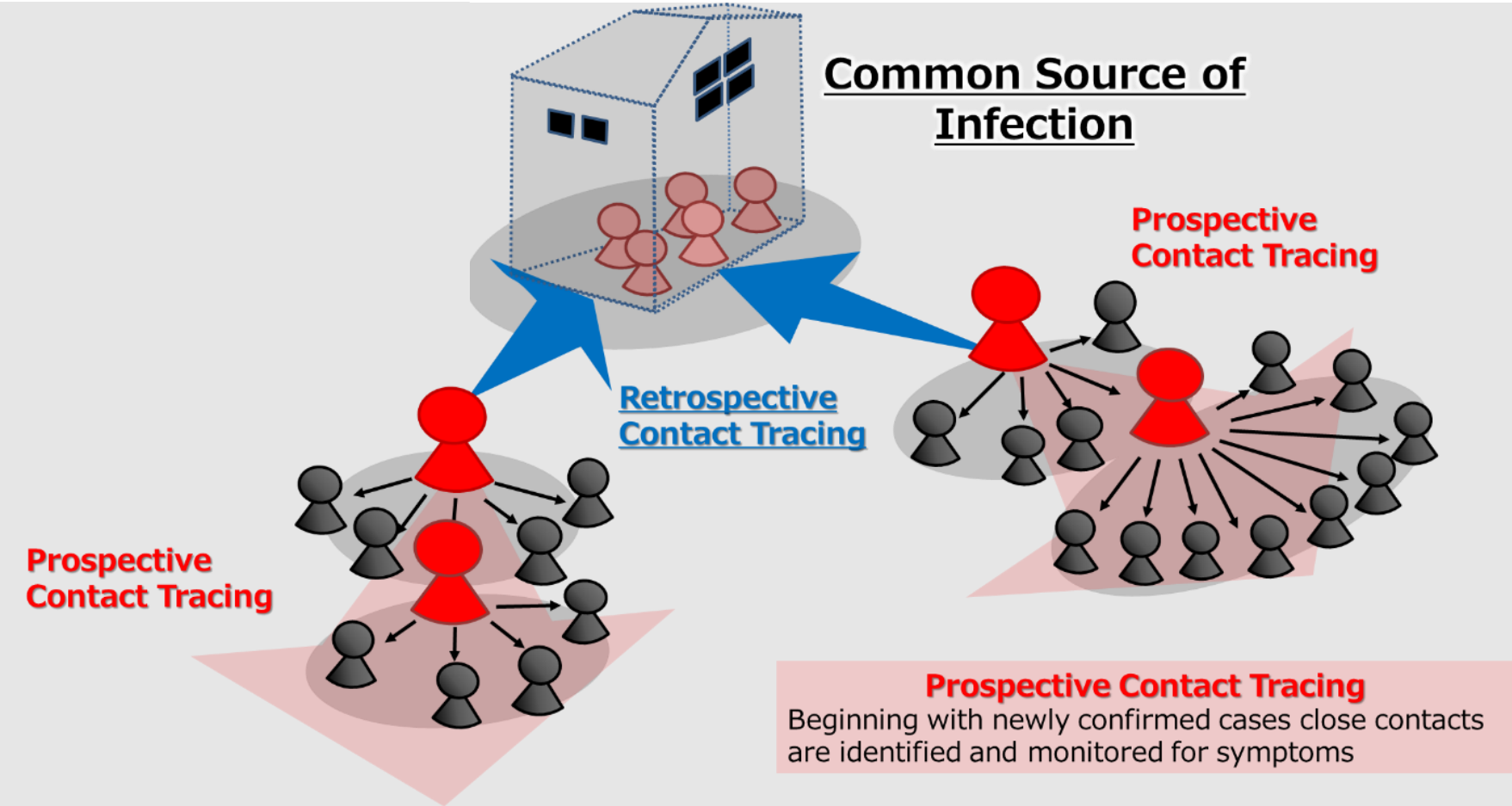
"Prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade."

Requirements, International Health Regulations



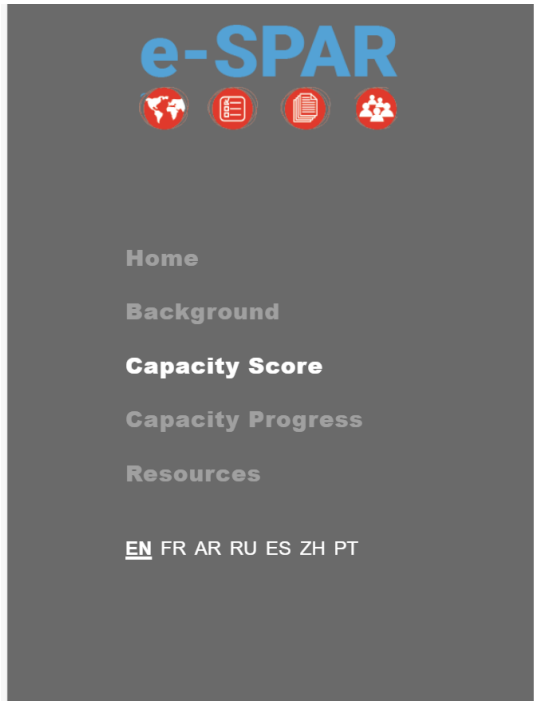
- **Strengthened national core capacity for surveillance and control**
- Mandatory reporting of possible public health emergency of international importance (PHEIC)
- Emergency Committee to advise DG
- Global response

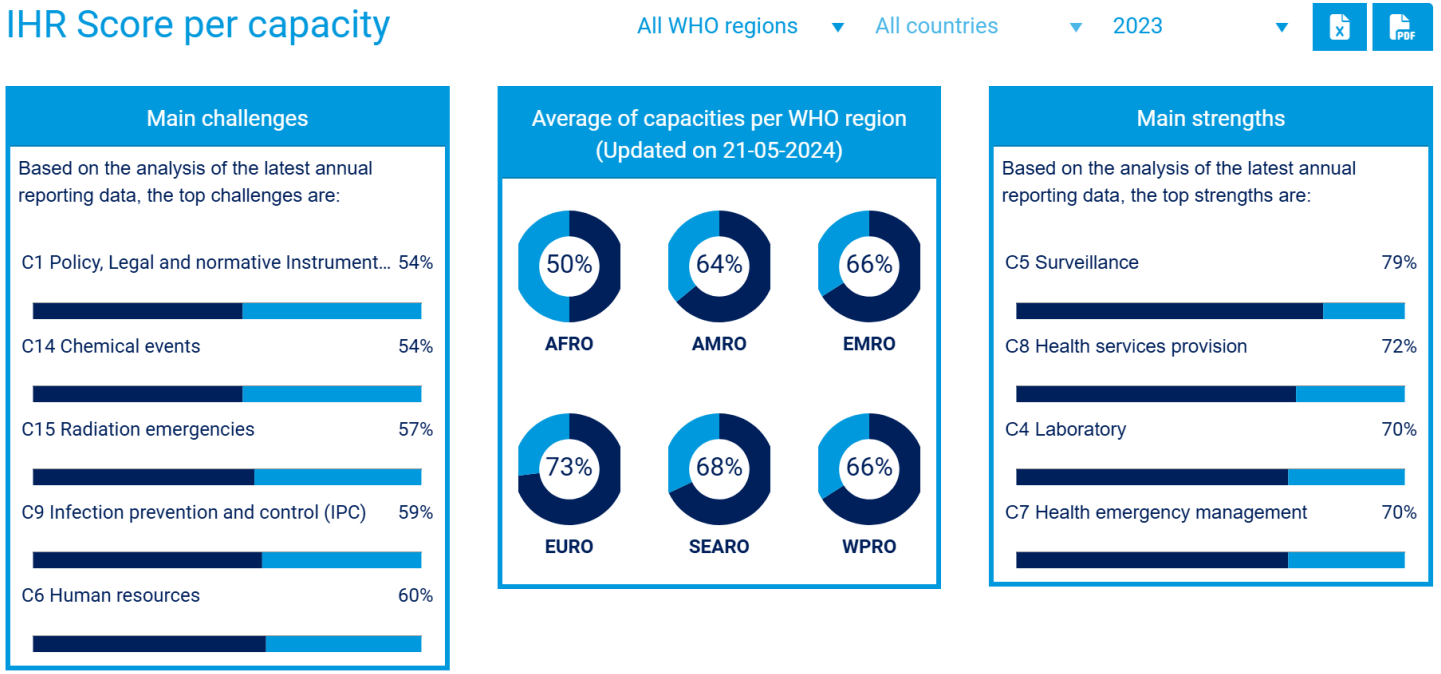
COVID-19 Japan: surveillance and contact tracing, targeted lockdowns



IHR core capacities in public health: annual self assessment

Annual IHR core capacities summary report

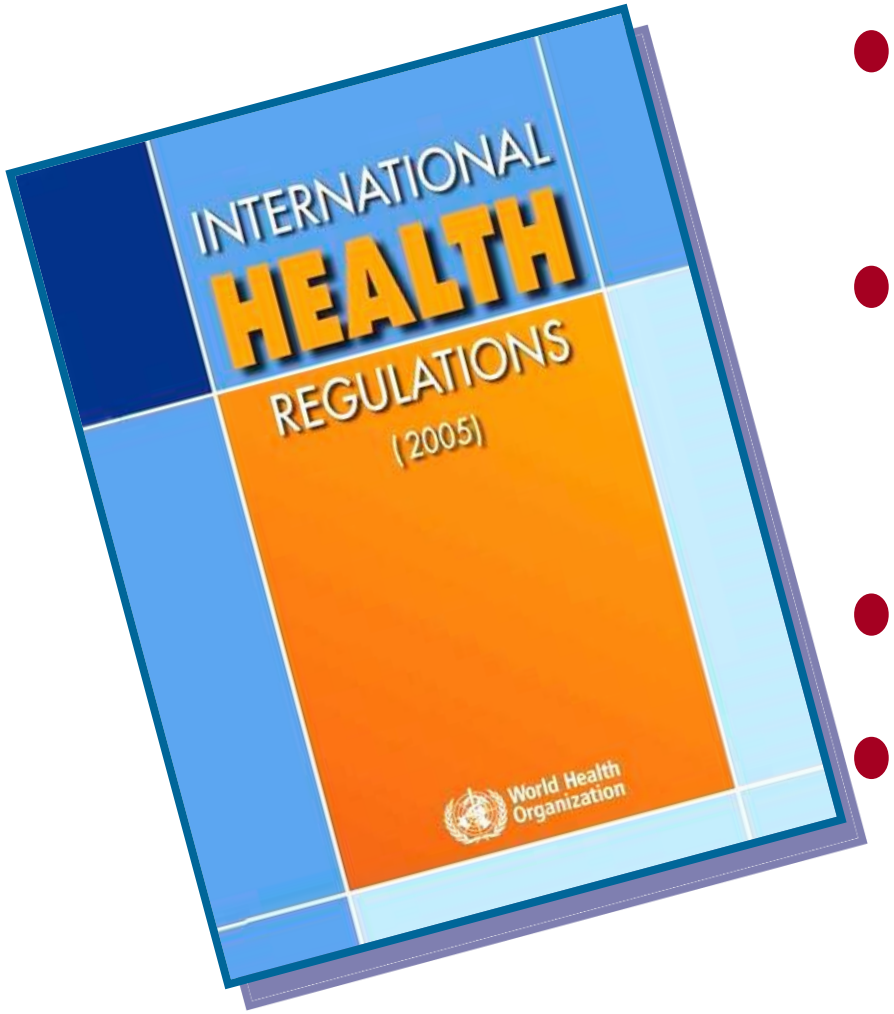




Health Security after IHR revision

- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection
- **Strong public health with detection, risk assessment and response**

Requirements, International Health Regulations



- Strengthened national core capacity for surveillance and control
- **Mandatory reporting of possible public health emergency of international importance (PHEIC)**
- **Emergency Committee to advise DG**
- **Global response**

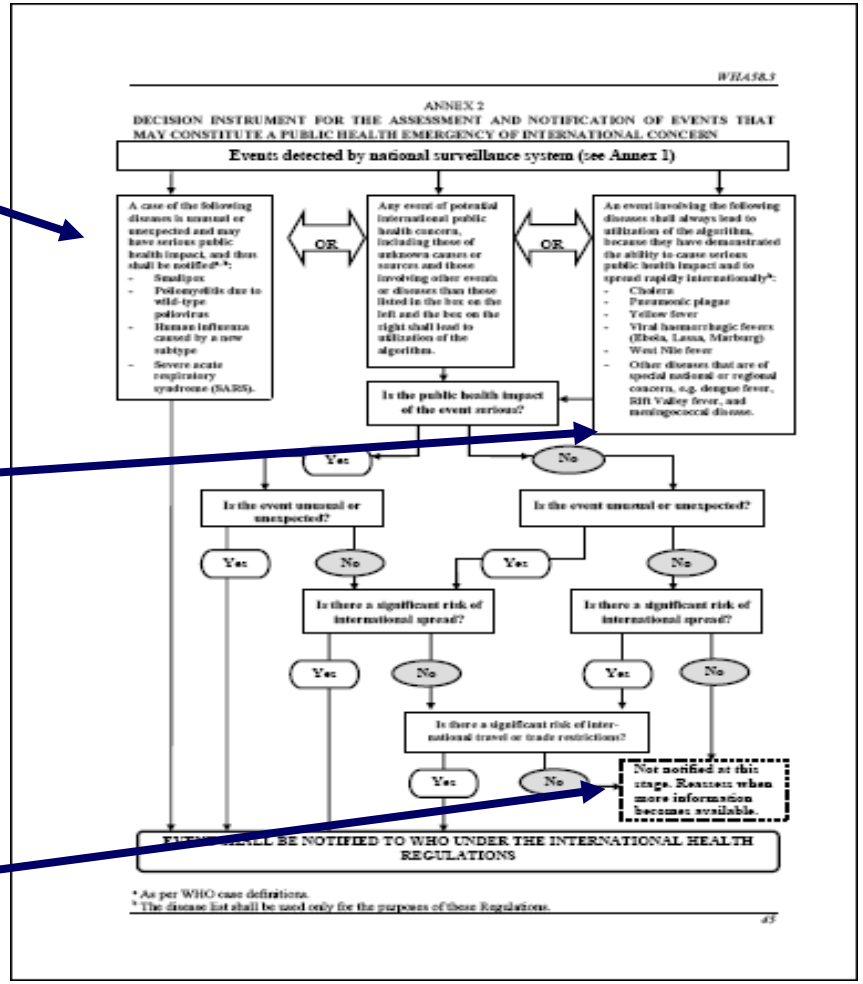
Decision instrument International Health Regulations, possible public health emergency of internatioanl concern (PHEIC)

4 diseases that shall be always be notified polio (wild-type polio virus), smallpox, human influenza new subtype, SARS.

Diseases that shall always lead to utilization of the algorithm: cholera, pneumonic plague, yellow fever, VHF (Ebola, Lassa, Marburg), WNF, others that are unusual or unexpected and cause:

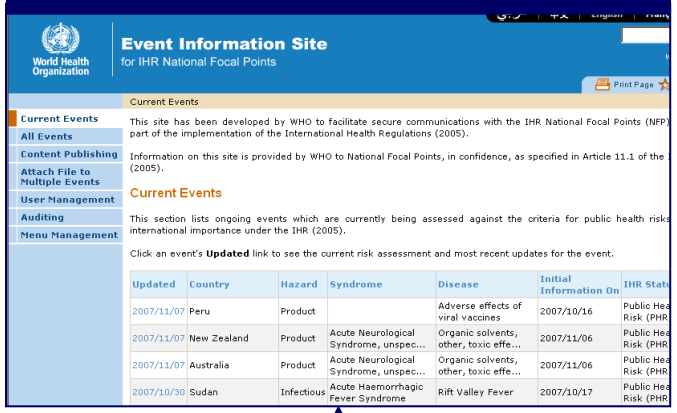
- serious public health impact
- risk of international spread
- risk of travel/trade restriction

Insufficient information: reassess as evidence becomes available



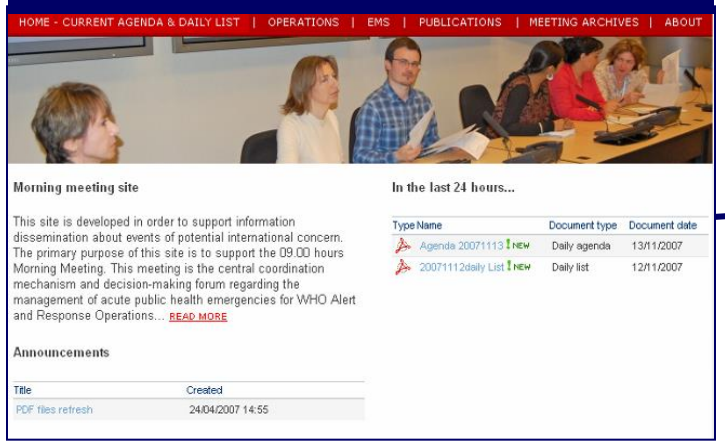
Event management system of the International Health Regulations

States Parties



Operations

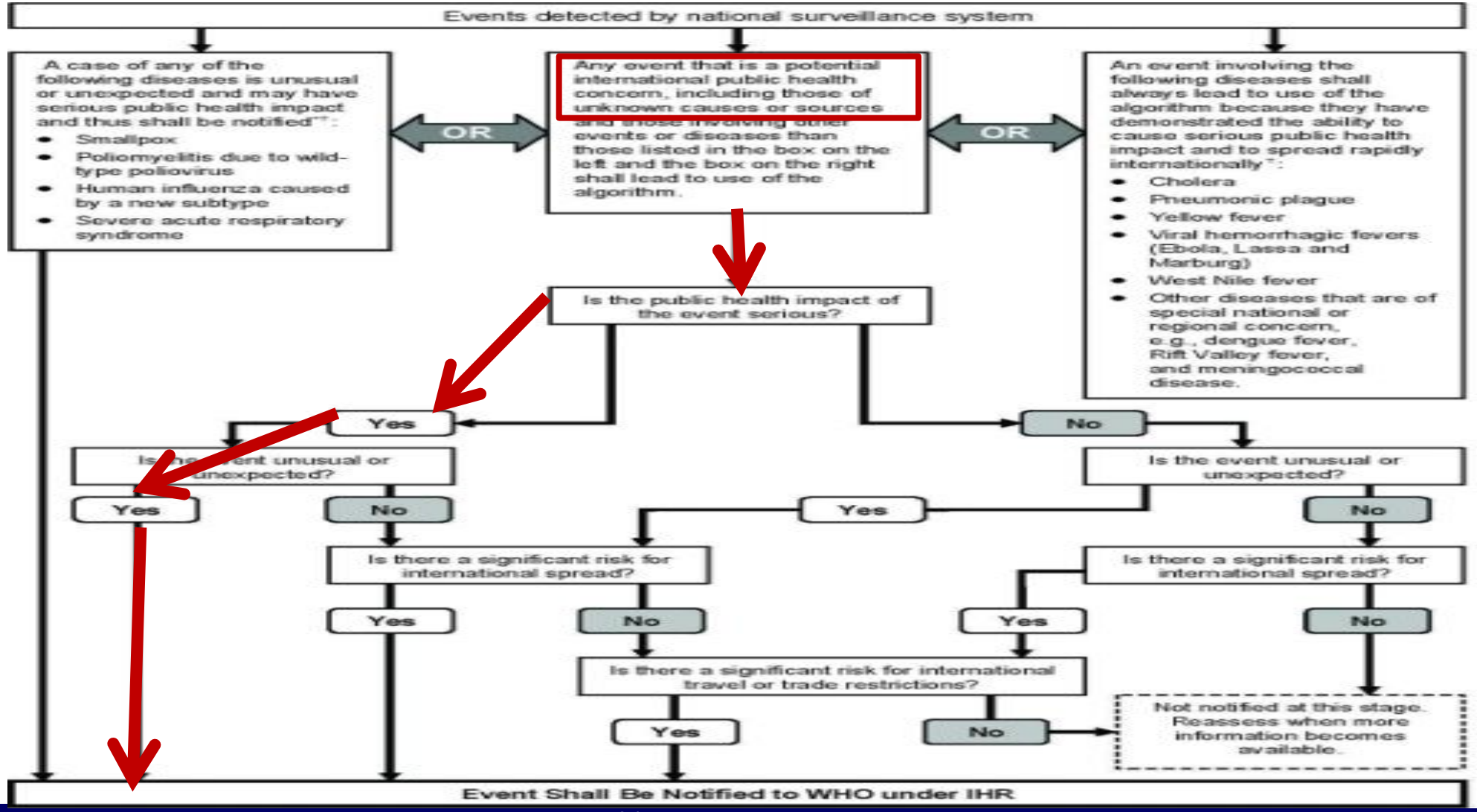
WHO Portal



Event Management System

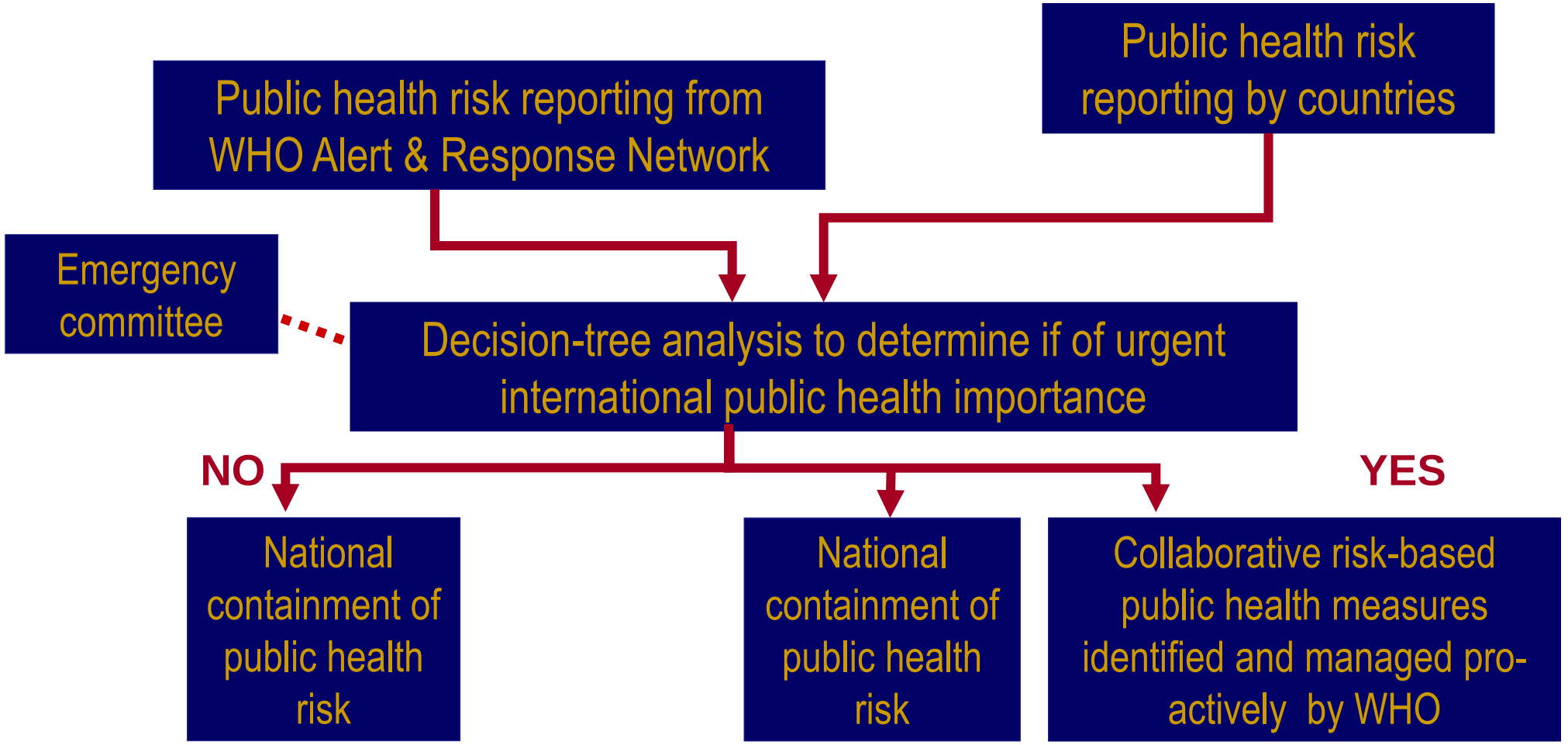
Zika, neurological disorders and microcephaly: is this a PHEIC?

Decision instrument International Health Regulations, Zika



IHR Emergency Committee, confirmation of PHEIC

Decision making and response and the revised International Health Regulations 2005



Health Security after IHR revision

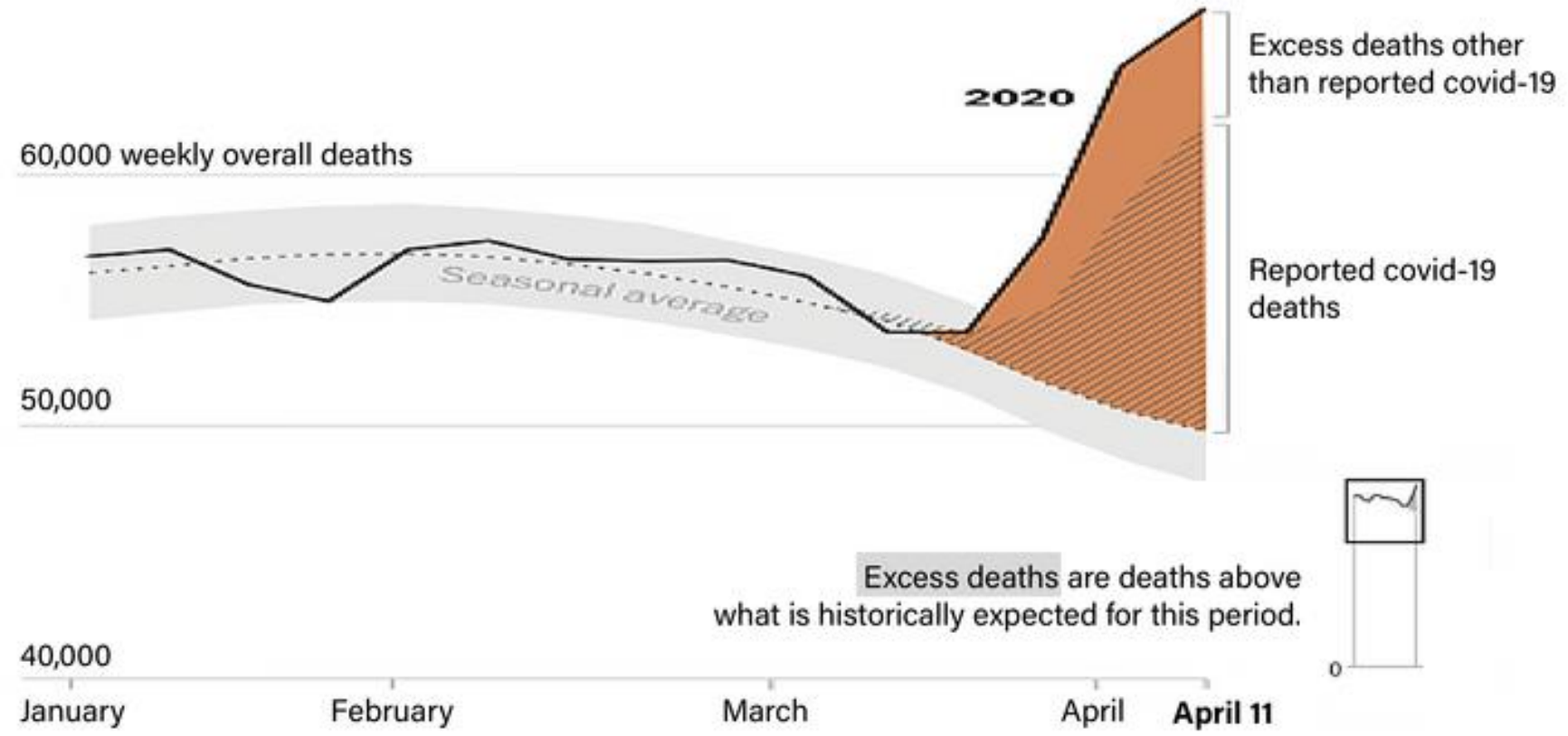
- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection
- **Strong public health with detection, risk assessment and response and the PHEIC safety net**

Health care collapse: West Africa (Ebola) and Italy (COVID-19)

Ebola outbreaks West Africa

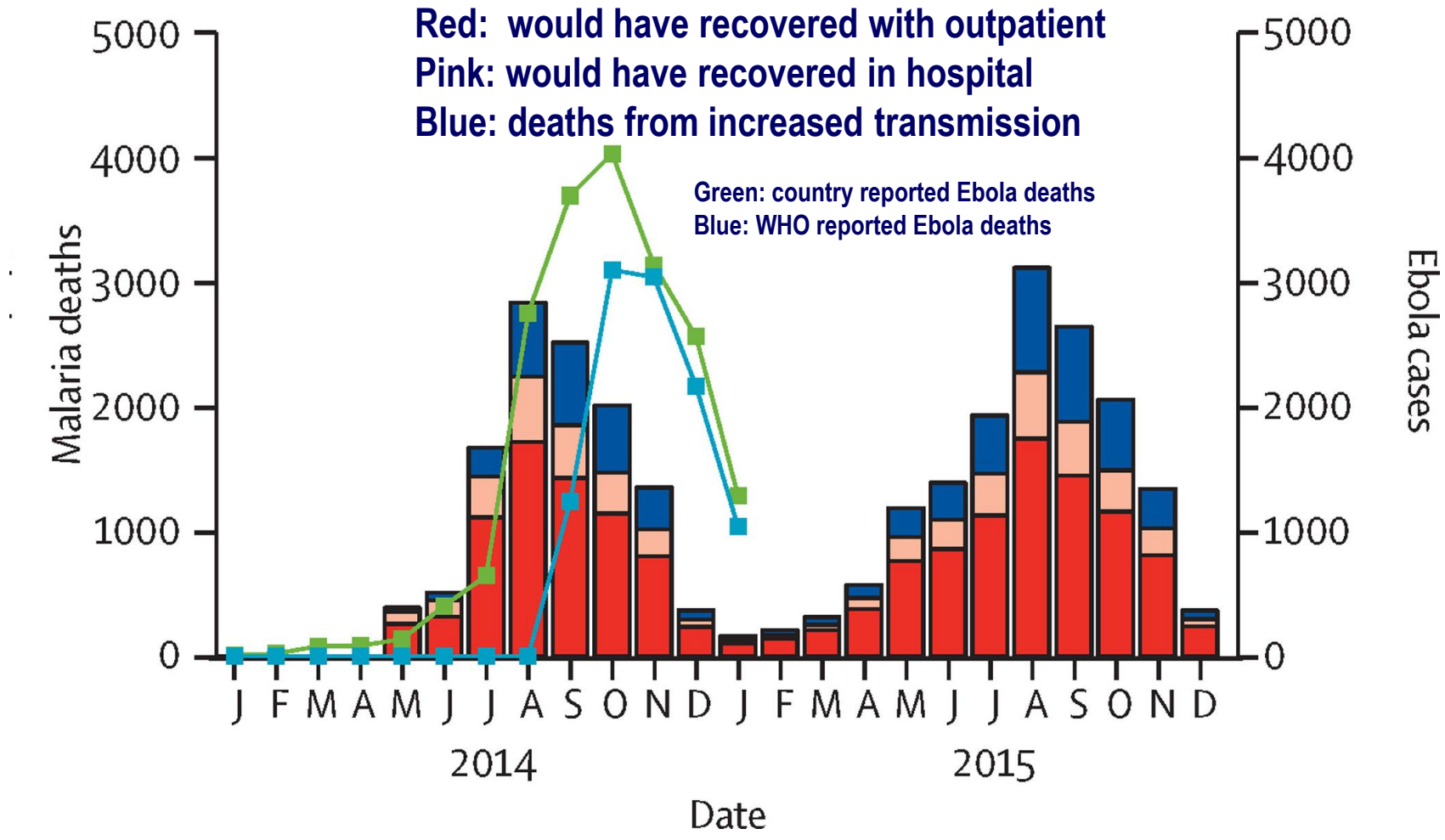
COVID-19 Europe

Failed healthcare resilience: United States, January to April 2020



Sources: Overall death data and covid-19 death counts come from the National Center for Health Statistics, and estimates for expected deaths come from the Yale School of Public Health's Modeling Unit.

Malaria deaths during West Africa Ebola outbreaks: Guinea, Liberia and Sierra Leone

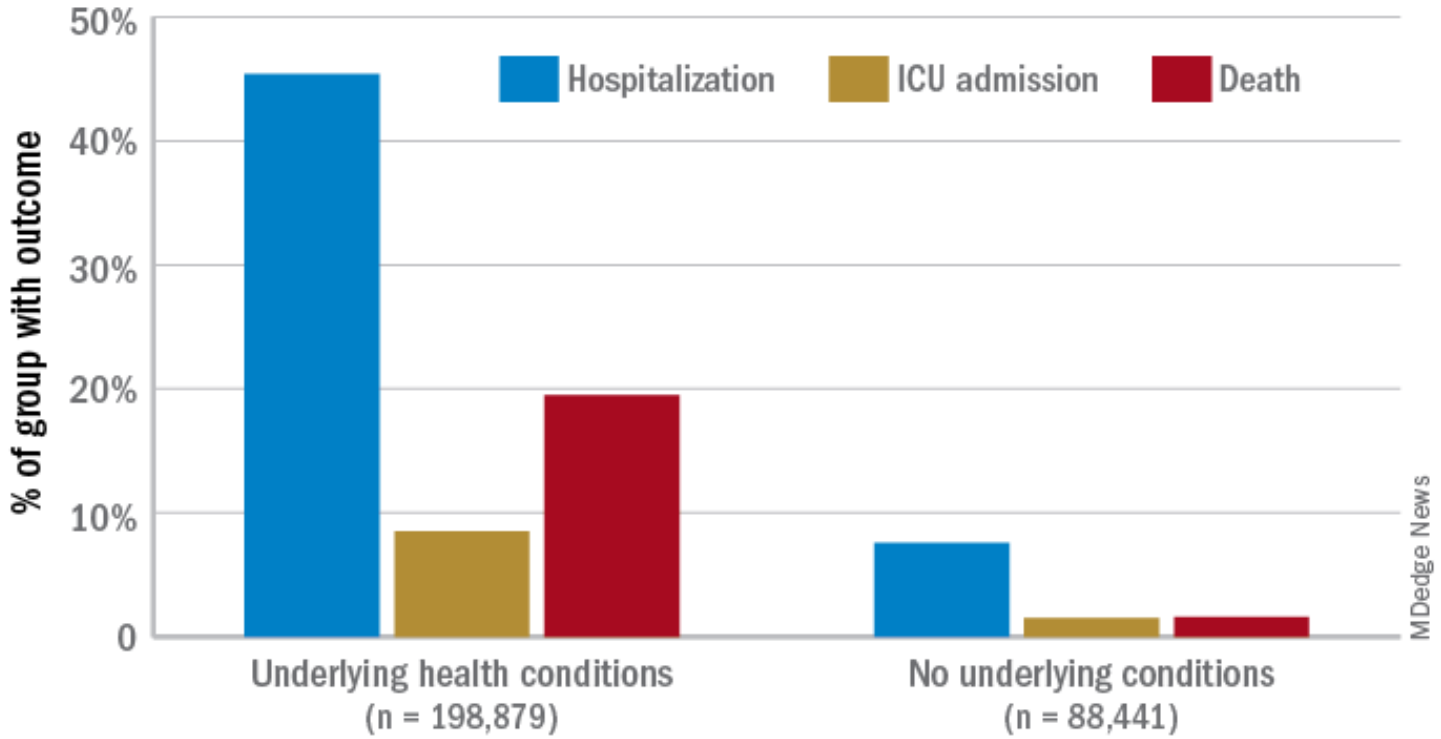


Malaria morbidity and mortality in Ebola-aff ected countries caused by decreased health-care capacity, and the potential eff ect of mitigation strategies: a modelling analysis Patrick G T Walker, Michael T White, Jamie T Griffi n, Alison Reynolds, Neil M Ferguson, Azra C Ghan

Health security after Ebola West Africa and COVID-19

- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection
- Strong public health with detection, risk assessment and response and the PHEIC safety net
- **Resilient healthcare with surge capacity and continuity of routine care**

Outcomes of patients with co-morbidities, United States, March – May 2020



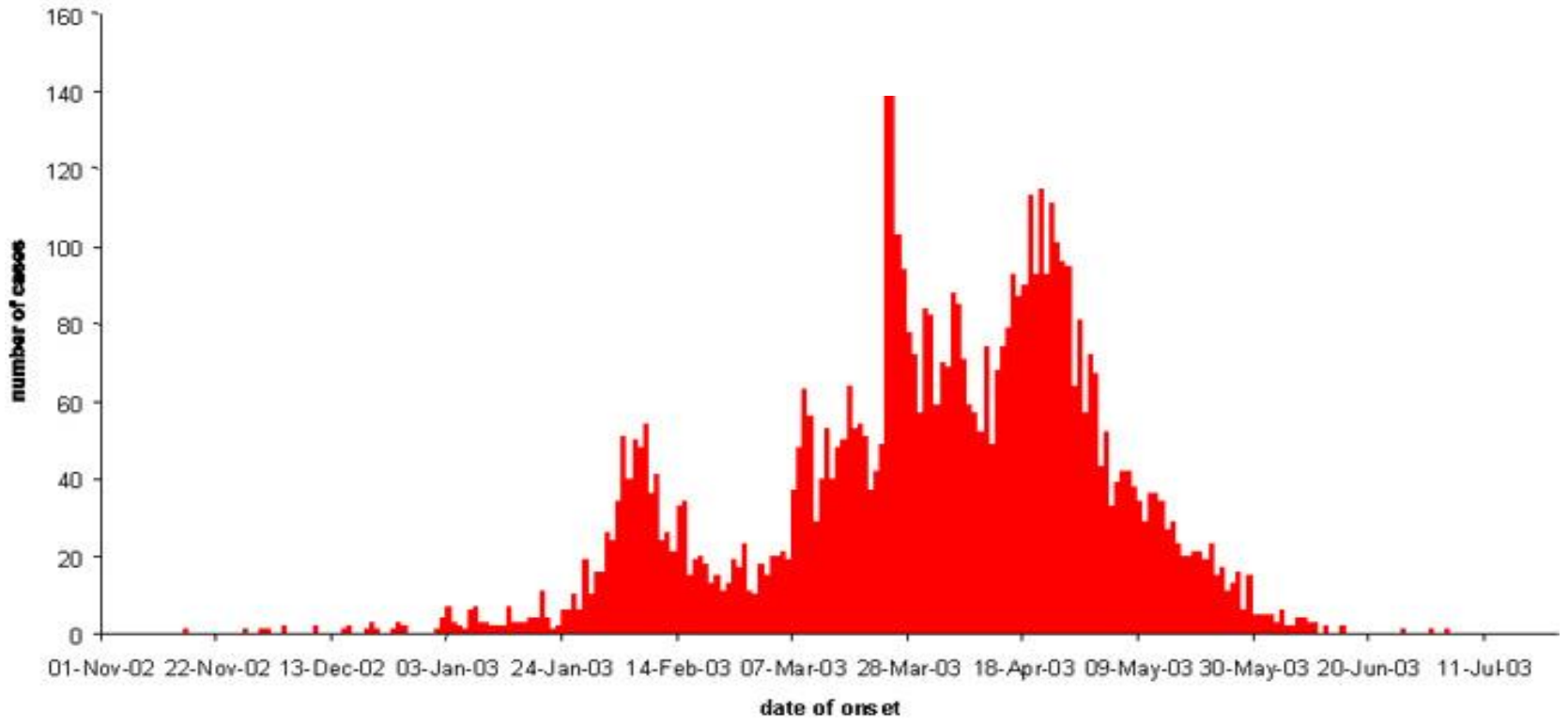
Notes: 1,761,503 cases were reported in the United States as of May 30, 2020. Outcome and underlying-condition status are unknown for the majority of those patients.

Source: MMWR. 2020 Jun 15;69(early release):1-7

Health security after COVID-19

- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection
- Strong public health with detection, risk assessment and response and the PHEIC safety net
- Resilient healthcare with surge capacity and continuity of routine care
- **Healthy populations that resist serious outcomes from infection**

SARS by date of onset worldwide, 1 March – 27 June 2003



*This graph does not include 2,527 probable cases of SARS (2,521 from Beijing, China), for whom no dates of onset are currently available.

SARS-like coronavirus antibody in civet cats, Guangdong Province, China

Volume 10, Number 12—December 2004

Dispatch

Antibodies to SARS-Coronavirus in Civets

Changchun Tu*[1], Gary Crameri†[1], Xiangang Kong‡, Jinding Chen§, Yanwei Sun¶, Meng Yu†, Hua Xiang*, Xianzhu Xia*, Shengwang Liu‡, Yunwen Hu§, Yedong Yu¶, Bryan T. Eaton†, Hua Xuan*✉, and Lin-Fa Wang†

Author affiliations: *Changchun University of Agriculture and Animal Sciences, Changchun, China; †CSIRO Livestock Industries, Geelong, Australia; ‡Harbin Veterinary Research Institute, Harbin, China; §South China Agriculture University, Guangzhou; China; ¶Guangdong Provincial Veterinary Station of Epidemic Prevention and Supervision, Guangzhou, China

Cite This Article

Abstract

Using three different assays, we examined 103 serum samples collected from different civet farms and a market in China in June 2003 and January 2004. While civets on farms were largely free from SARS-CoV infection, ≈80% of the animals from one animal market in Guangzhou contained significant levels of antibody to SARS-CoV, which suggests no widespread infection among civets resident on farms, and the infection of civets in the market might be associated with trading activities under the conditions of overcrowding and mixing of various animal species.

Source: Tu C, Crameri G, Kong X, Chen J, Sun Y, Yu M, et al. Antibodies to SARS-Coronavirus in Civets. Emerg Infect Dis. 2004;10(12):2244-2248. https://doi.org/10.3201/eid1012.040520

SARS-like coronavirus antibody, wet markets, Guangdong Province

MMWR Morb Mortal Wkly Rep. 2003 Oct 17;52(41):986-7.

Prevalence of IgG antibody to SARS-associated coronavirus in animal traders--Guangdong Province, China, 2003

Centers for Disease Control and Prevention (CDC)

PMID: 14561956

Free article

Abstract

Severe acute respiratory syndrome (SARS) was identified in 2003 as an infectious disease caused by the SARS-associated coronavirus (SARS-CoV), a member of the coronavirus family not observed previously in humans. Because its sequence data differ from that of known human coronaviruses, SARS-CoV is suspected to have crossed the species barrier between an animal host and humans. The SARS outbreak began in China's Guangdong Province, where approximately 1,500 probable cases were identified during November 2002-June 2003. Detection of SARS-like coronavirus has been reported previously in masked palm civets (sometimes called civet cats) and a raccoon dog for sale in a live animal market in Shenzhen municipality. This report summarizes results of an investigation conducted by public health authorities in Guangdong Province, which compared the seroprevalence of SARS-CoV IgG antibody in animal traders (i.e., workers in live animal markets) with that of persons in control groups. The results indicated that 13% of the animal traders, none of whom had SARS diagnosed, had IgG antibody to SARS-CoV, compared with 1%-3% of persons in three control groups. Although the results provide indirect support for the hypothesis of an animal origin for SARS, they also underscore the need for detailed patient histories and more focused animal studies to confirm an animal origin for SARS.

Translation of research into public health action to prevent emergence

- Educate animal traders and live market workers ab… emerging infections and how to prevent the…
- Educate general populations about t… … with live animal markets and provide i… …w to prevent emergence
- Develop a v… … animals at wild animal farms

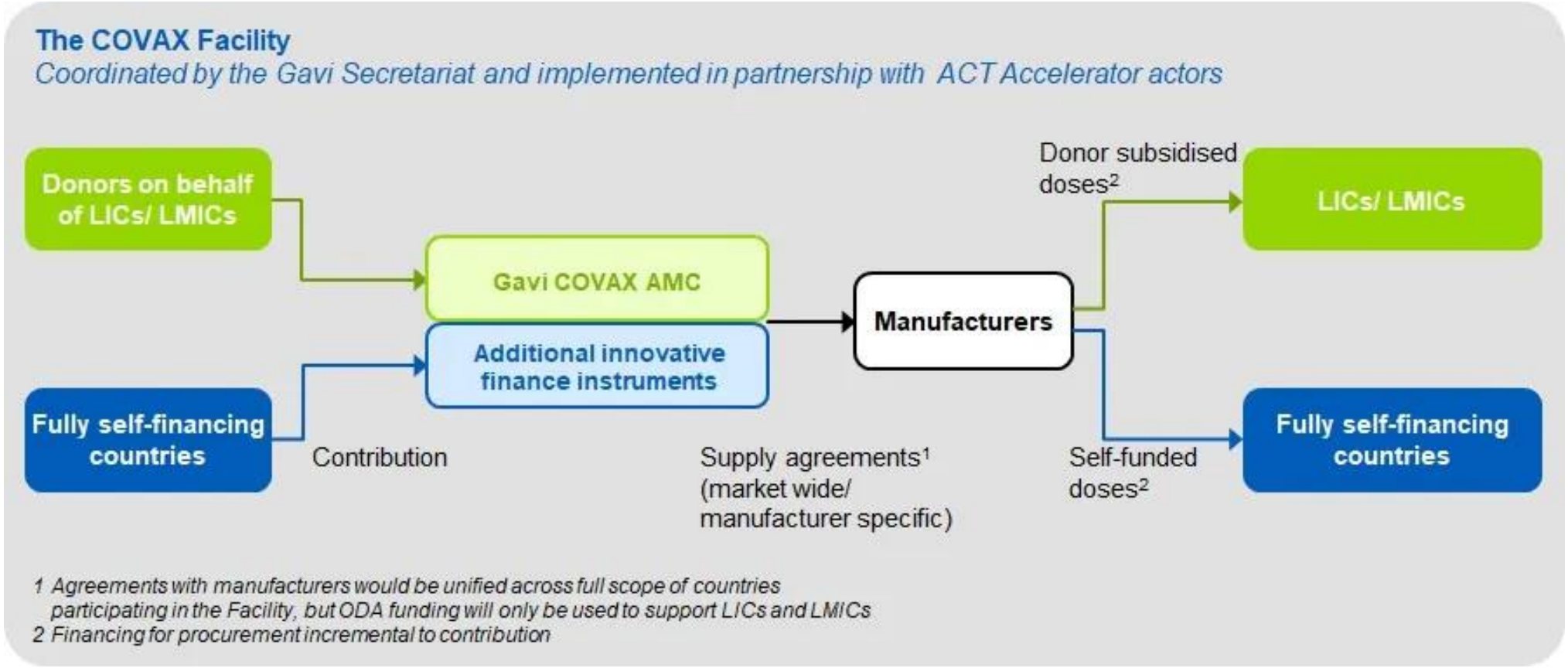
The Chinese response: legislation making it illegal to sell wild animals

…rking together of animal, human, enviornmental and commercial sectors

Health security

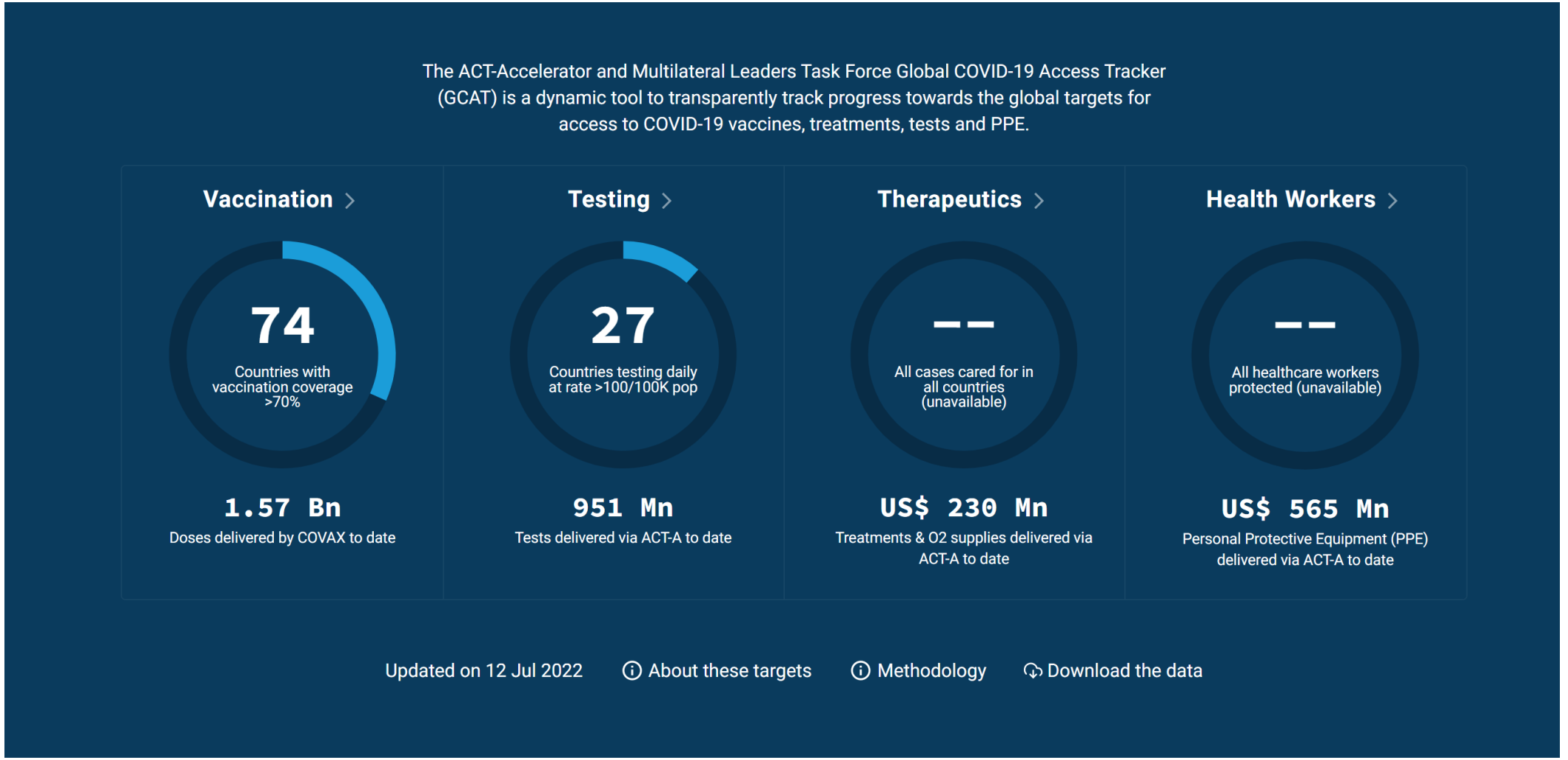
- Border requirements to protect against the international spread of infectious diseases at borders with quarantine, rodent and vector control, vaccination and border detection
- Strong public health with detection, risk assessment and response and the PHEIC safety net
- Resilient healthcare with surge capacity and continuity of routine care
- Healthy populations that resist serious outcomes from infection
- **Working together of animal, human and environment sectors**

Equitable access: COVID-19 vaccines and the COVAX Facility



Funding and funding gaps, ACT Accelerator, 18 March, 2022

ACT Accelerator access tracker, 13 July, 2022



Health security 2025

- Border requirements to protect against t… national spread of infectious diseases at bo… th quarantine, rodent and vector control, vacci… and border detection
- Strong public health with d… risk assessment and response and the PHEI… net
- Resilient healthcar… rge capacity and continuity of routine care
- Healthy po… that resist serious outcomes from infectio…
- Wo… gether of animal, human and environment sectors

Underpinned by more equitable access

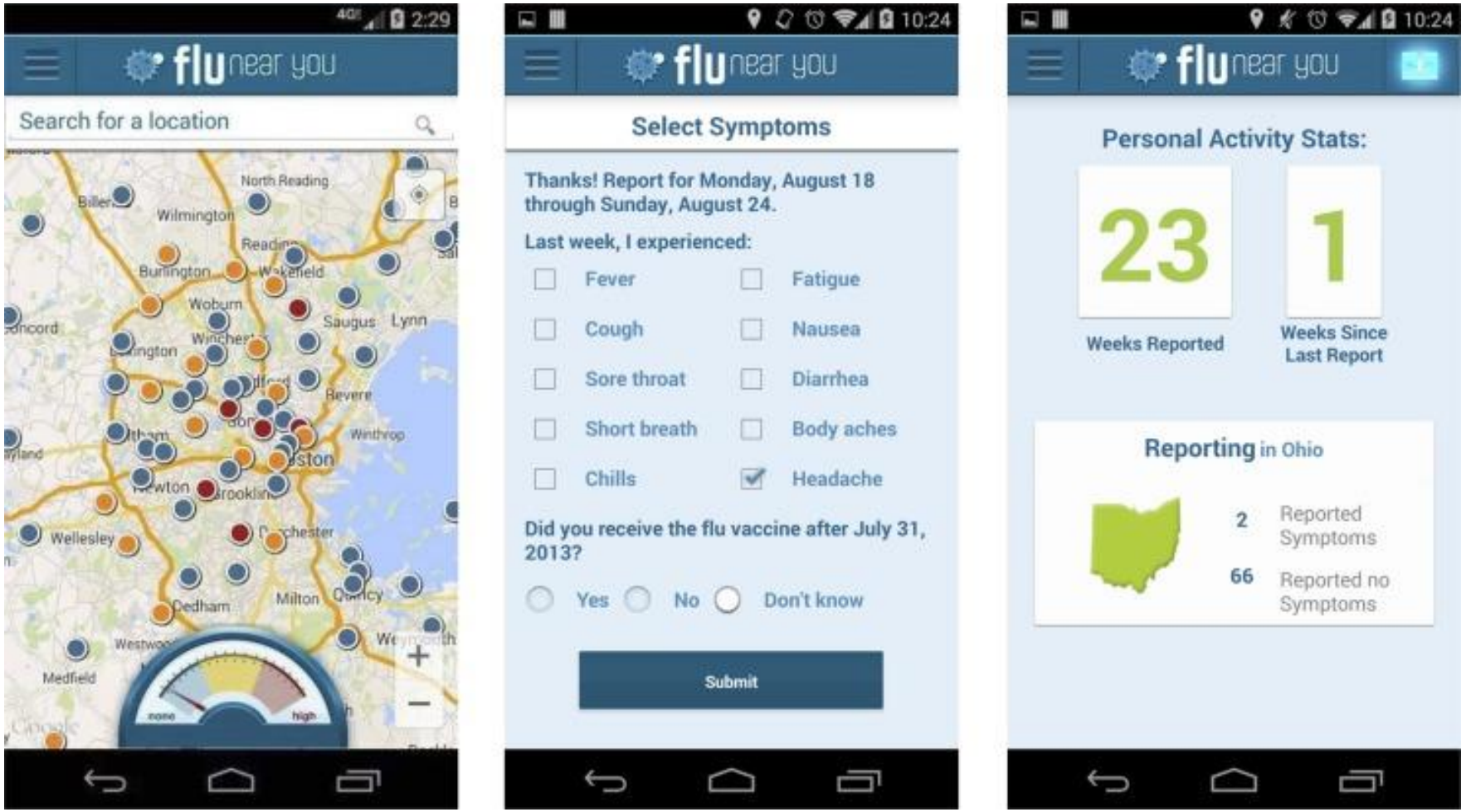
Strengthening national health security: surveillance for more rapid detection and response

Community reporting and alert using handheld devices

Participatory Surveillance
“Flu near you” USA

- **Data collection:** Smartphone and web applications for community members to report respiratory symptoms consistent with Influenza-like illness (ILI)
- **Laboratory testing:** None associated
- **Action:** Local, regional and national collation to signal any necessary action

Flu Near You, participatory surveillance, USA



Ending Pandemics Flu Near You

Flu Near You, participatory surveillance, USA

Collective understanding of influenza at local, regional and national levels

[Ending Pandemics Flu Near You]

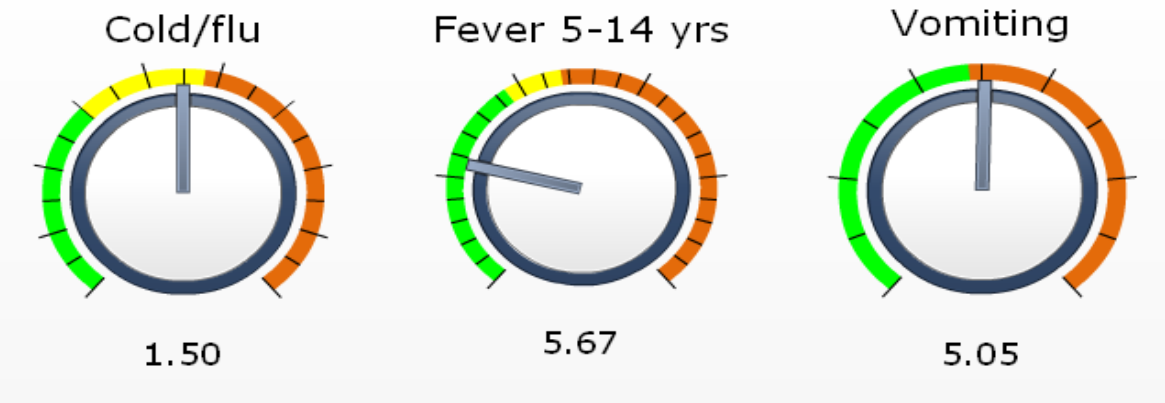
Automatic syndromic surveillance

Syndromic surveillance : NHS Direct databases

- Telephone health line manned by nurses
- Over 300 clinical algorithms used to assess patients symptoms
- Daily calls automatically monitored for 10 syndromes including: cold/flu, cough, fever, diarrhoea, vomiting

Automatic Digital Surveillance and Thresholds, UK

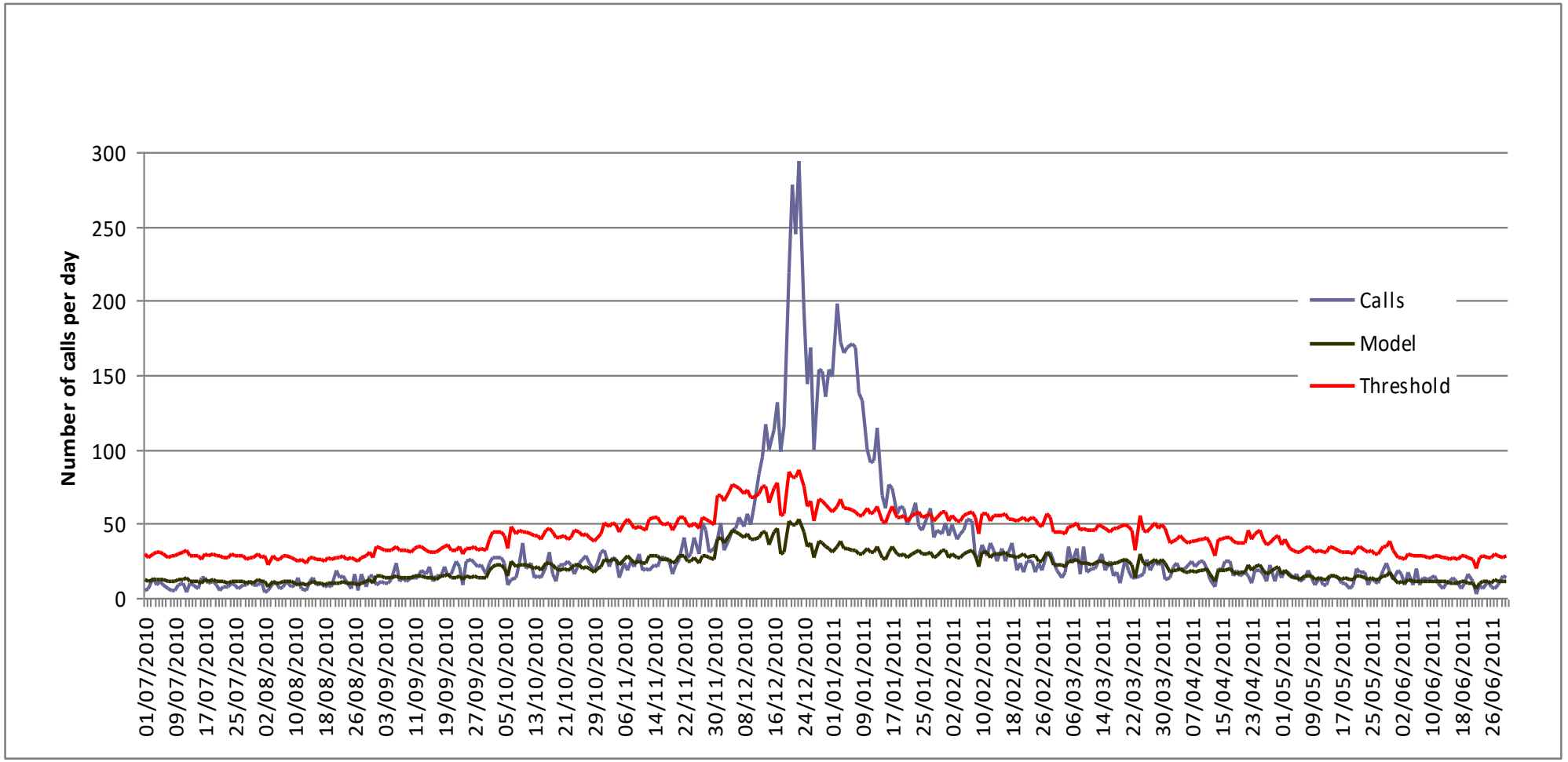
NHS Direct Syndromic Dashboard



- **Source:** Telephone health line manned by nurses and emergency dept records
- **Reporting:** Over 300 clinical algorithms used to assess patients symptoms
- **Collection:** Daily records automatically monitored for 10 syndromes including: cold/flu, cough, fever, diarrhoea, vomiting
- **Action:** standard investigation protocol implemented

Influenza and norovirus threshold key:
GREEN: Call numbers are within baseline levels
YELLOW: Call numbers are approaching early warning thresholds suggesting increasing community activity
ORANGE: Early warning thresholds have been breached indicating increased community activity

Calls to NHS Direct in London, coded to syndromic cold/flu indicator



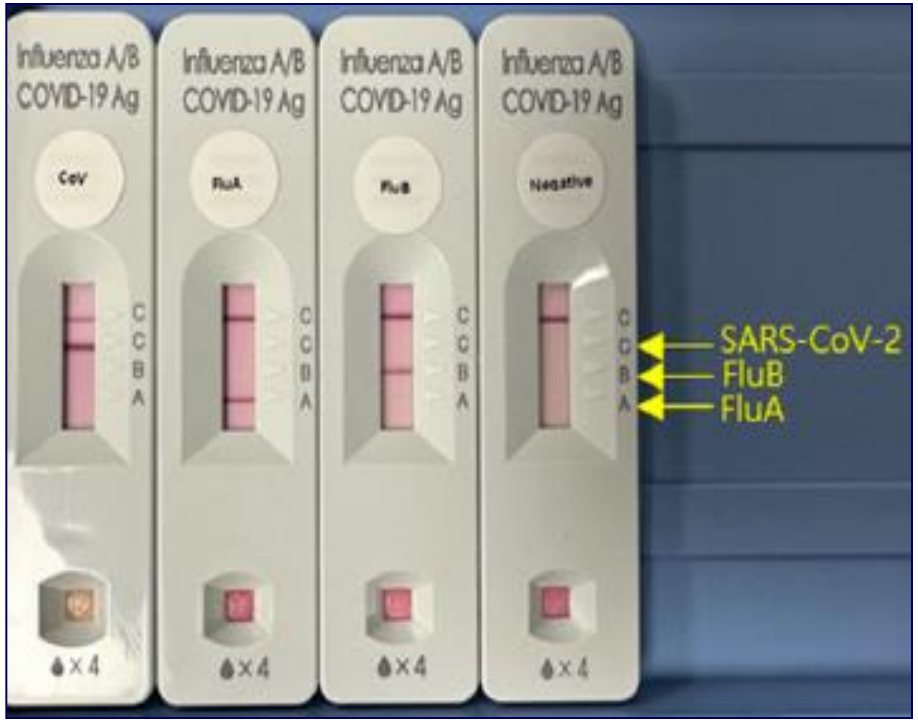
Digital surveillance mapping

HealthMap: digital mapping App

HealthMap: digital mapping website

Closer to patient laboratory testing

Tests for Confirming Clinical Diagnosis and Surveillance



Multiplex rapid antigen tests for use with ILI surveillance samples:

Increase of near-Point-of-Care Molecular Platforms

Plug and play format:

- 2-3 minutes hands-on time
- 5 – 75 minutes to result
- Data connectivity
- Multiplex testing complements syndromic surveillance to confirm cause of outbreak at source
  - Respiratory panel
  - Gastroenteric panel
  - Fever panel
  - Neuro panel

Genomic sequencing and environmental surveillance

Genomic Sequencing – decreased cost, increased accessibility

Lab Instruments for sequencing & fragment analyses

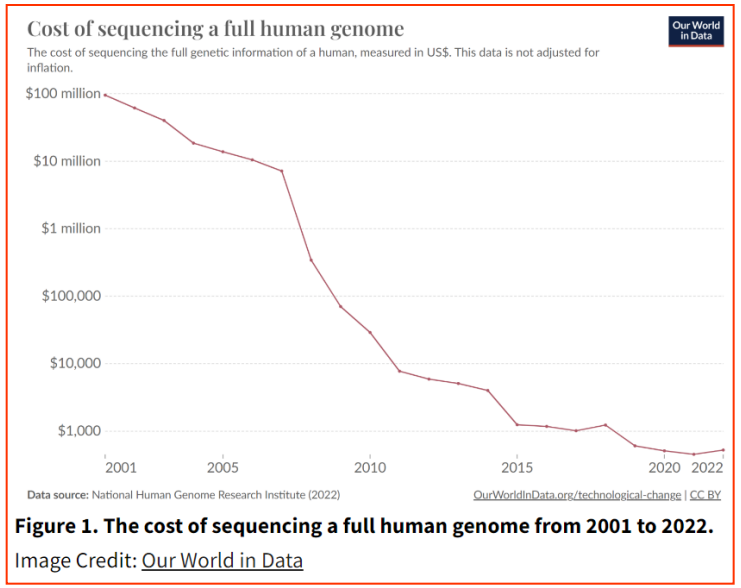
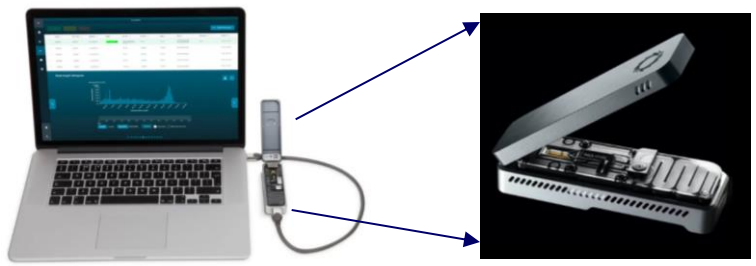
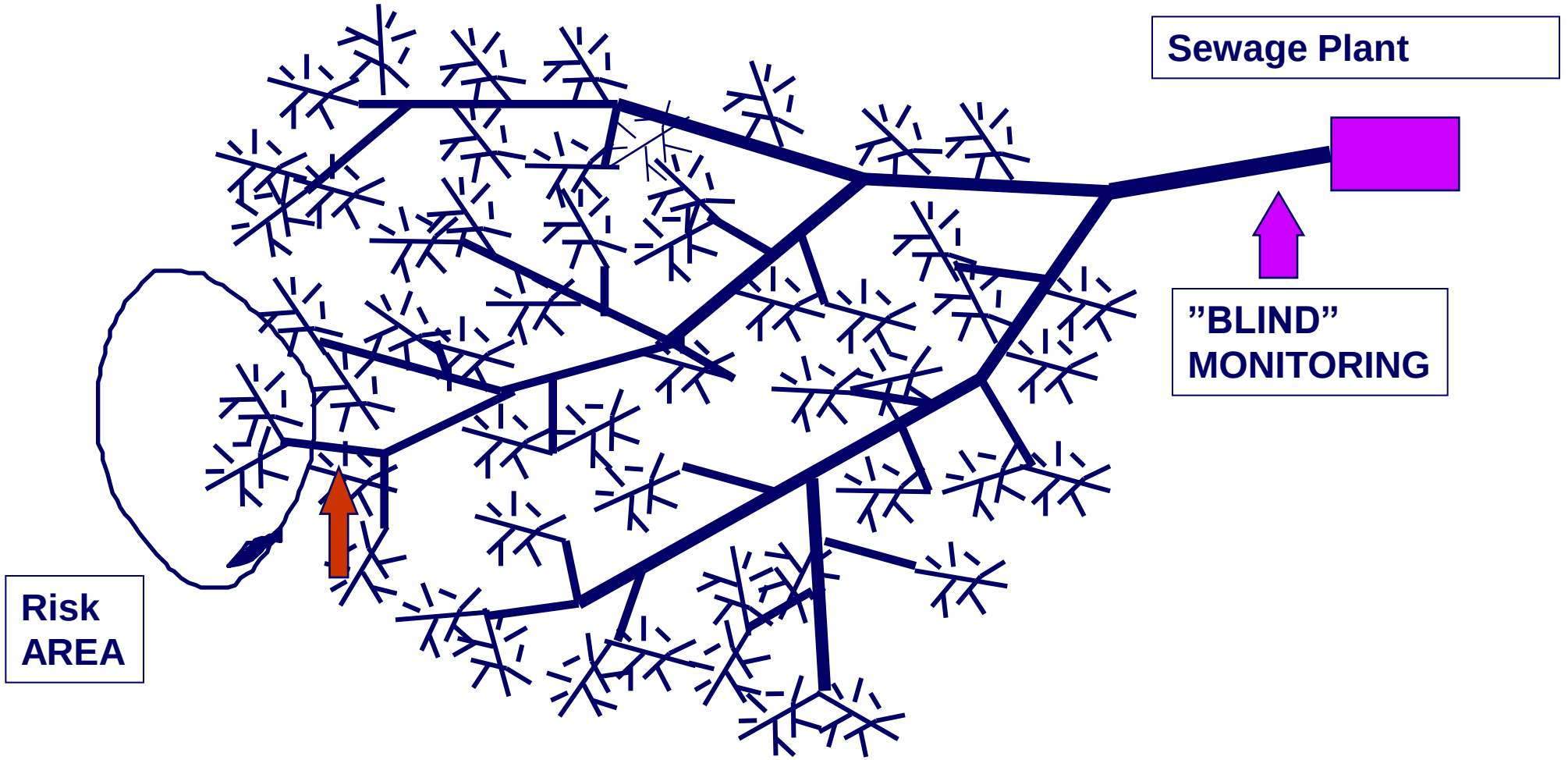


Figure 1. The cost of sequencing a full human genome from 2001 to 2022.
Image Credit: Our World in Data

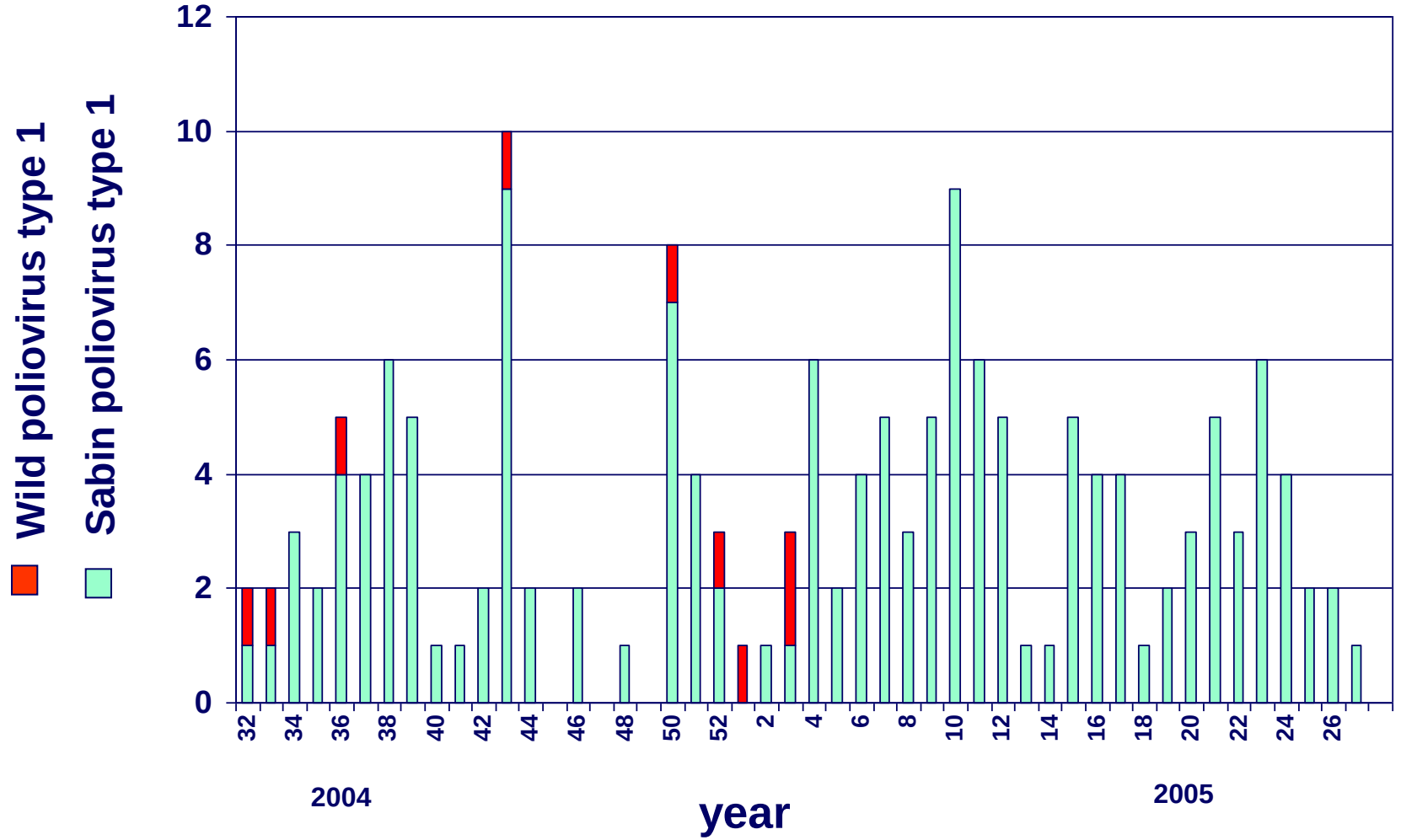


Minlon: Portable (87g); Real time data; unrestricted read length

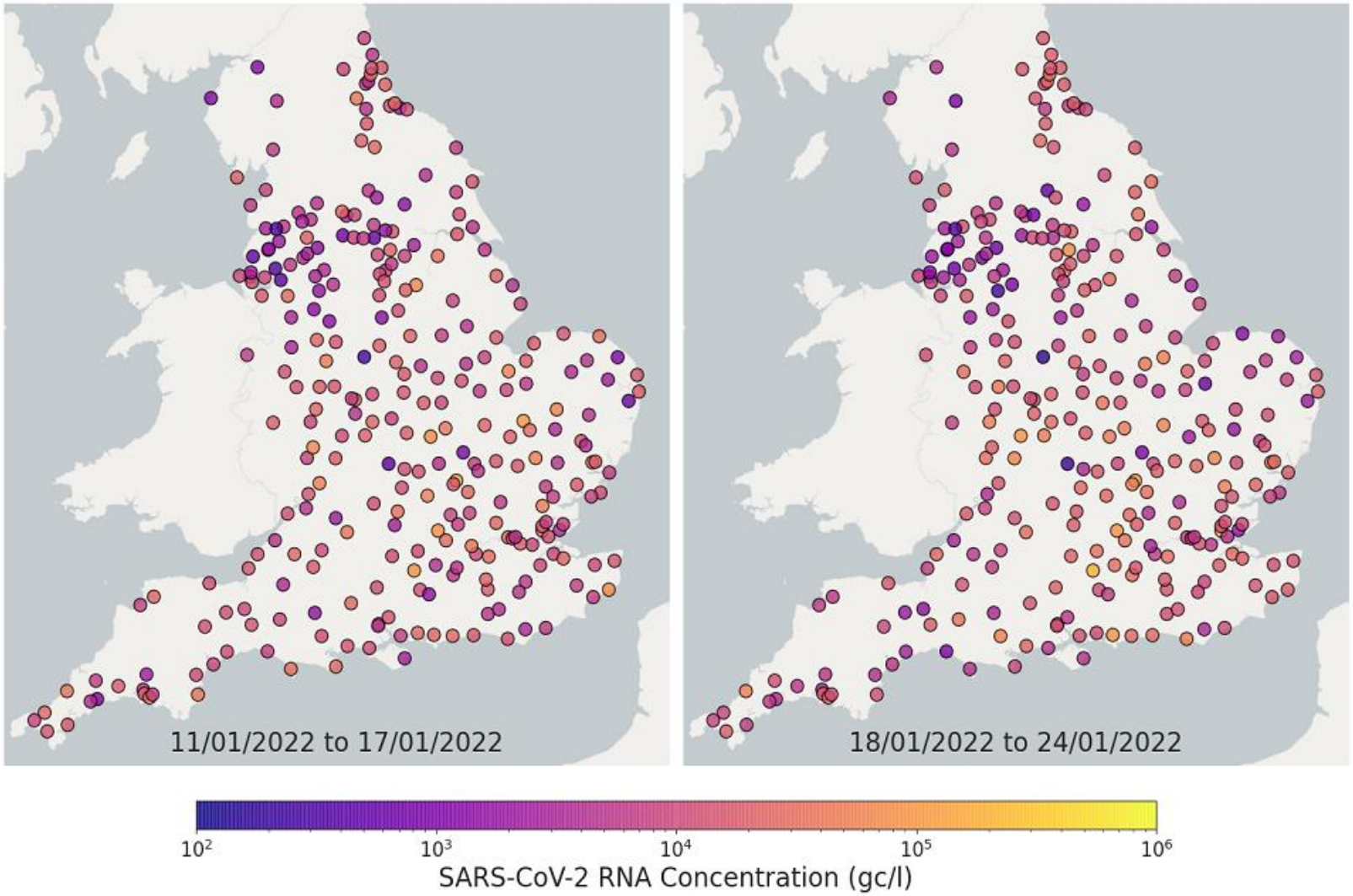
Environmental polio surveillance, sewage network, Cairo, Egypt



Poliovirus isolated from sewage by week, Egypt, August 2004 – August 2005

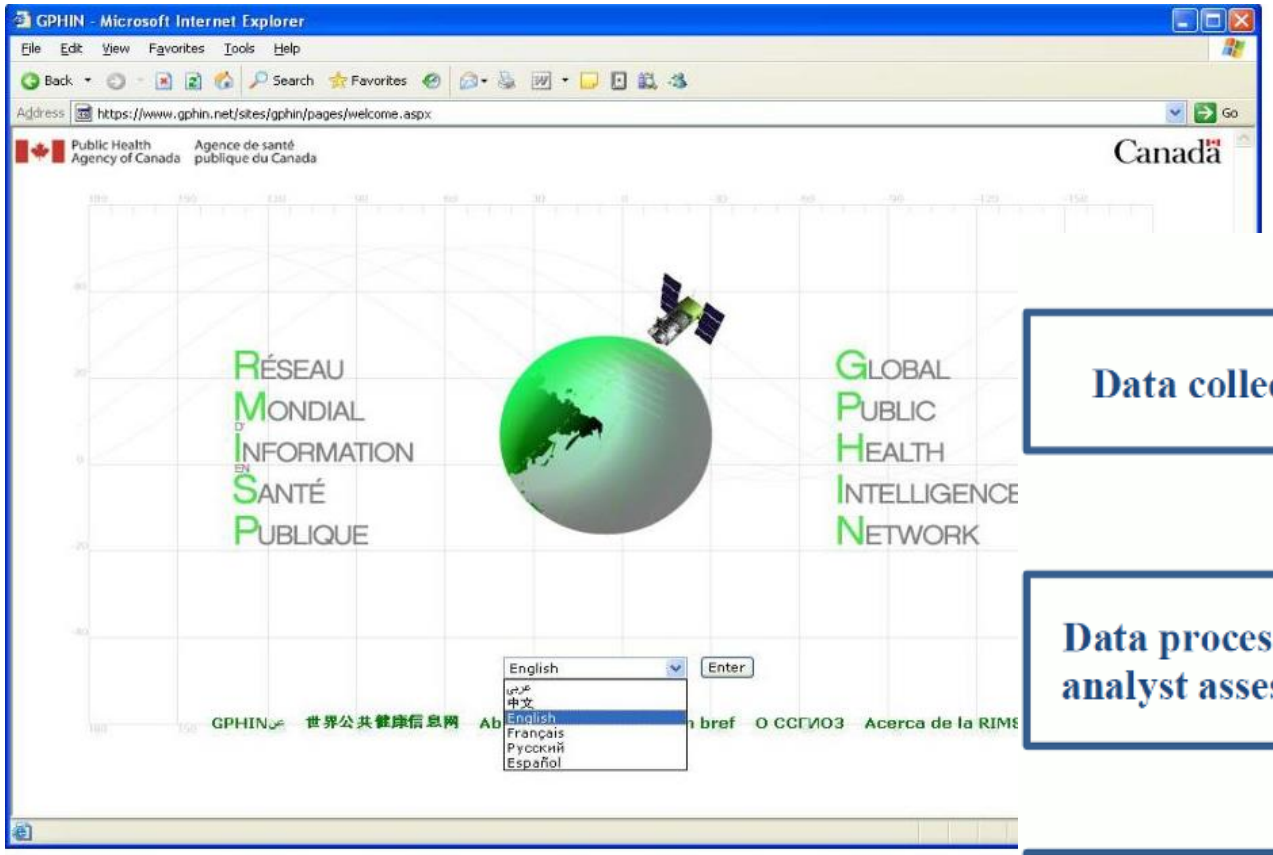


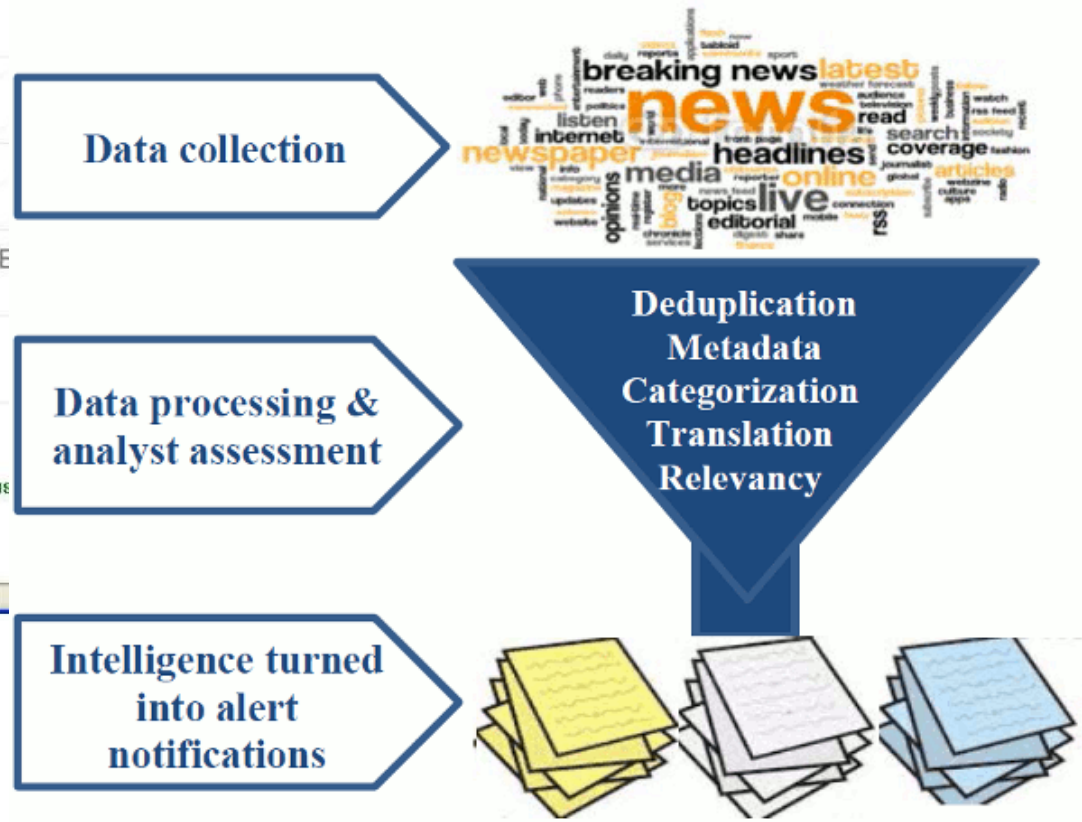
Environmental COVID-19 surveillance, United Kingdom



Web-based global alert systems

Global Public Health Intelligence Network (GPHIN)





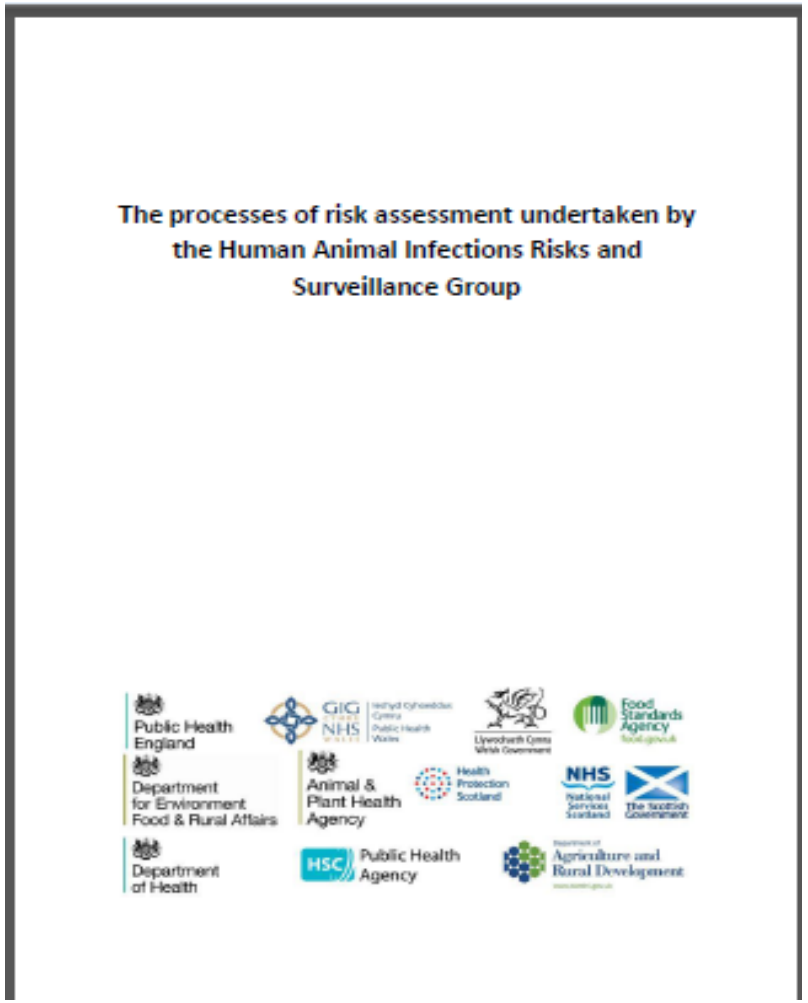
Programme for monitoring emerging diseases

ProMED team worldwide

OUR TEAM - ProMED-mail (promedmail.org)

Joint human/animal/environmental surveillance

Human Animal Infections Risk Assessment Group (HAIRS)



The processes of risk assessment undertaken by the Human Animal Infections Risks and Surveillance Group

Public Health England
GIG NHS
Food Standards Agency
Department for Environment Food & Rural Affairs
Animal & Plant Health Agency
Health Protection Scotland
NHS
The Scottish Government
Department of Health
HSC Public Health Agency
Agriculture and Rural Development

HM Government

Infectious Disease Surveillance and Monitoring for Animal and Human Health: summary of notable incidents of public health significance. March 2019

***Incident assessment:**

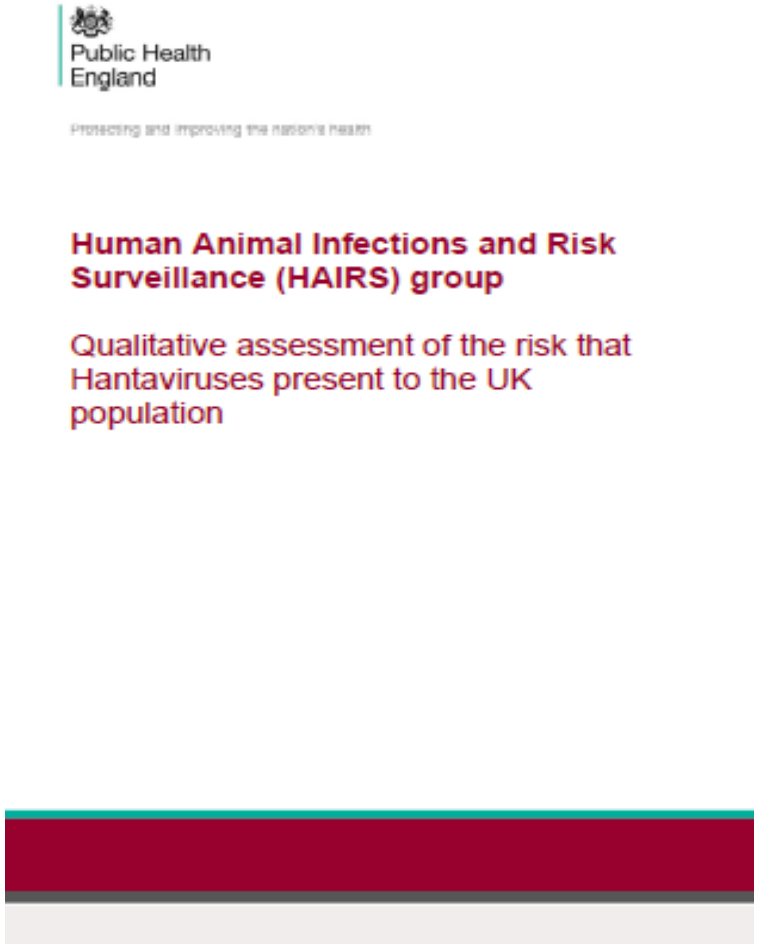
Deteriorating	No Change	Improving	Undetermined
Incident is deteriorating with increased implications for public health	Update does not alter current assessment of public health implications	Incident is improving with decreasing implications for public health	Insufficient information available to determine potential public health implications

Notable incidents of public health significance	Incident assessment*
Ebola virus disease (EVD), Democratic Republic of Congo	▲

After several weeks of overall decline, Ebola cases significantly increased again towards the end of March, with the total number of confirmed and probable cases now exceeding 1,000. An increase had been expected following the disruption to response activities at the end of February, but weekly case numbers reached the highest seen to date during this outbreak. However, cases do remain localised to North Kivu and Ituri provinces [map]. As of 31 March, a total of 1,089 confirmed and probable cases have been reported across 21 health zones. This is an increase of 199 confirmed cases in the past month, compared to 110 in February. Less than half (45%) were known contacts. Two new health zones, Lubero and Bunia, reported confirmed cases linked to chains of transmission in previously affected areas. One new probable case was identified, bringing the total number of probable cases to 66. Overall, 80 health workers have been infected. Butembo and Katwa are the main hot spots of the outbreak, however Mandima, Masereka and Vuhovi reported increasing numbers of cases. The Katwa Ebola Treatment Centre (ETC) officially reopened on 30 March to increase capacity to respond in that area.

Response efforts are still being met with strong community resistance and reluctance to

Human – Animal Infections and Risk Surveillance Group (HAIRS): guidelines


Public Health England

Protecting and improving the nation's health

Human Animal Infections and Risk Surveillance (HAIRS) group

Qualitative assessment of the risk that Hantaviruses present to the UK population

Human Animal Infections and Risk Surveillance Group (HAIRS): newsletter

Public Health England

Protecting and improving the nation's health

Zoonoses Newsletter

Issue 18, December 2016

PHE publications gateway number: 2016526

This newsletter is produced on behalf of the UK Public Health Network for Zoonoses.

The purpose of this network is to strengthen links, share expertise, and contribute to the effective prevention and control of zoonotic infections in the UK. Membership includes representatives from Public Health England, Public Health Wales, Health Protection Scotland, Public Health Agency Northern Ireland and Chartered Institute of Environmental Health.

Severe leptospirosis acquired in the UK: a reminder

Mandy Walsh, PHE National Infection Service; Emma Aarons PHE Rare and Imported Pathogens Laboratory; Vicki Chalker, PHE Bacteriology Reference Department

Leptospirosis caused by the spirochaete bacterium *Leptospira interrogans* is an important zoonosis with an excess of 1 million infections estimated to occur globally each year. *Leptospira icterohaemorrhagiae* is the most common serovar causing human disease. In the UK, between 50 and 80 human cases are diagnosed each year.

Image by Melodi2 Freeimages.com

Humans mainly acquire infection by direct contact with the urine of chronically infected animals, particularly the brown rat *Rattus norvegicus*. Infection occurs when

Human Animal Infections and Risk Surveillance Group (HAIRS)

Feature

Veterinary Record Towards One Health

ONE HEALTH

One Health in action: the work of the HAIRS group

The Human Animal Infections and Risk Surveillance (HAIRS) group is a collaboration between a number of human and animal health organisations within the UK government. The group aims to provide a 'joined-up' response to emerging diseases that threaten the health of people or animals. Here, Dilys Morgan, who chairs the group, discusses its work, highlighting its response to Schmallenberg virus, and shows how a One Health approach can improve government responses to potential crises

THE BSE Inquiry report, published in October 2000, was a seminal publication that demonstrated the advantages of a One Health approach. The BSE Inquiry was set up in 1998 to review the emergence and identification of BSE and new variant

Association Images

The HAIRS group has met every month since February 2004 and is chaired by Public Health England. It acts as a forum to identify and discuss new and emerging infections, especially at the human-animal interface, and plays a pivotal role for human and

Surveillance of antivax movement

Failure of peer review process: MMR and Autism: Lancet 1998

Early report

Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children

A J Wakefield, S H Murch, A Anthony, J Linnell, D M Casson, M Malik, M Berelowitz, A P Dhillon, M A Thomson, P Harvey, A Valentine, S E Davies, J A Walker-Smith

Summary

Background We investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder.

Methods 12 children (mean age 6 years [range 3–10], 11 boys) were referred to a paediatric gastroenterology unit with a history of normal development followed by loss of acquired skills, including language, together with diarrhoea and abdominal pain. Children underwent gastroenterological, neurological, and developmental assessment and review of developmental records. Ileocolonoscopy and biopsy sampling, magnetic-resonance imaging (MRI), electroencephalography (EEG), and lumbar puncture were done under sedation. Barium follow-through radiography was done where possible. Biochemical, haematological, and immunological profiles were examined.

Findings Onset of behavioural symptoms was associated by the parents, with measles, mumps, and rubella vaccination in eight of the 12 children, with measles infection in one child, and otitis media in another. All 12 children had intestinal abnormalities, ranging from lymphoid nodular hyperplasia to lymphoid ulceration. Histology showed patchy chronic inflammation in 11 children and reactive ileal lymphonodular hyperplasia in seven, but no granulomas. Behavioural disorders included autism (nine), disintegrative psychosis (one), and possible postviral or vaccinal encephalitis (one). There were no focal neurological abnormalities and MRI and EEG tests were normal. Abnormal laboratory results were significantly raised urinary methylmalonic acid compared with age-matched controls (p<0·003), low haemoglobin in four children, and low serum IgA in one child.

Interpretation We identified associated gastrointestinal disease and developmental regression in a group of previously normal children, which was generally associated in time with possible environmental triggers.

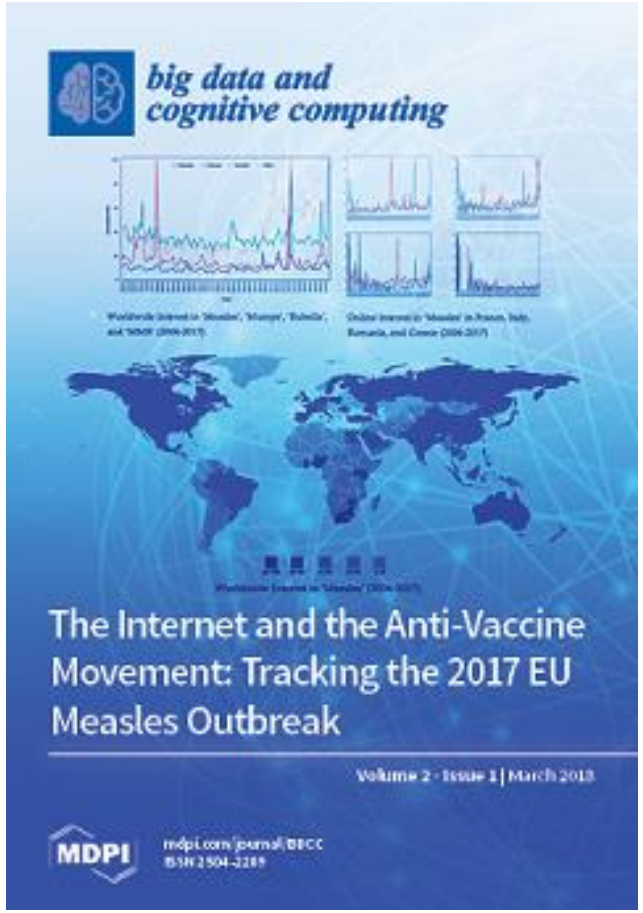
Lancet 1998; **351**: 637–41
See Commentary page

Inflammatory Bowel Disease Study Group, University Department of Medicine and Histopathology (A J Wakefield FRCS, A Anthony MB, J Linnell FRC, A P Dhillon MRCPath, S E Davies MRCPath) **and the University Department of Paediatric Gastroenterology** (S H Murch MB, D M Casson MRCP, M Malik MRCP, M A Thomson FRCP, J A Walker-Smith FRCP.), **Child and Adolescent Psychiatry** (M Berelowitz FRCPsych), **Neurology** (P Harvey FRCP), **and Radiology** (A Valentine FRCR), **Royal Free Hospital and School of Medicine, London NW3 2QG, UK**

Correspondence to: Dr A J Wakefield

RETRACTED

Surveillance of the anti-vax movement



Big Data Cogn. Comput. **2018**, *2*(1), 2; https://doi.org/10.3390/bdcc2010002

Open Access

Article

The Internet and the Anti-Vaccine Movement: Tracking the 2017 EU Measles Outbreak

Amaryllis Mavragani * and Gabriela Ochoa

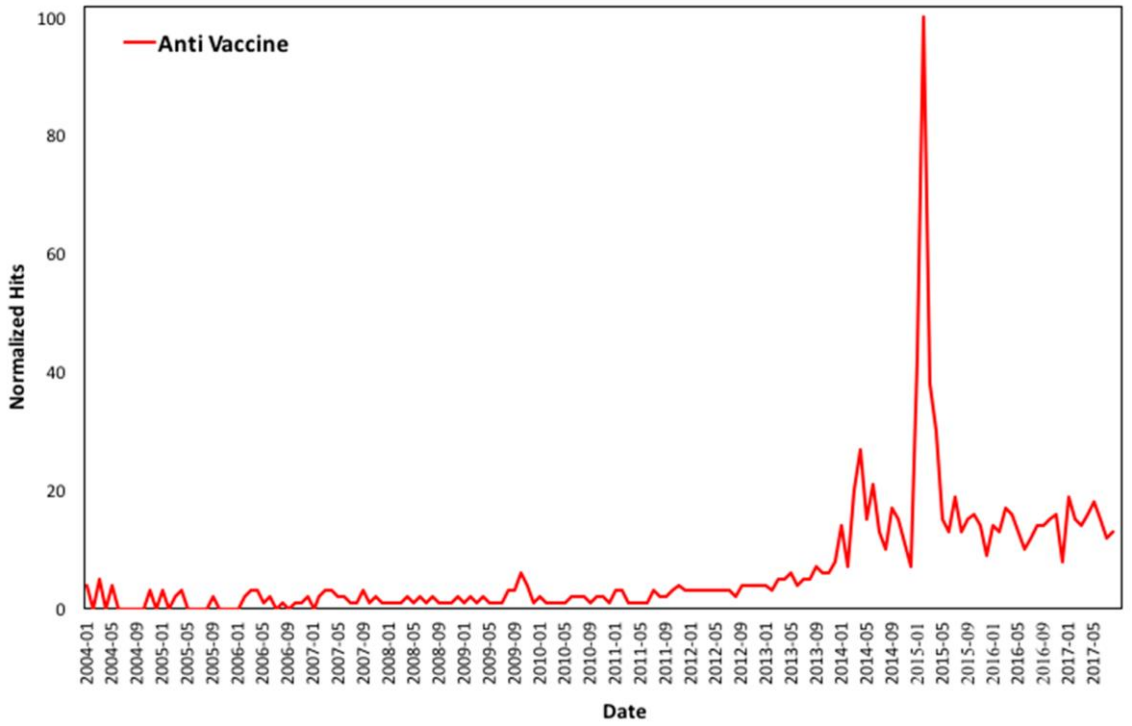
Department of Computing Science and Mathematics, Faculty of Natural Sciences, University of Stirling, Stirling, Scotland FK9 4LA, UK

* Author to whom correspondence should be addressed.

Received: 26 November 2017 / Accepted: 13 January 2018 / Published: 16 January 2018

Abstract: In the Internet Era of information overload, how does the individual filter and process available knowledge? In addressing this question, this paper examines the behavioral changes in the online interest in terms related to Measles and the Anti-Vaccine Movement from 2004 to 2017, in order to identify any relationships between the decrease in immunization percentages, the Anti-Vaccine Movement, and the increased reported Measles cases. The results show that statistically significant positive correlations exist between monthly Measles cases and Google queries in the respective translated terms in most EU28 countries from January 2011 to August 2017. Furthermore, a strong negative correlation ($p < 0.01$) exists between the online interest in the term 'Anti Vaccine' and the Worldwide immunization percentages from 2004 to 2016. The latter could be supportive of previous work suggesting that conspiracist ideation is related to the rejection of scientific propositions. As Measles require the highest immunization percentage out of the vaccine preventable diseases, the 2017 EU outbreak could be the first of several other diseases' outbreaks or epidemics in the near future should the immunization percentages continue to decrease. Big Data Analytics in general and the analysis of Google queries in specific have been shown to be valuable in addressing health related topics up to this

Internet activity, Google trends, measles queries, 2004 - 2017



Deliberate use of human pathogens to cause harm

Anthrax bioterrorism USA, 2001

Current Category A biological agents and BARDA

Category A

Definition

The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. High-priority agents include organisms that pose a risk to national security because they

- can be easily disseminated or transmitted from person to person;
- result in high mortality rates and have the potential for major public health impact;
- might cause public panic and social disruption; and
- require special action for public health preparedness.

Agents/Diseases

- Anthrax (*Bacillus anthracis*)
- Botulism (*Clostridium botulinum* toxin)
- Plague (*Yersinia pestis*)
- Smallpox (variola major)
- Tularemia (*Francisella tularensis*)
- Viral hemorrhagic fevers, including
  - Filoviruses (Ebola, Marburg)
  - Arenaviruses (Lassa, Machupo)

Source: CDC

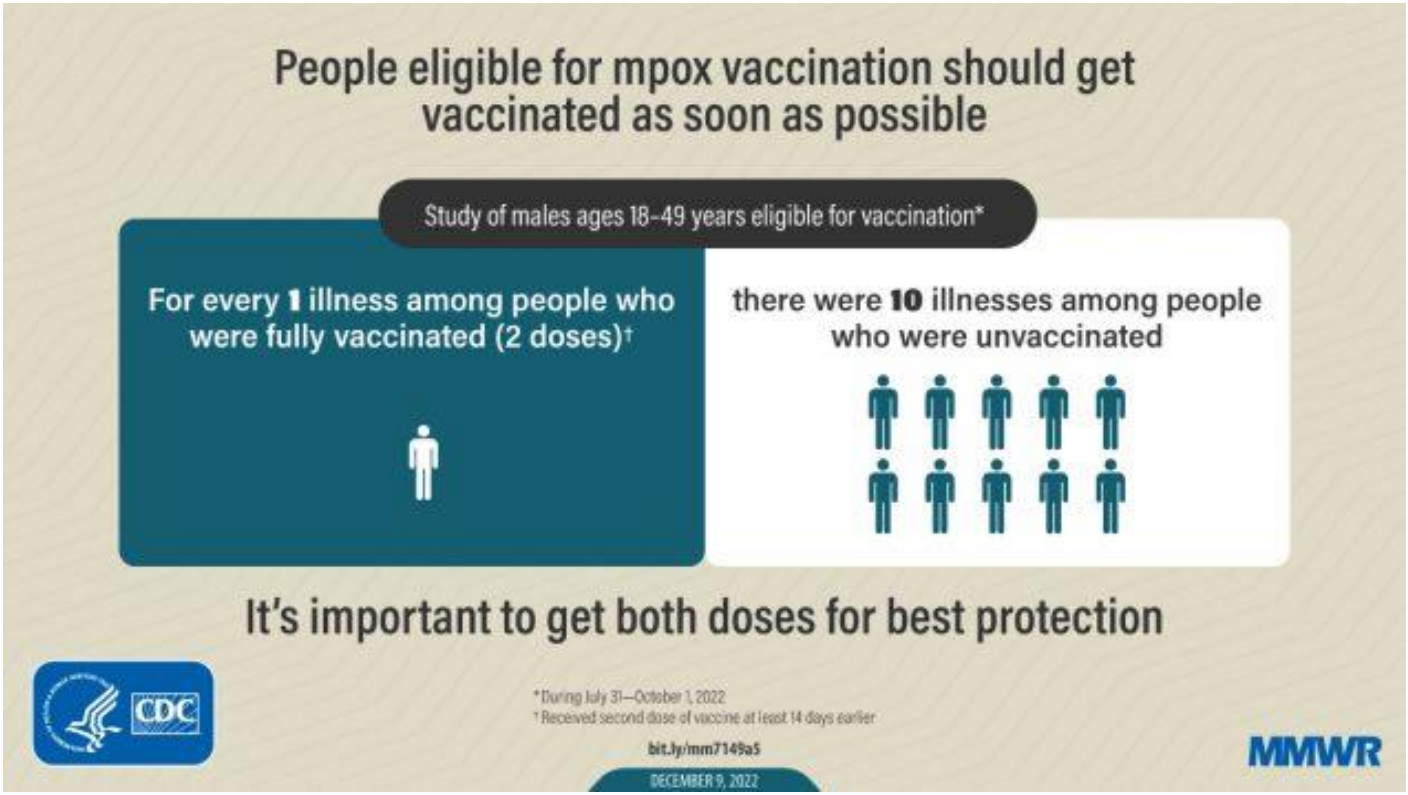
Biomedical advanced research and development authority (BARDA)

December 2006	Established
Jurisdiction	Federal Government of the United States
Headquarters	Hubert H. Humphrey Building, Washington, D.C.
Employees	150
Annual budget	$1.6 billion USD (2020)
Agency executive	•Gary Disbrow, Acting Director
Parent agency	Office of the Assistant Secretary for Preparedness and Response
Website	www.medicalcountermeasures.gov/barda

Defence spending for deliberately caused outbreaks with public health benefit

Non-replicating smallpox/monkeypox vaccine

Non-replicating smallpox vaccine, recommendations for vaccination



Final thought

- How can defence funding for bioterrorism also benefit naturally occurring outbreaks in present-day economies?

Q+A

Upcoming APIC-GL Webinars

- **May 20** – Construction & Renovation
  - Kristen VanderElzen
- **July 8** – Topic TBD
- **Aug 12** – Member Presentations
- **Oct 9** – APIC-GL Fall Conference
- **Nov 4** – NHSN Rebaseline

Please note this schedule is subject to change.
All changes and additional event details will be communicated via email, once confirmed.

Please direct questions to
Kelsey Ostergren – kostergren@mha.org,
Chau Nguyen - chau.nguyen@corewellhealth.org, or
Denise Parr – parrd1@michigan.gov

SAVE THE DATE
2025 APIC Great Lakes Fall Conference

WHEN: October 9

WHERE: Eagle Eye Golf Club & Banquet Center

APIC-GL is looking for our most creative minds to submit design ideas for APIC 2025 Annual Conference t-shirts!

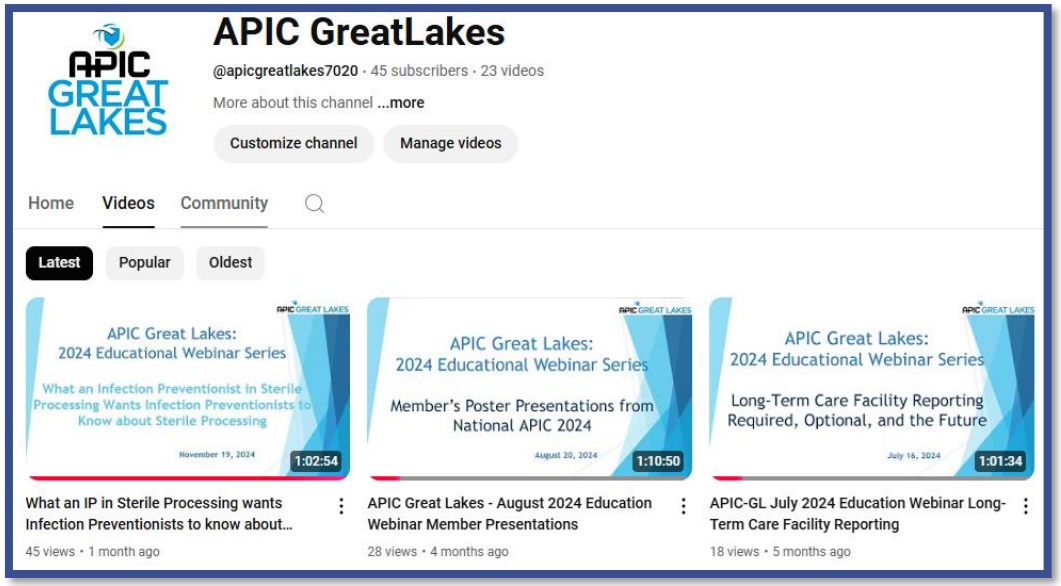
The **winner will receive a free t-shirt!**

Whether you are attending live, virtually, or cannot attend, we want to see your creative designs!

Email your submissions in JPEG or PNG format to **apicgreatlakes.com** by March 15th, 2025!

Missed a webinar? No worries!

- Check out the APIC- GL YouTube Channel, where you can find recordings of all prior meetings!



- Presentation slides & any supplemental materials can be found on the APIC-GL website

Job Postings

- If you have an open position you would like to post to the APIC-GL webpage, please email us at apicgreatlakes@gmail.com

- Link to job board

APIC GREAT LAKES

PEER MENTORSHIP ROUNDTABLE

Thank you for joining us today!