MEDINFO23

8 – 12 JULY 2023 | SYDNEY, AUSTRALIA

@Globalbiosec

The public health case for AI and open source data for rapid epidemic intelligence

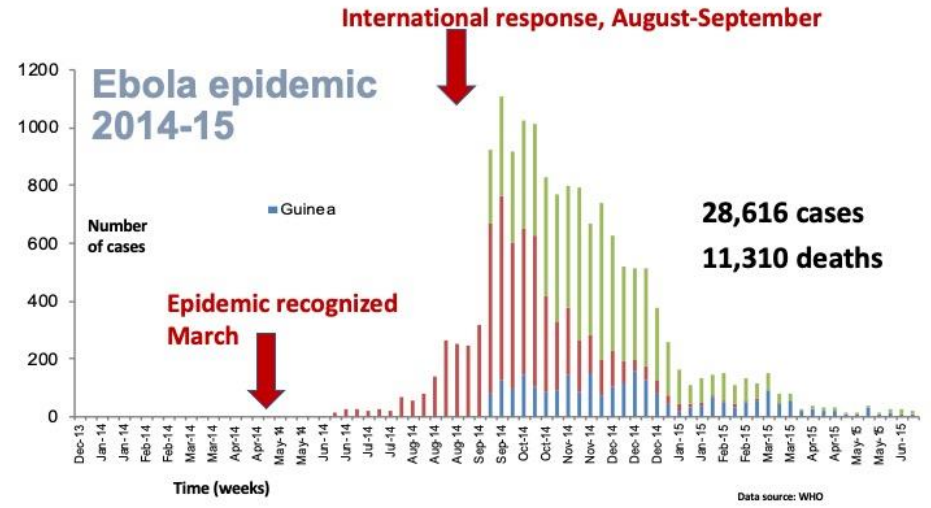
Raina MacIntyre

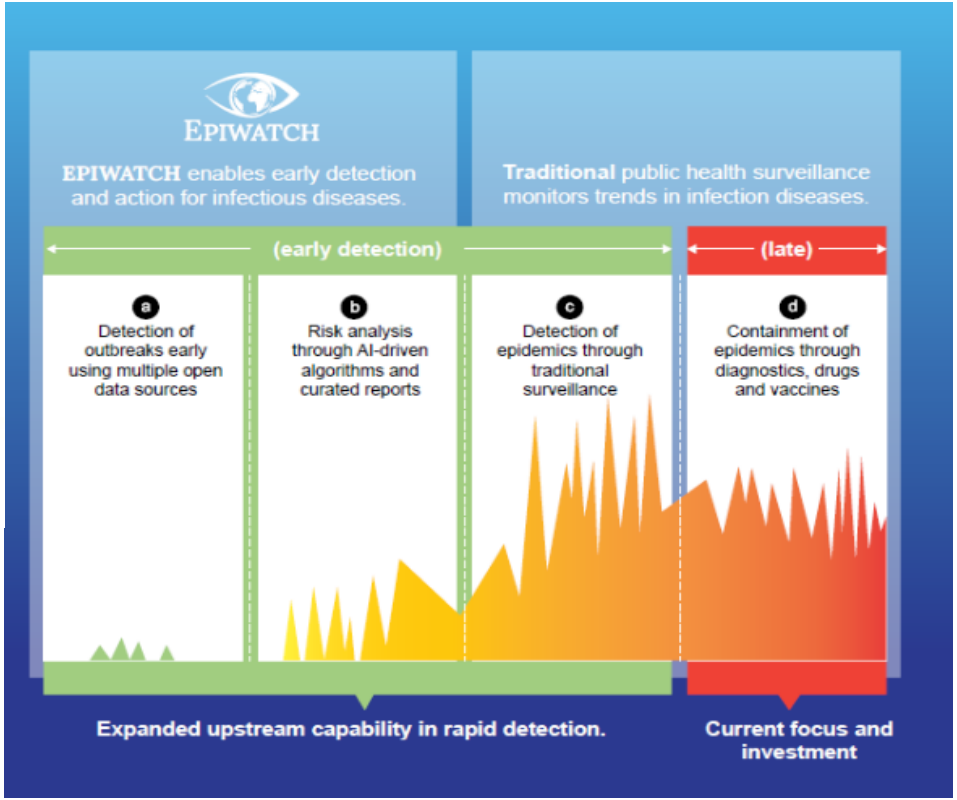
Head, Biosecurity Program, The Kirby Institute, UNSW

Project RFRHPI000280received funding from the Australian Government

@TheInstituteDH #MEDINFO23

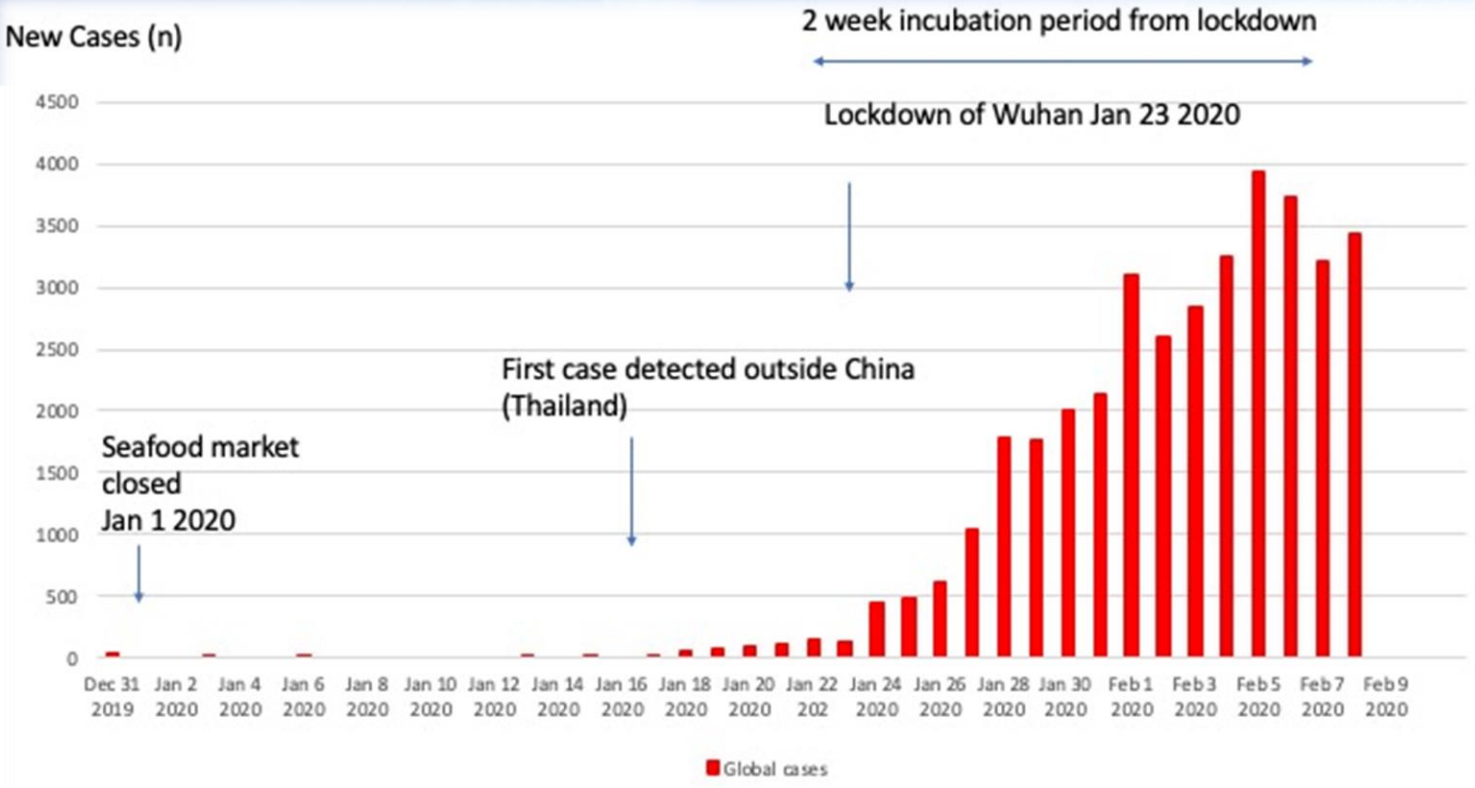
Exponential growth





EPIWATCH

COVID-19



EPIWATCH

COVID-19 Date of onset vs date of

Figure 2: Epidemic curve of 2019-nCoV cases (n=138) identified outside of China, by date of onset of symptoms and travel history, 9 February 2020

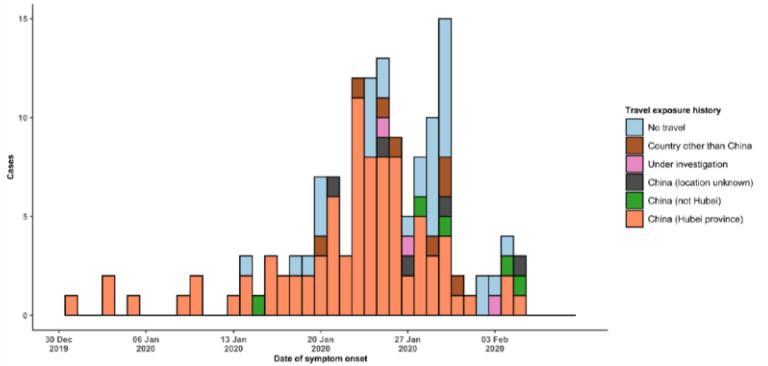
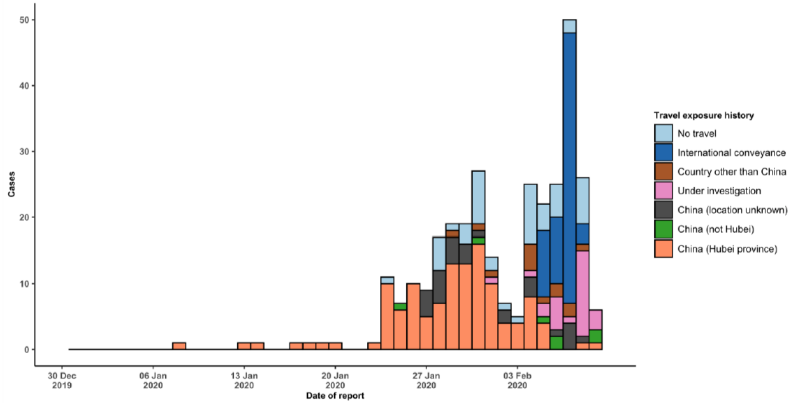


Figure 3: Epidemic curve of 2019-nCoV cases (n=307) identified outside of China, by date of reporting and travel history, 9 February 2020

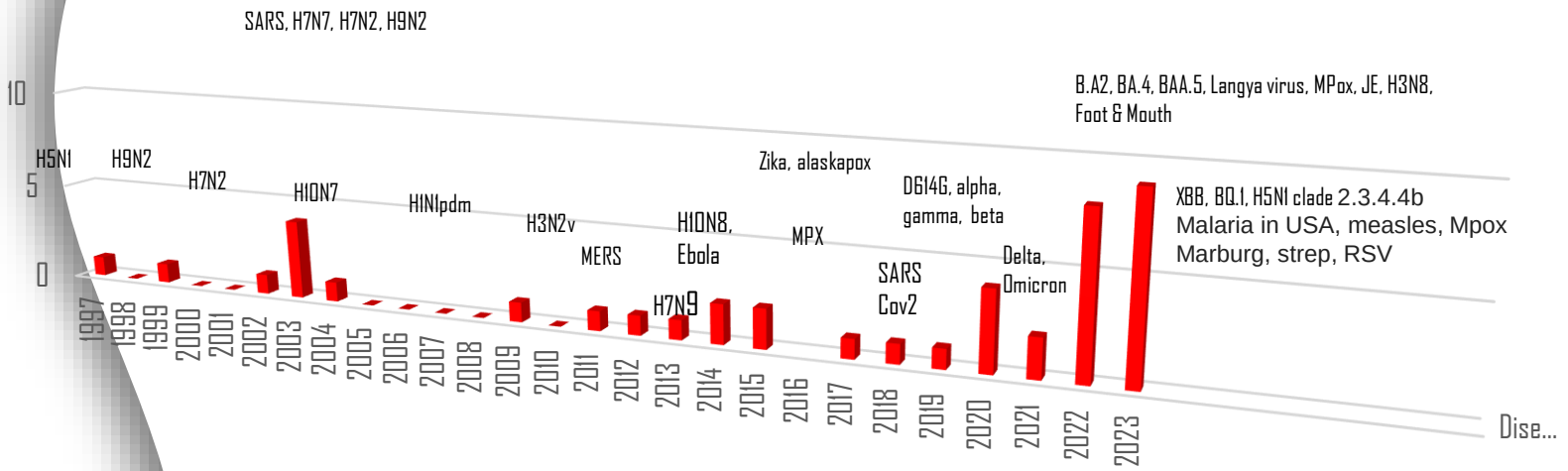


Imagine.....

COVID detected before it spread worldwide through an early signal for severe pneumonia.

The epidemic stopped in its tracks in 2019 and consigned to the archives of rare, serious outbreaks…

Acceleration of emerging infections

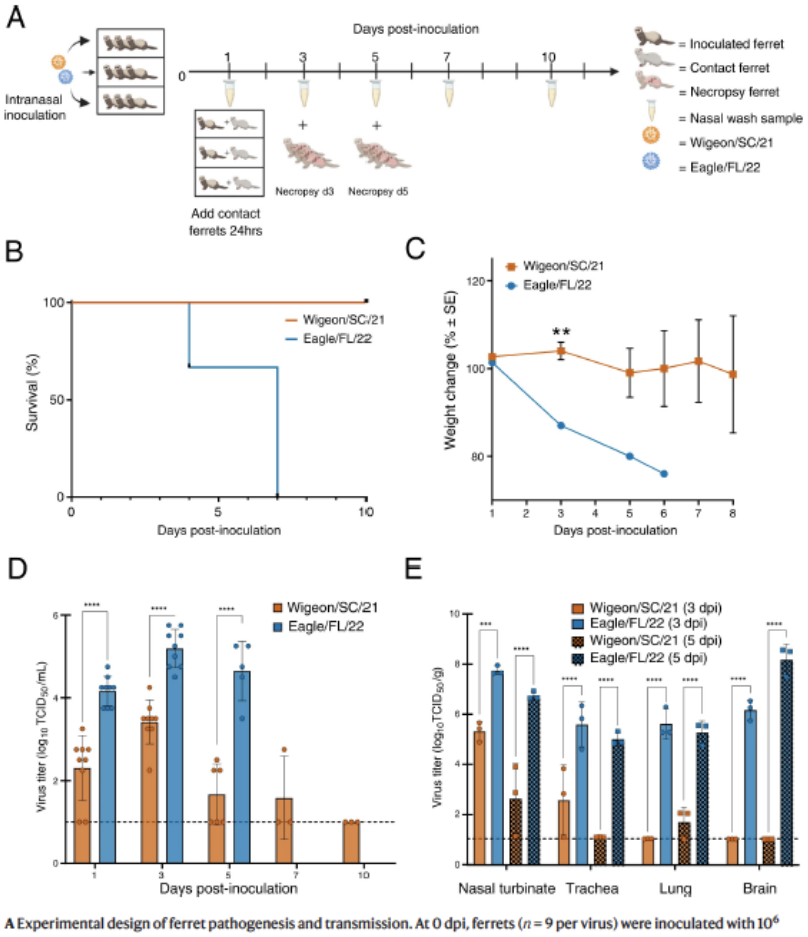


EPIWATCH

Kandeil A, Patton C, Jones JC, et al. Rapid evolution of A(H5N1) influenza viruses after intercontinental spread to North America. **Nat Commun**. 2023 May 29;14(1):3082.

Fig. 1: Pathogenicity of North American HPAI Influenza A(H5N1) clade 2.3.4.4b Wigeon/SC/21 and Eagle/FL/22 viruses in ferrets.

From: Rapid evolution of A(H5N1) influenza viruses after intercontinental spread to North America



A Experimental design of ferret pathogenesis and transmission. At 0 dpi, ferrets ($n = 9$ per virus) were inoculated with 10^6

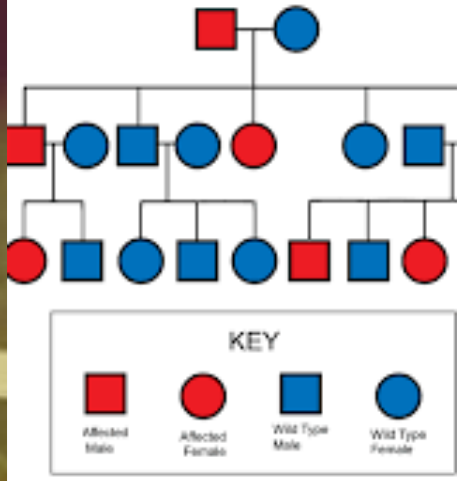
An interesting outbreak

- On September 17, the Public Health Department of City X began to receive reports of gastroenteritis in people who had eaten at restaurants several days before symptom onset.

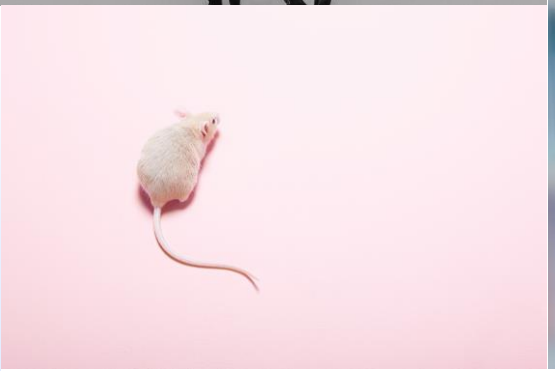
Silence

EPIWATCH

What's changed today?



Horsepox, mousepox and synbio



Anthrax: Error or terror

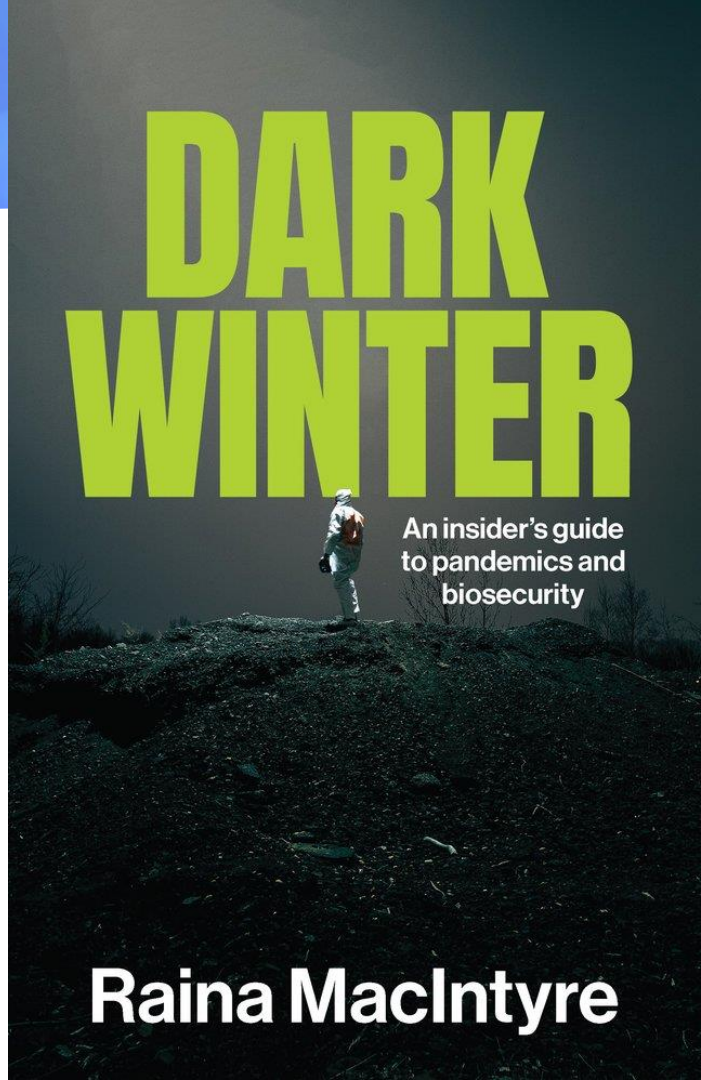
Dual-use technology

Exponential decline in cost

Lab in a box

EPIWATCH

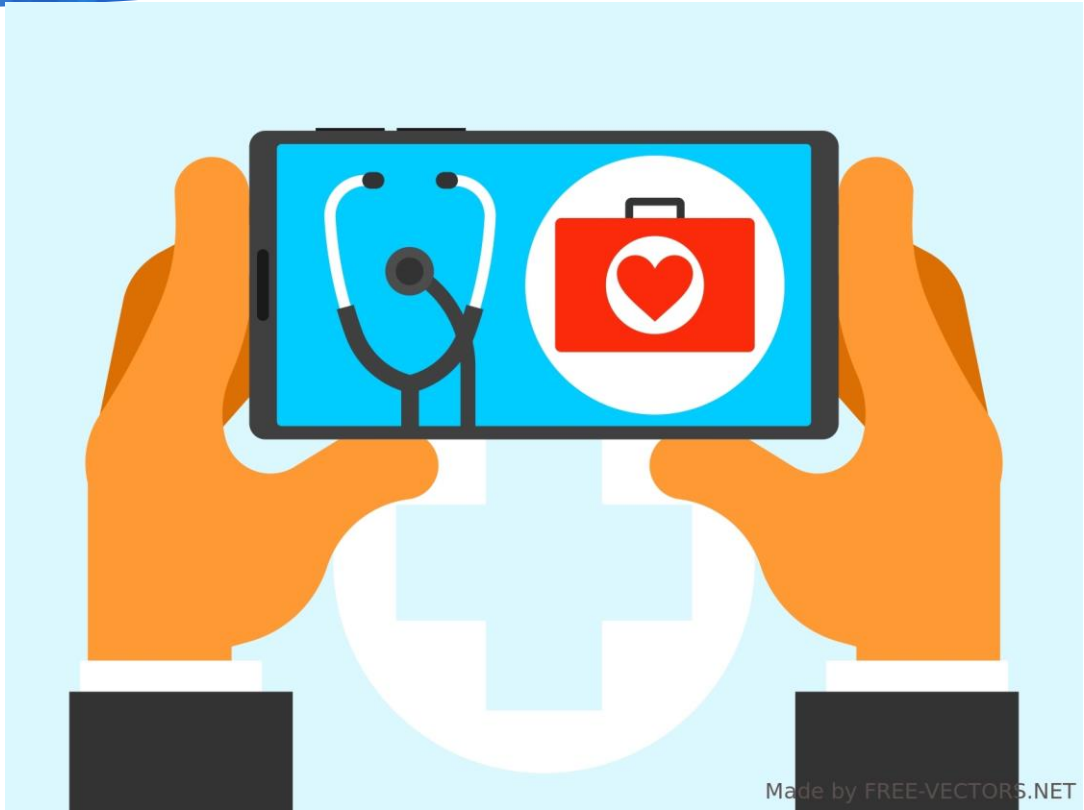
Outbreak detection more important than ever



EPIWATCH

Harnessing vast open-source data for health emergencies

Public health slower to adopt AI solutions



Artificial intelligence system

2 Test and train the data for rapid epidemic intelligence

3 Development of risk prediction tools

4 Development of a public dashboard and interface for EPIWATCH (incl. mobile app)

Web sources
News alerts (Google)
Health web sites
Health Organisations

52 languages

Automated Translation
Translates Non-English articles.

NLP Entity Recognition
Natural Language Processing
Artificial Intelligence

Detects unusual biosecurity activity and stores important data points (date, location, disease, outcome).

Add to database
Article to review

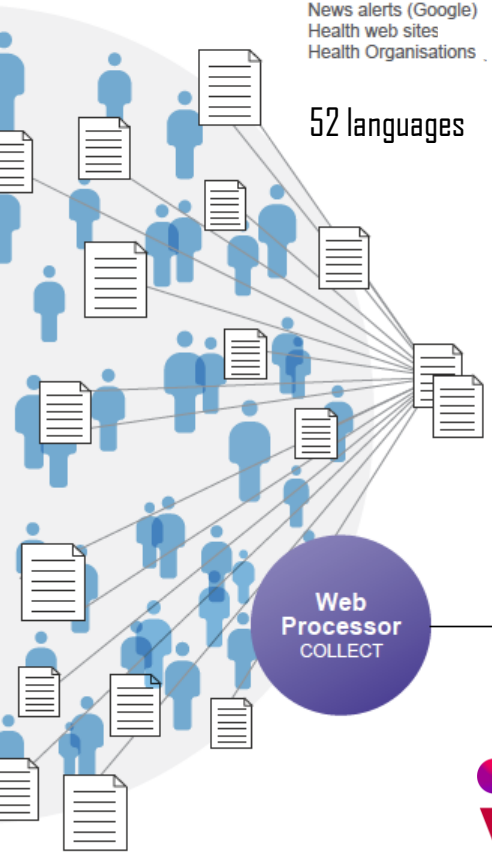
Article Classification and Prioritisation
Artificial Intelligence

Prioritises severity (Very High, High, Medium and Low) using disease and country parameters.

Human Review
Correct alerts, info feeds back into model.

Risk Analysis Tools
EPIRISK
FLUCAST
Google Apps
Apple Apps

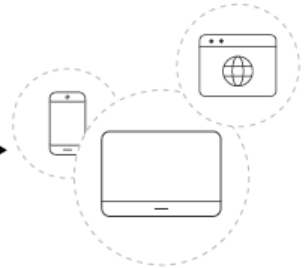
Public Dashboard
Dashboard
Website - curated data with ability to filter.



Government reported 54 new cases of diphtheria through September in Venuzuelia.

Source	
URL	
Title	
...	
...	

- ✓ VHigh — Covid-19
- ✓ High — 54 new cases of diphtheria
- ✓ Med — Anambra Govt vaccinates 5.5m residents
- ✓ Low — Is yawning contagious?
- ⊗ — Is dry cat food harmful



Web Processor
COLLECT

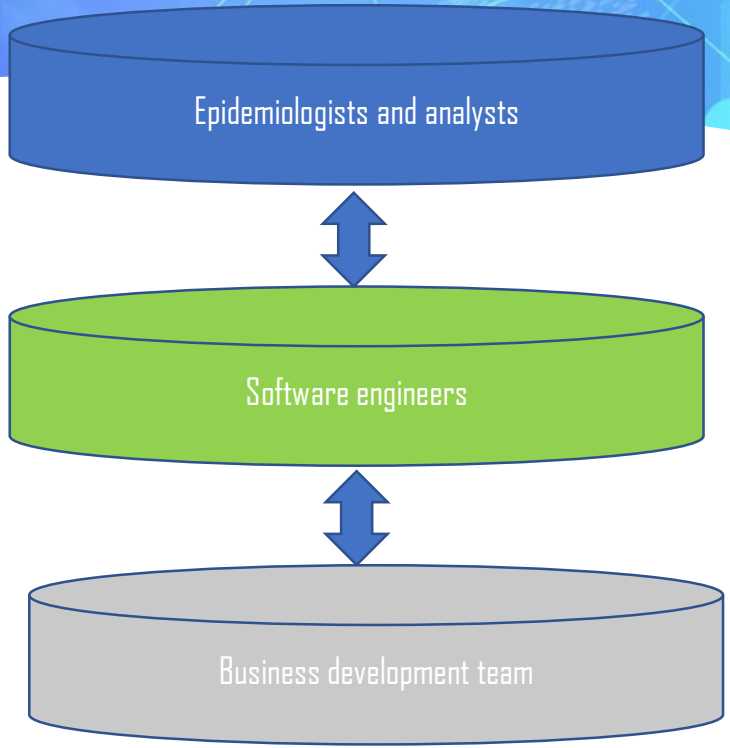
★★★★★ WINNER
InnovationAus
2022 AWARDS FOR EXCELLENCE
PEOPLE'S CHOICE

Database
STORE

read/write

Server
APPLY

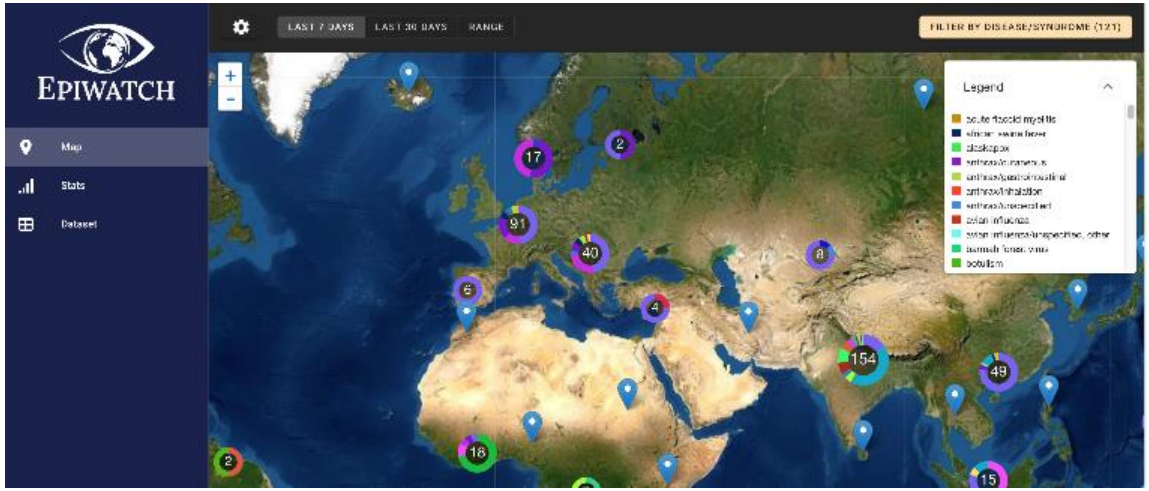
The EPIWATCH Team



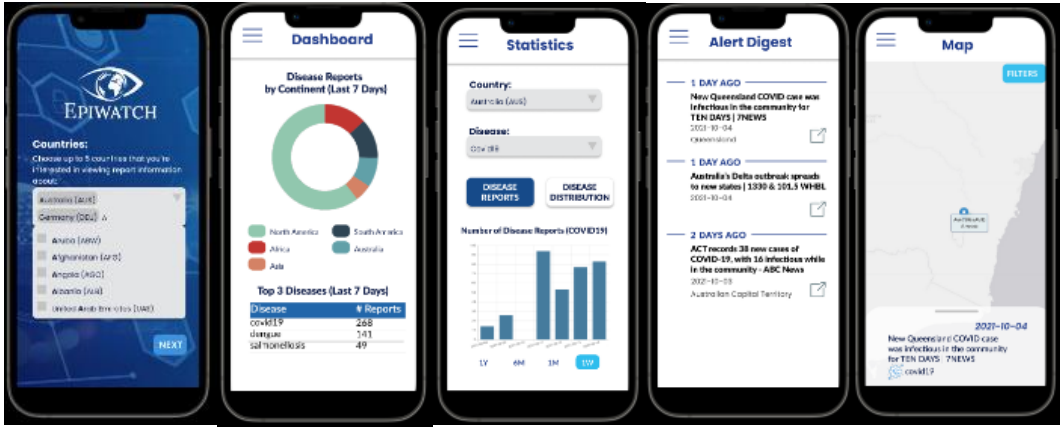
EPIWATCH

Early warnings and Intelligence at your fingertips

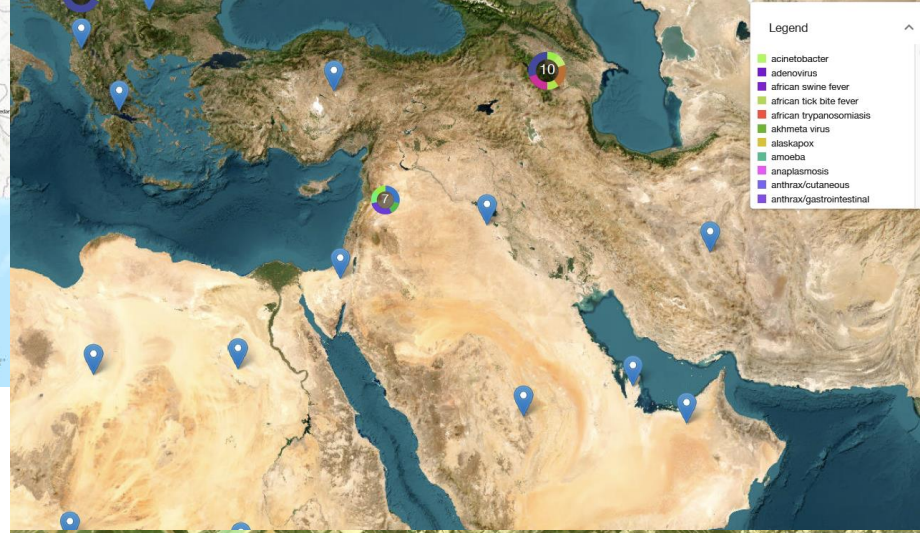
Public dashboard



Mobile app prototype



EPIWATCH

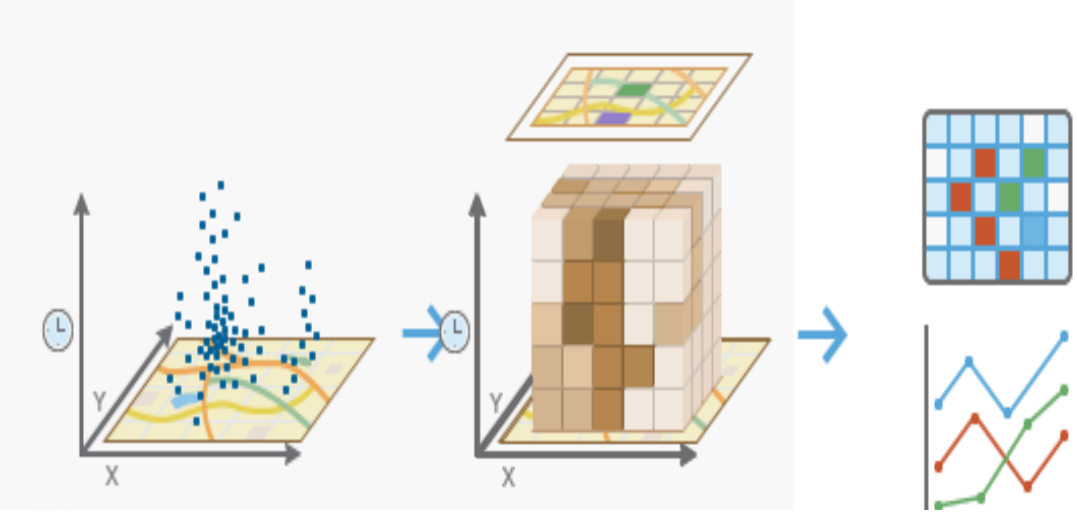


Mpox cumulative counts from May

2022 to February 2023

EPIWATCH

Red flagging of epidemics and emerging hot spot analysis



Quigley et al

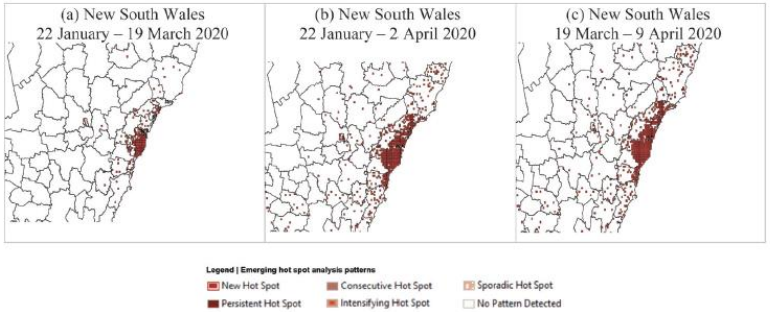


Figure 5. Trends in Spatial Clusters of All COVID-19 Cases in New South Wales Before, Within 14 Days, and Within 21 Days After the Disembarkation of Passengers From the Ruby Princess Cruise Ship (March 19, 2020).

EPIWATCH

Rigorously researched

GLOBAL BIOSECURITY

Feroza Binti Sulaiman, NK Semara Yanti, Dyah Ayu Shinta Lesmanawati, MJ Trent, CR MacIntyre & AA Chughtai. Language-specific gaps in identifying early epidemic signals – a case study of the Malay language. *Global Biosecurity*, 2019; 1(3).

RESEARCH ARTICLES

Language-specific gaps in identifying early epidemic signals – a case study of the Malay language

Feroza Binti Sulaiman[1], NK Semara Yanti[2], Dyah Ayu Shinta Lesmanawati[3], Mallory Trent[4], Chandini Raina MacIntyre[4], Abrar Ahmad Chughtai[5]

[1]Ministry of Health, Malaysia
[2]Udayana One Health Collaborating Center, Indonesia
[3]Universitas Gadjah Mada, Indonesia
[4]Biosecurity Program, Kirby Institute, University of New South Wales, Australia
[5]School of Public Health and Community Medicine, University of New South Wales, Australia

Original Research

Using open-source intelligence to identify early signals of COVID-19 in Indonesia

Yoser Thamtono,[a] Aye Moa[a] and Chandini Raina MacIntyre[a]
Correspondence to Yoser Thamtono (yoserthamtono@protonmail.com)

Published on 18.9.2020 in Vol 6, No 3 (2020): Jul-Sep

Preprints (earlier versions) of this paper are available at https://preprints.jmir.org/preprint/18939, first published March 28, 2020.

Using Open-Source Intelligence to Detect Early Signals of COVID-19 in China: Descriptive Study

Elizabeth Benedict Kpozehouen [1]; Xin Chen [1]; Mengyao Zhu [2]; C Raina Macintyre [1]

PLOS

Citation

Please cite as:

Kpozehouen EB, Chen X, Zhu M, Macintyre CR
Using Open-Source Intelligence to Detect Early Signals of COVID-19 in China: Descriptive Study
JMIR Public Health Surveill 2020;6(3):e18939
doi: 10.2196/18939
PMID: 32598290

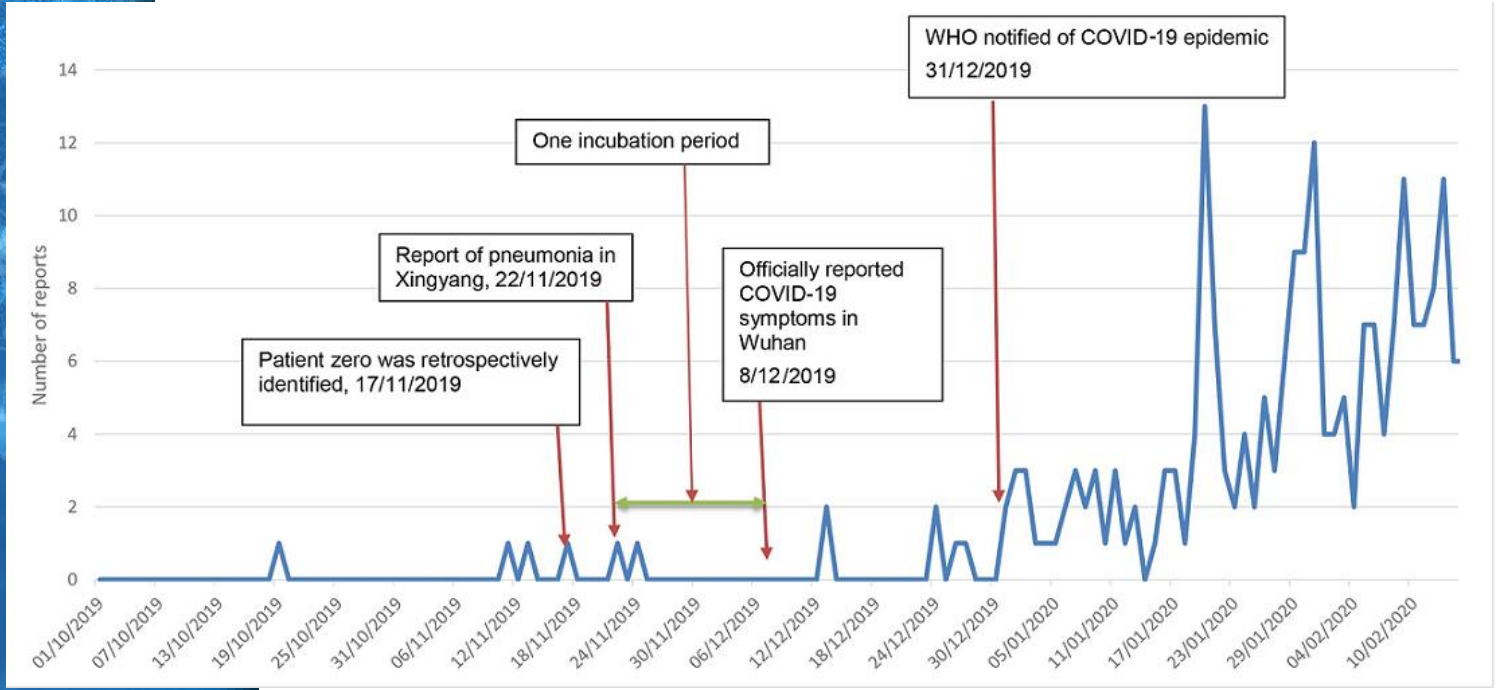
RESEARCH ARTICLE

Automated monitoring of tweets for early detection of the 2014 Ebola epidemic

Aditya Joshi[1]*, Ross Sparks[1], Sarvnaz Karimi[1], Sheng-Lun Jason Yan[2], Abrar Ahmad Chughtai[2], Cecile Paris[1], C. Raina MacIntyre[3,4]

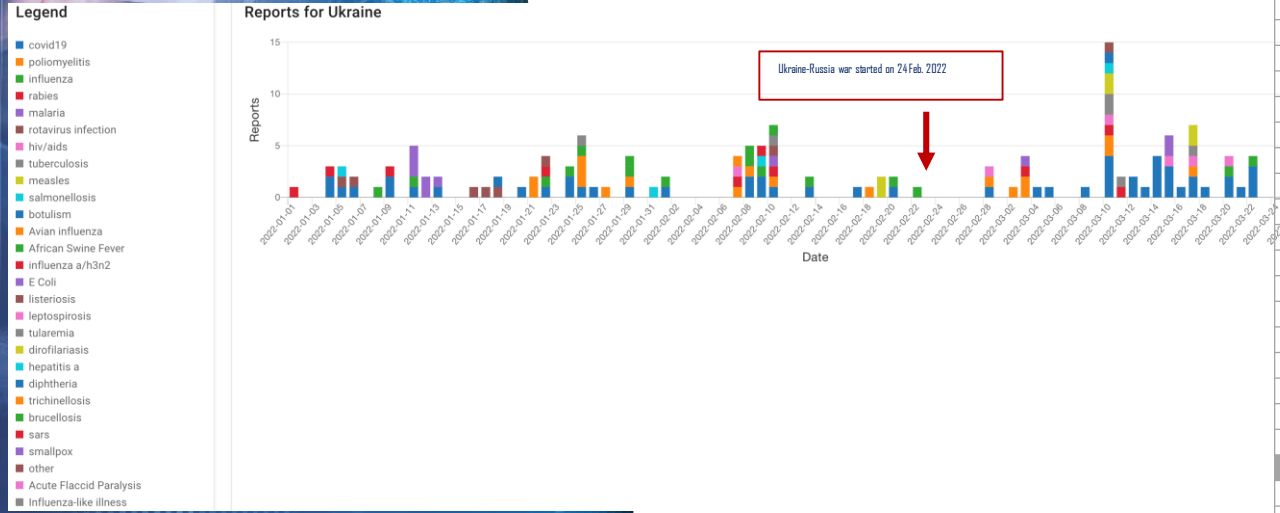
1 Data61, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Sydney, NSW, Australia, **2** School of Public Health and Community Medicine, University of New South Wales (UNSW), Sydney, NSW, Australia, **3** Kirby Institute, University of New South Wales (UNSW), Sydney, NSW, Australia, **4** College of Public Service & Community Solutions, Arizona State University, Phoenix, AZ, United States of America

Reports of pneumonia, severe acute respiratory illness from Oct 2019, to Feb 2020



Kpodzehouen EB, Chen X, Zhu M, Macintyre CR Using Open-Source Intelligence to Detect Early Signals of COVID-19 in China: Descriptive Study JMIR Public Health Surveill 2020;6(3)

EPIWATCH reports of Ukraine epidemics (1 Jan 2022 to 28 March 2022)

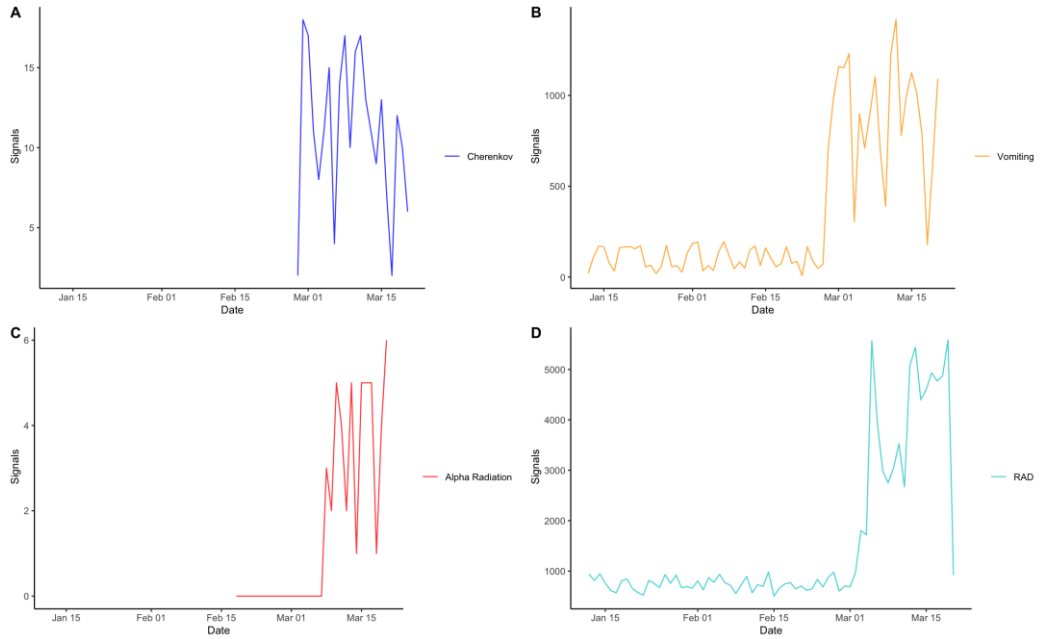


Disease	Number of reports
Covid19	57
Poliomyelitis	18
Rabies	7
Malaria	7
Rotavirus Infection	5
Influenza	4
Tuberculosis	4
Measles	4
Hiv/aids	4
Botulism	3
Salmonellosis	3
Influenza a/h3n2	2
E Coli	2
Dirofilariasis	2
SARS#	2
Other	2
African Swine Fever	1
Listeriosis	1
Leptospirosis	1
Tularemia	1
Hepatitis a	1
Avian Influenza	1
Diphtheria	1
Trichinellosis	1
Brucellosis	1
smallpox^	1
Syndromes	
Acute Flaccid Paralysis	1
Influenza-like illness	1
Total	117*

Ranked diseases and syndromes by number of reports in EPIWATCH

EPIWATCH

CBRNE: Radiation signals Ukraine



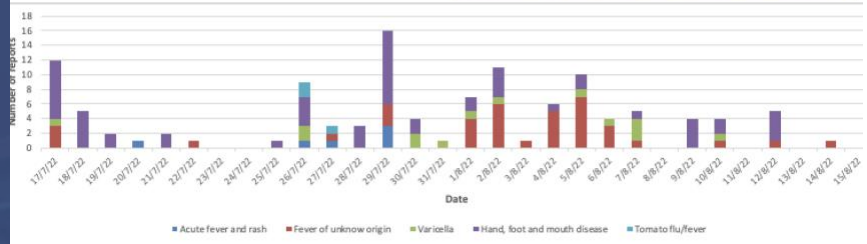
EPIWATCH

MONKEYPOX WATCH

ID	Disease/ Syndrome	Location	Period of outbreak	Previous situation summary	Current situation summary
1	Monkeypox*	Multiple countries	May 2022 – Present	Thailand: 1st case of monkeypox reported in 22 yo female, 4 cases YTD United States: >7510 cases, monkeypox declared public health emergency India: 1st death due to monkeypox in 22yo returning from UAE, 1st case in 30yo Nigeriam female, YTD 9 cases	WHO renames Congo Basin and West Africa clades to Clade I and Clade II, with open forum to rename disease Scotland lacks half the vaccines it needs with global supply shortages First cases in Guatemala, Moldova First human-to-dog transmission in France

*Reports of potential Monkeypox in the last 30 days (17 July 2022 to 15 August 2022)

The map and graph present reports of "acute fever and rash" (n=6), "varicella" (n=14), "fever of unknown origin" (n=38), "hand, foot and mouth disease (HFMD)" (n=57), "tomato flu/fever" (all in India) (n=3), in the past 30 days (17 July to 15 August 2022). Reports above include cases that may present with similar symptoms to monkeypox. There has been an increase of monkeypox cases presenting in non-endemic countries, since the first case confirmed in the United Kingdom on 7 May 2022.



EPIWATCH

EPISCOPE

THE WEEKLY DIGEST

WEEK

WEEK IN SUMMARY

HUMAN	ANIMAL		
32	1	73	111
New Outbreaks		Diseases	Locations

GLOBAL OUTBREAK DETECTION

TOP 5 DISEASES

Disease	# Reports
COVID-19	440
Monkeypox	246
Langya Virus	139
Dengue	105
West Nile Virus	80

Avian Influenza Bulletin -29 June 2023

Update on Recent Humans Cases:

- Peru: A steady and sustained increase has been reported with pneumonia cases (13,819) and deaths (104) year to date.
- Brazil: Amapá, a state in Brazil, registers 14 deaths and over 120 hospitalisations in children due to severe respiratory syndrome

Human H5N1 2.3.4.4b Confirmed Cases:

Currently, there have been 896 human infections of H5N1 in 23 countries since 1997 . Of those, 11 cases are the 2.3.4.4b lineage which have occurred since 2022 with details provided below:

United Kingdom; 5 January 2022: An asymptomatic case was identified in an individual who kept a large flock of ducks at their home in England.

United States; 27 April 2022: A case was identified from a person who was exposed to sick poultry from culling. The case had mild symptoms and recovered.

China; 22 September 2022: 38yo female farmer from Qinzhou, Guangxi province, who had exposure to backyard poultry and developed symptoms on 22 September 2022. She later was hospitalized for pneumonia and died in Oct 2022.

Spain; 27 September & 13 October 2022: An outbreak was declared in a poultry farm in Guadalajara. Samples were from all (12) farm workers and a case was identified (a 19-year-old male) on 27 September. An additional sample was taken from farm workers later in the month, which identified another case (a 27-year-old male), on October 2022, even though they tested negative initially.

Vietnam; 5 October 2022: First human case in eight years reported in 5yo girl in Phu Tho, who had consumed meat from sick chickens & ducks a week before falling sick. She recovered after treatment.

Ecuador; 9 January 2023: A case in a 9yo girl from Bolívar, who had contact with backyard poultry, acquired infection a week before symptom onset.

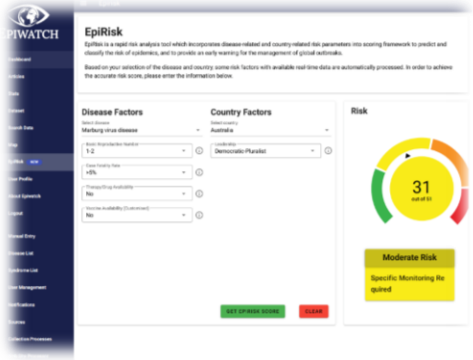
China; January 2023: 53-year-old woman in the eastern province of Jiangsu, who is believed to have begun to experience symptoms on January 31 after being exposed to poultry, before testing positive to H5N1 in February **(details are very limited).**

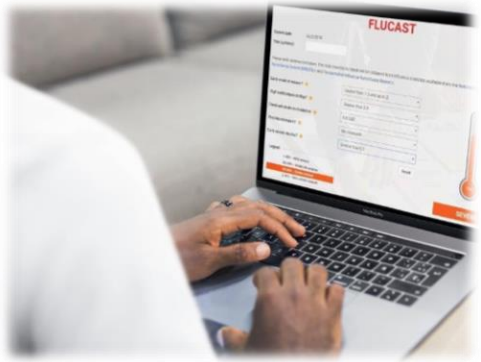
Chile; 29 March 2023: A case developed symptoms after participating in the culling of poultry. 53-year-old man with symptom onset on March 13. The man; however, two concerning mutations were found in the PB2 gene which have shown previously to help with virus replication in mammals. No additional cases have been identified from the initial case.

United Kingdom; 23 April & 29 April: Two poultry workers tested positive but remained asymptomatic. The first case was likely contracted the virus through exposure through nose and/or throat from material inhaled on the farm. The details of how the other contracted the virus remains unknown.

EPIWATCH

More than early warning





EPIWATCH

MORE than epidemic detection

Community Sentiments

EPIWATCH

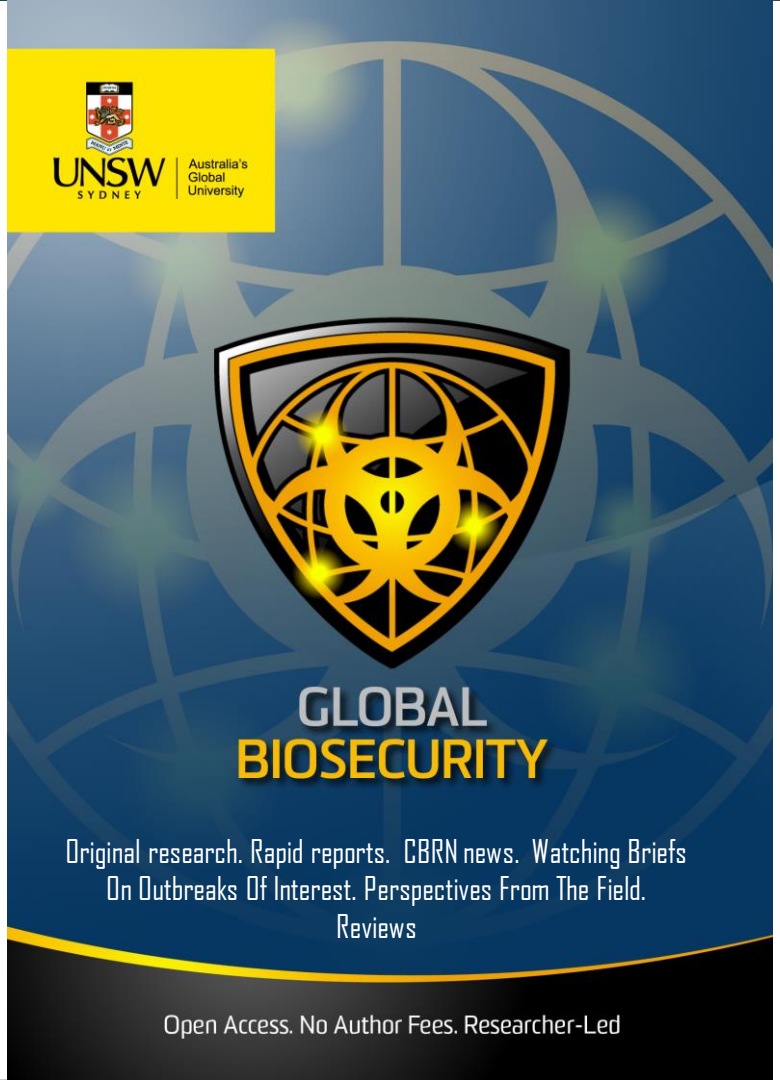
Gamified training

EPIWATCH

Immersive tabletop exercises

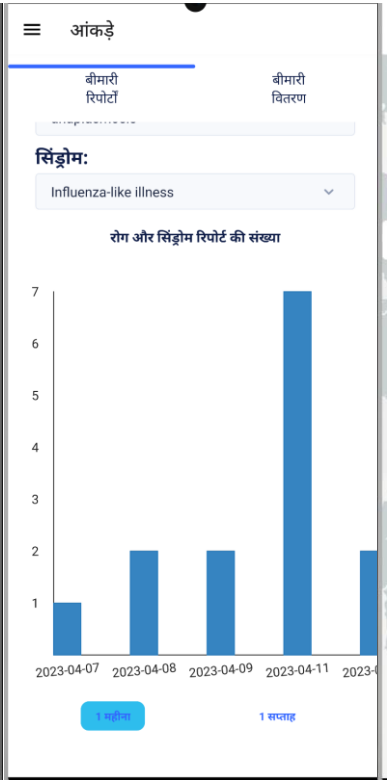
Training of public health workforce

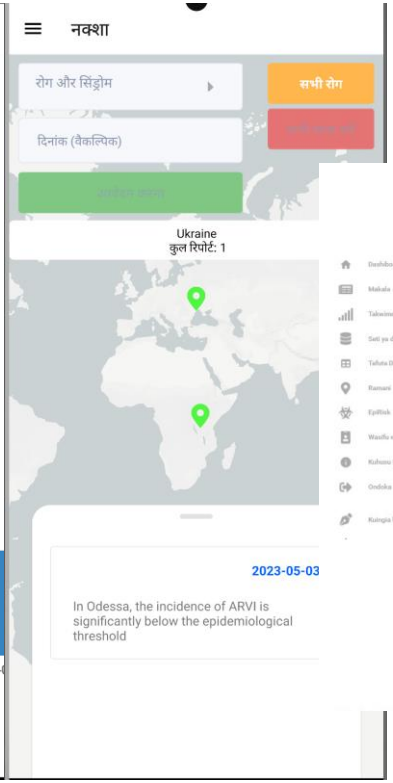
Rapid dissemination

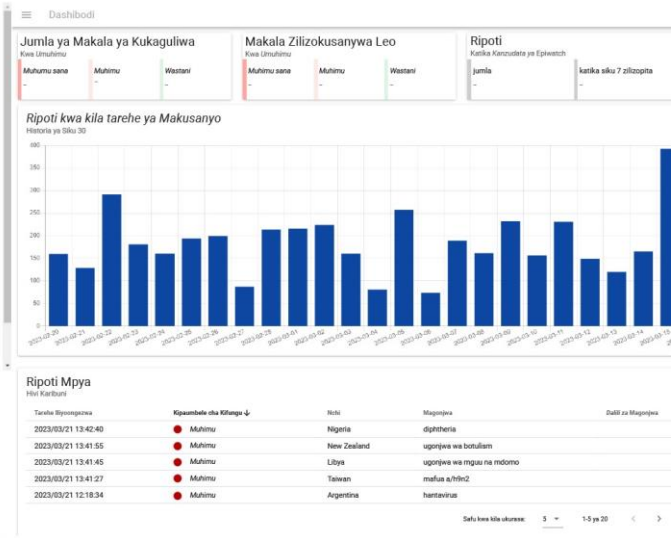


EPIWATCH

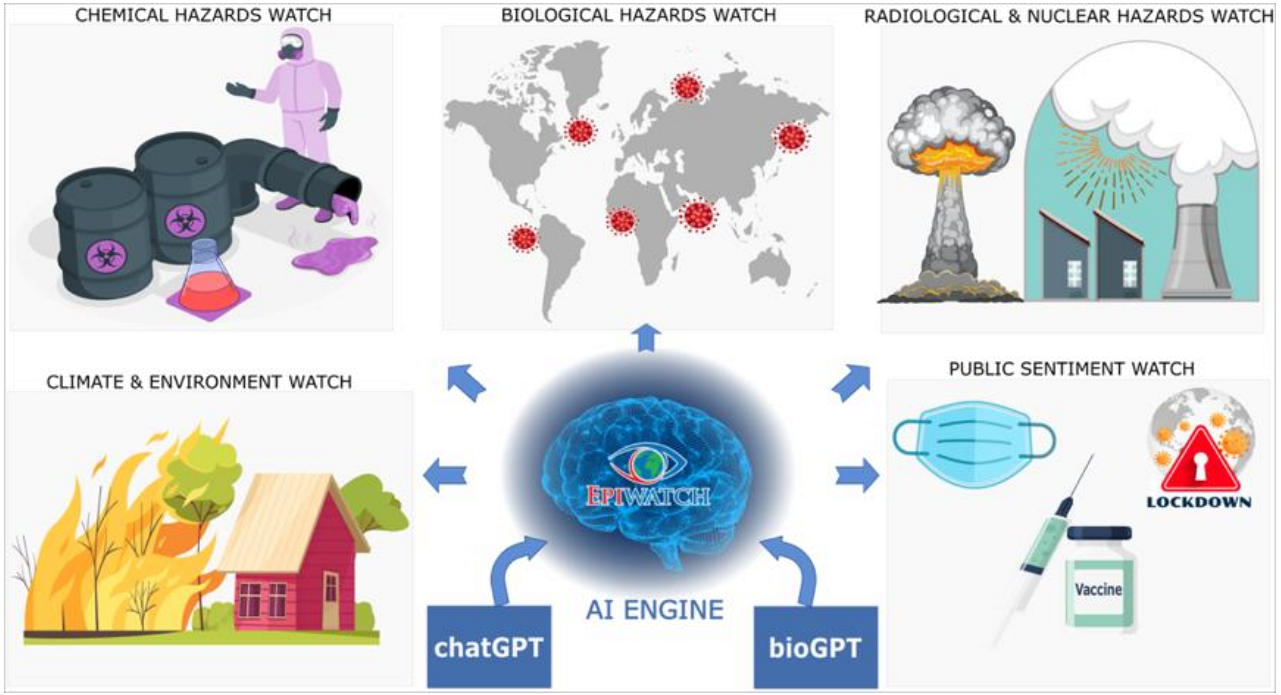
Access at grass roots – local languages





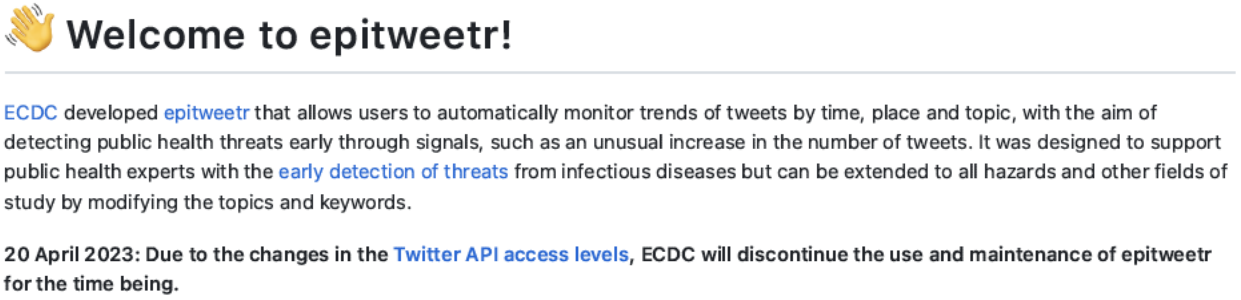


EPIWATCH for Health Emergencies



Limitations

- Dependence on grant funding
- GDPR
- Data terms and conditions



Acknowledgment of support

Balvi

Microsoft support

NHMRC

MRFF

EPIWATCH

Thank you

MedInfo and AIDH

EPIWATCH Team

Vitalik Buterin

NHMRC

MRFF

Microsoft

UNSW

Kirby Institute

IABCA
INDIA AUSTRALIA BUSINESS & COMMUNITY ALLIANCE

2023 IABCA Award Finalists

r.macintyre@unsw.edu.au

UNSW SYDNEY

UNSW Kirby Institute

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