Biodiversity, globalisation and communicable diseases in Europe

Jonathan E. Suk, ECDC

Credits

Partner agencies

- EFSA
- EMA
- WHO
- European Commission

AMR

- Dominique Monnet

Food-borne diseases

- Johanna Takkinen

Vector-borne diseases

- Herve Zeller

Climate change

- Jan Semenza

ECDC

- EU agency established 2005 – Stockholm
- Covering EU 28 & 3 EEA countries
- Staff: 300 approx.
- Most EU nationalities represented

Our mission

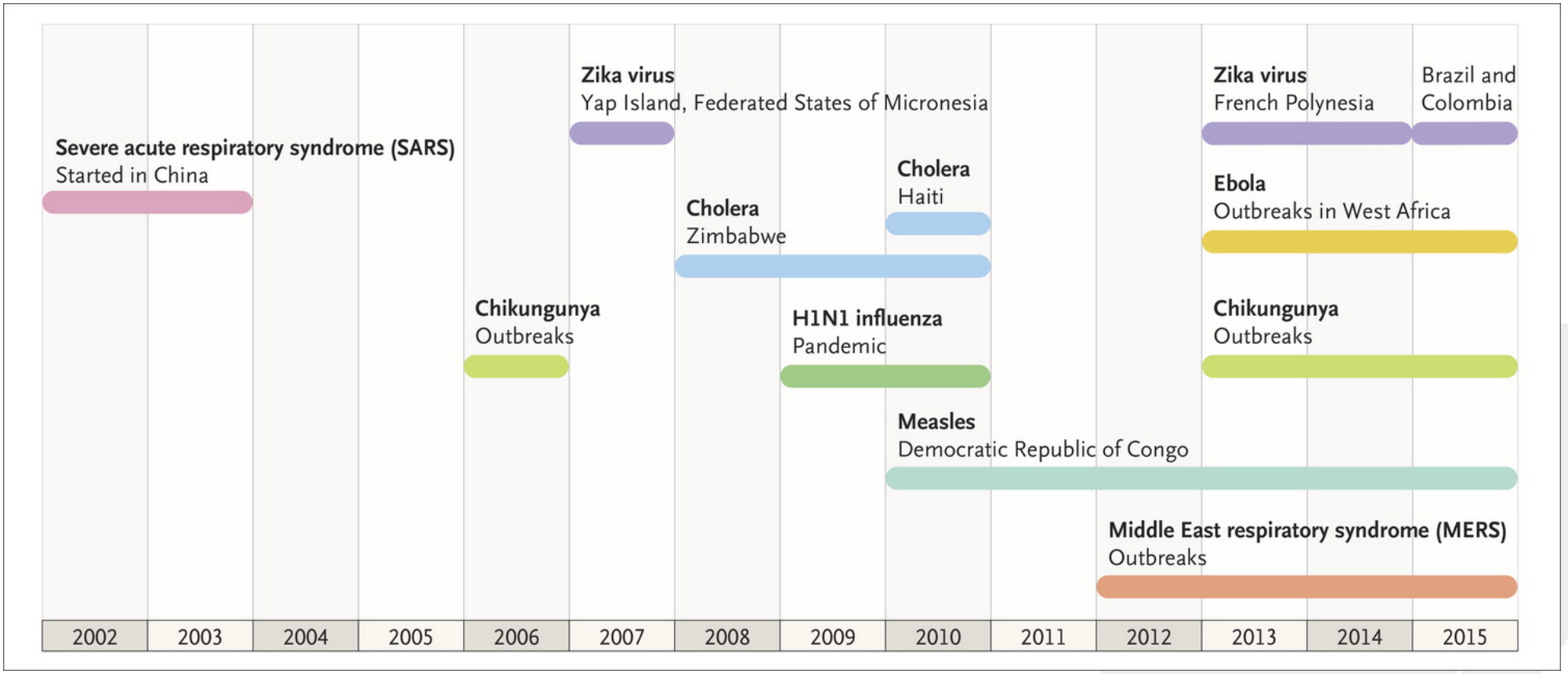
'ECDC's mission is to identify, assess and communicate current and emerging threats to human health posed by ***infectious diseases'.*** *(ECDC founding regulation 851/2004)*

Core functions:

- Disease surveillance
- Epidemic intelligence
- Risk assessment
- Health communication
- Scientific advice and guidance
- Response support
- Preparedness and capacity strengthening
- Training

- Antimicrobial resistance and healthcare-associated infections
- Emerging and vector-borne diseases
- Food- and waterborne diseases and zoonoses
- Influenza
- Microbiology
- Tuberculosis
- HIV, sexually transmitted infections and viral hepatitis
- Vaccine-preventable diseases

Preface: Major Recent Emerging and Reemerging Infectious-Disease Outbreaks

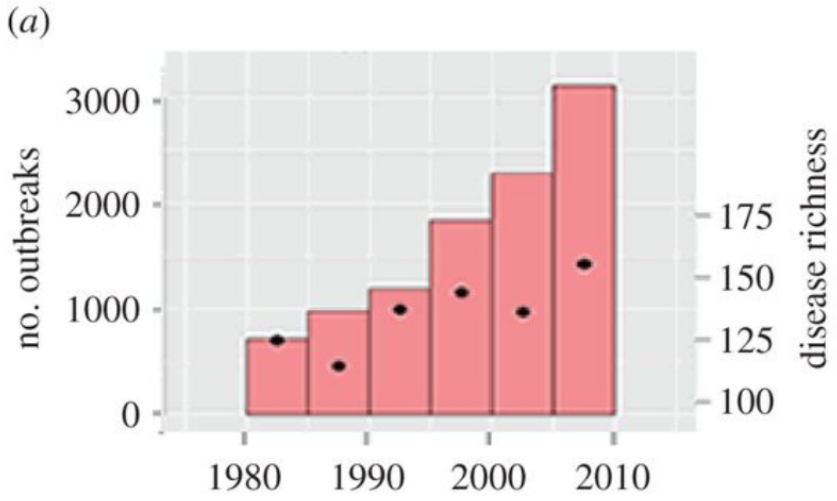


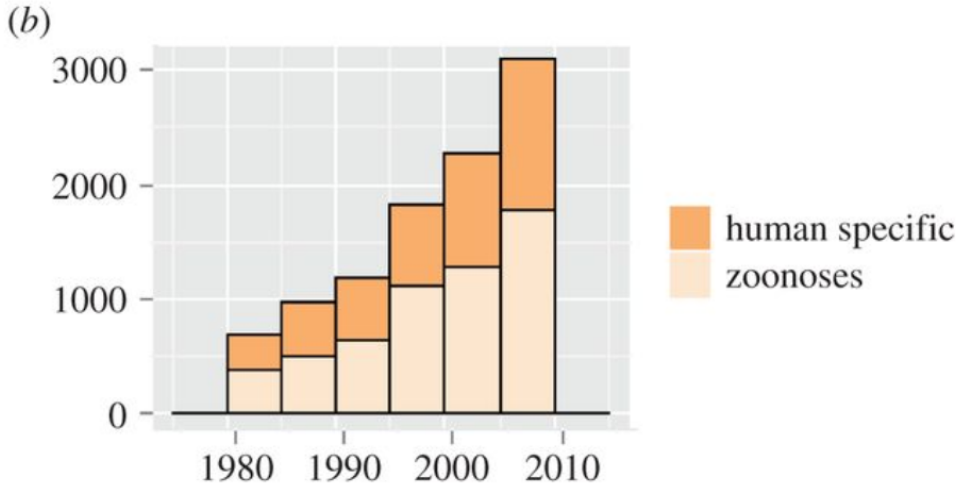
Sands P et al. N Engl J Med 2016;374:1281-1287.

Increasing trend in infectious disease outbreaks

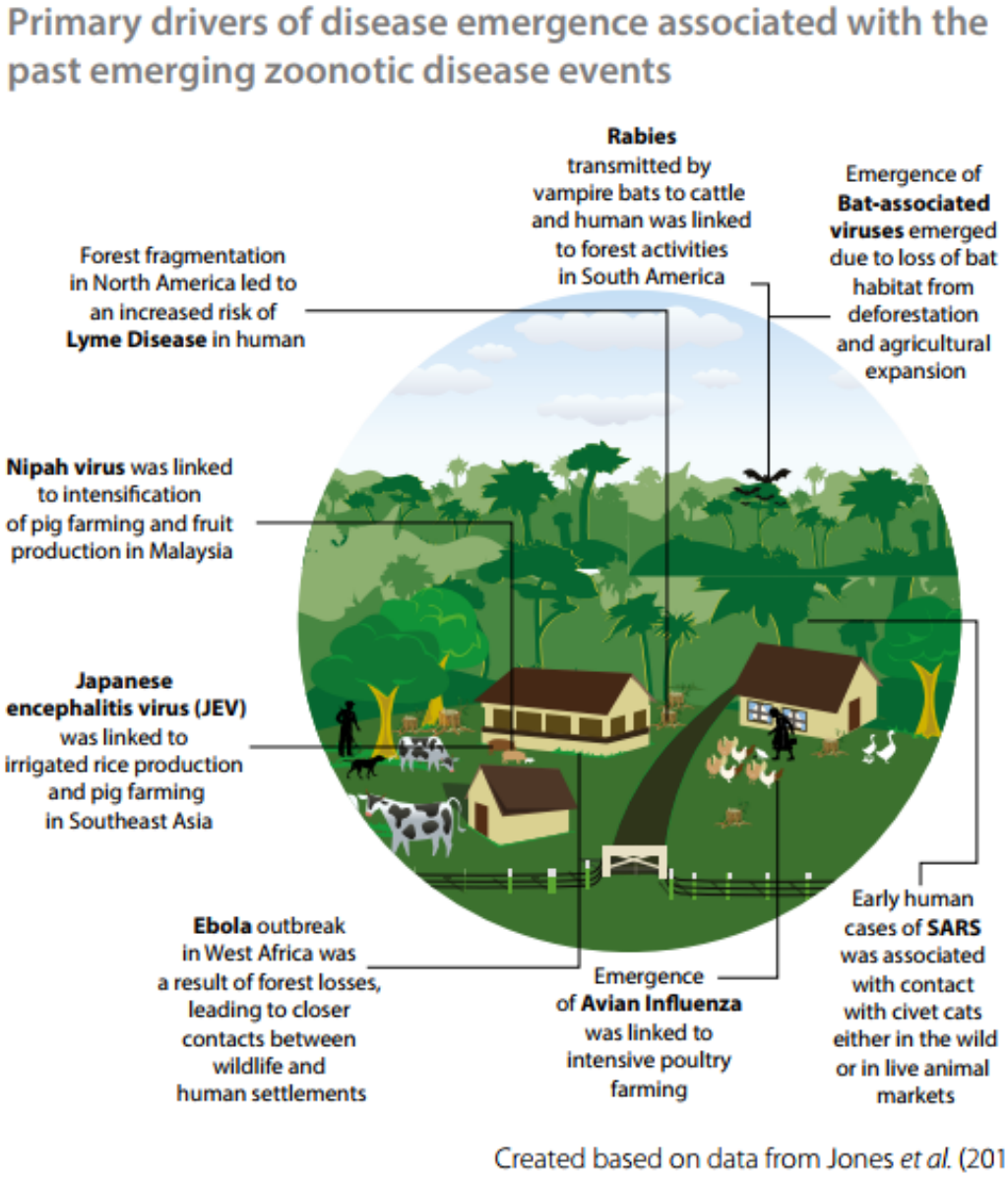
Study of 33 year dataset of 12,102 outbreaks of 215 human infectious diseases:

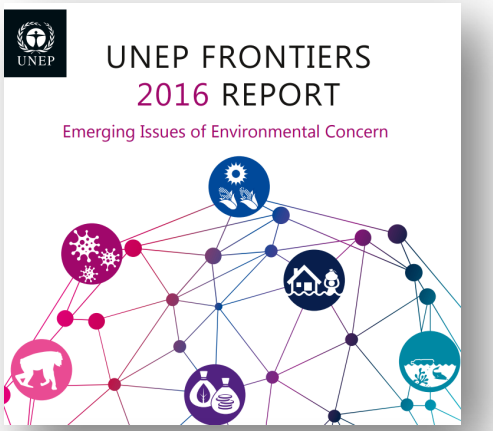
- Total number and diversity of outbreaks, and richness of diseases have increased since 1980
- 65% of diseases were zoonoses
- Salmonellosis caused most outbreaks

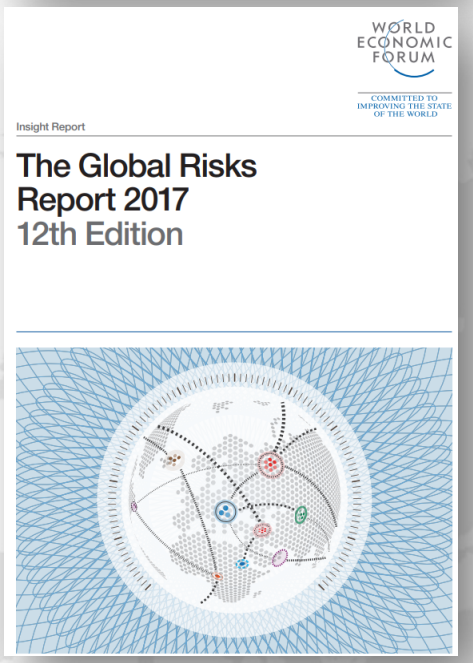




"Blurred lines of emergent disease and ecosystem health"

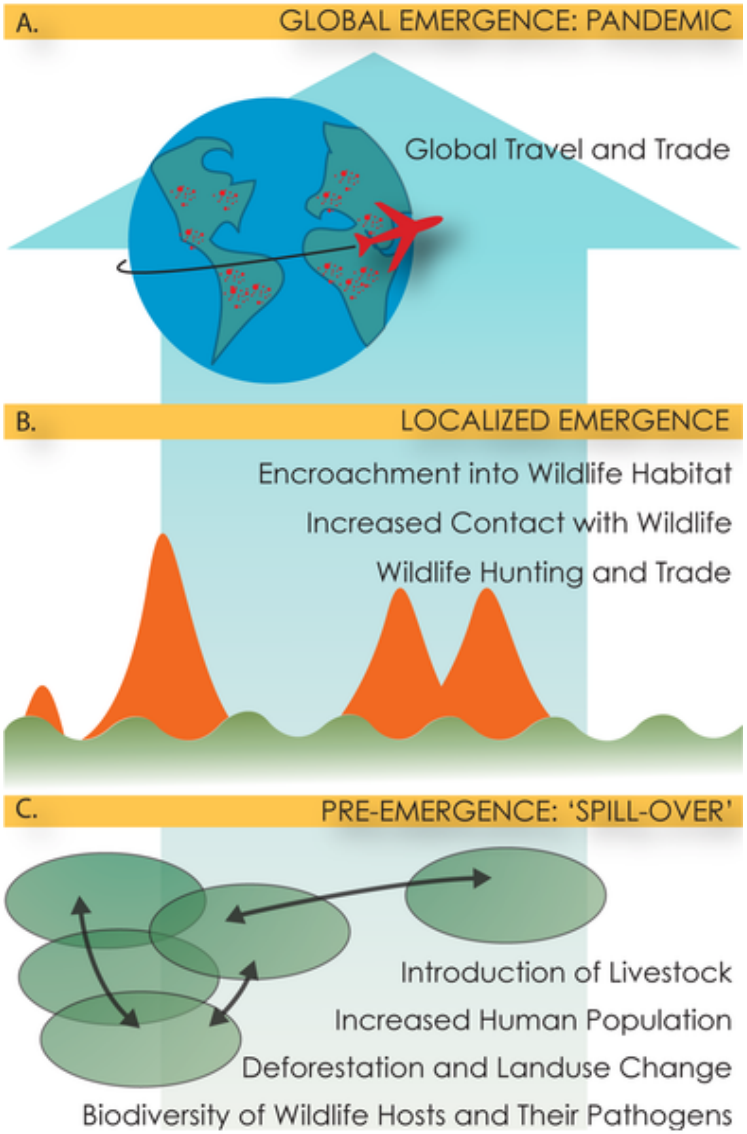






http://www.unep.org/frontiers/sites/unep.org.frontiers/files/documents/unep_frontiers_2016.pdf,
Jones et al.,PNAS, 2013, 110(21): 8399-8404.

Summary: Process of pandemic emergence

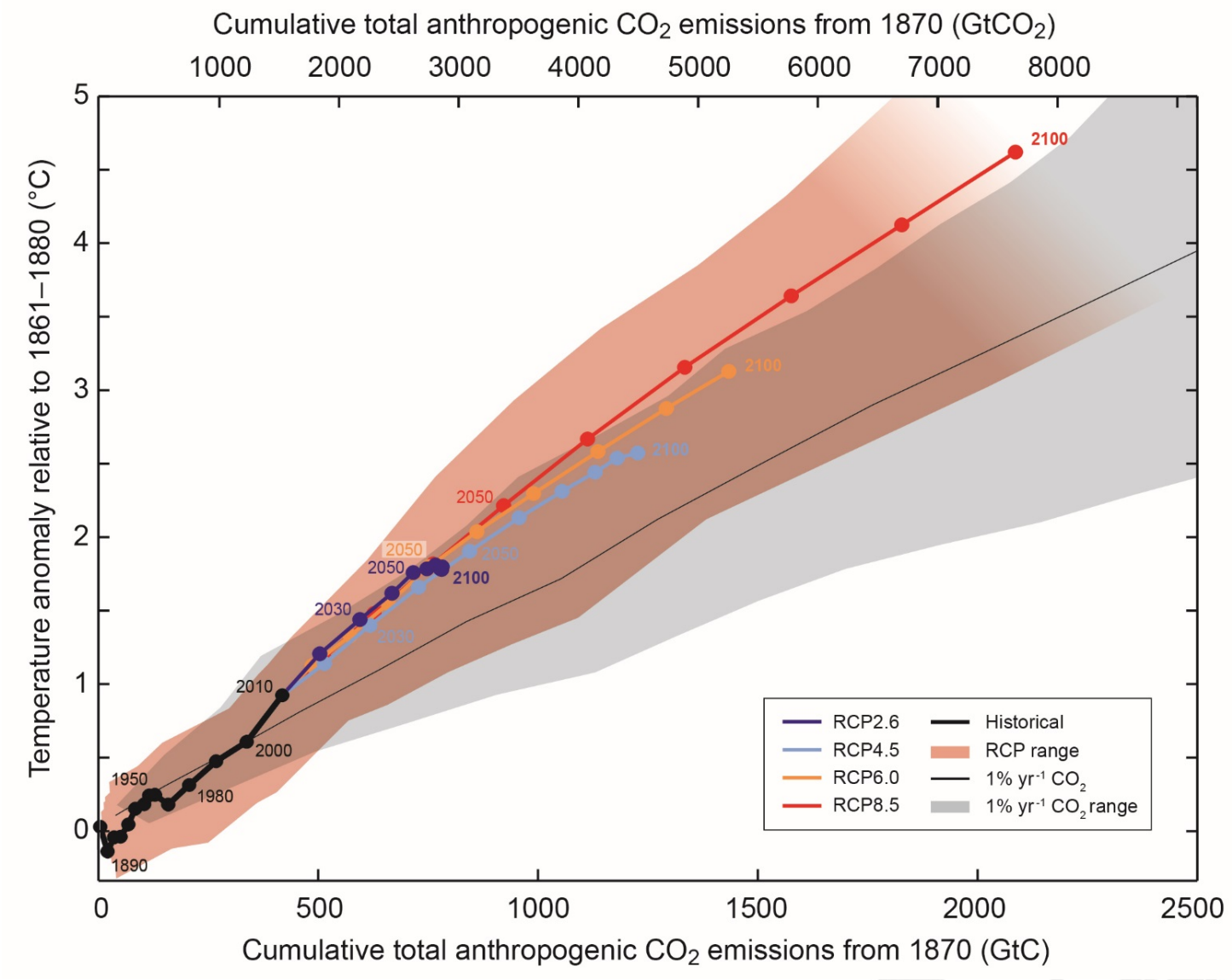


Biodiversity, wildlife, and humans

- Deforestation and urban sprawl force wildlife into new habitats
- Higher population densities lead to increased number of interactions between humans and animals
- Global trade and travel ensure that insects, animals, and humans will interact in novel settings

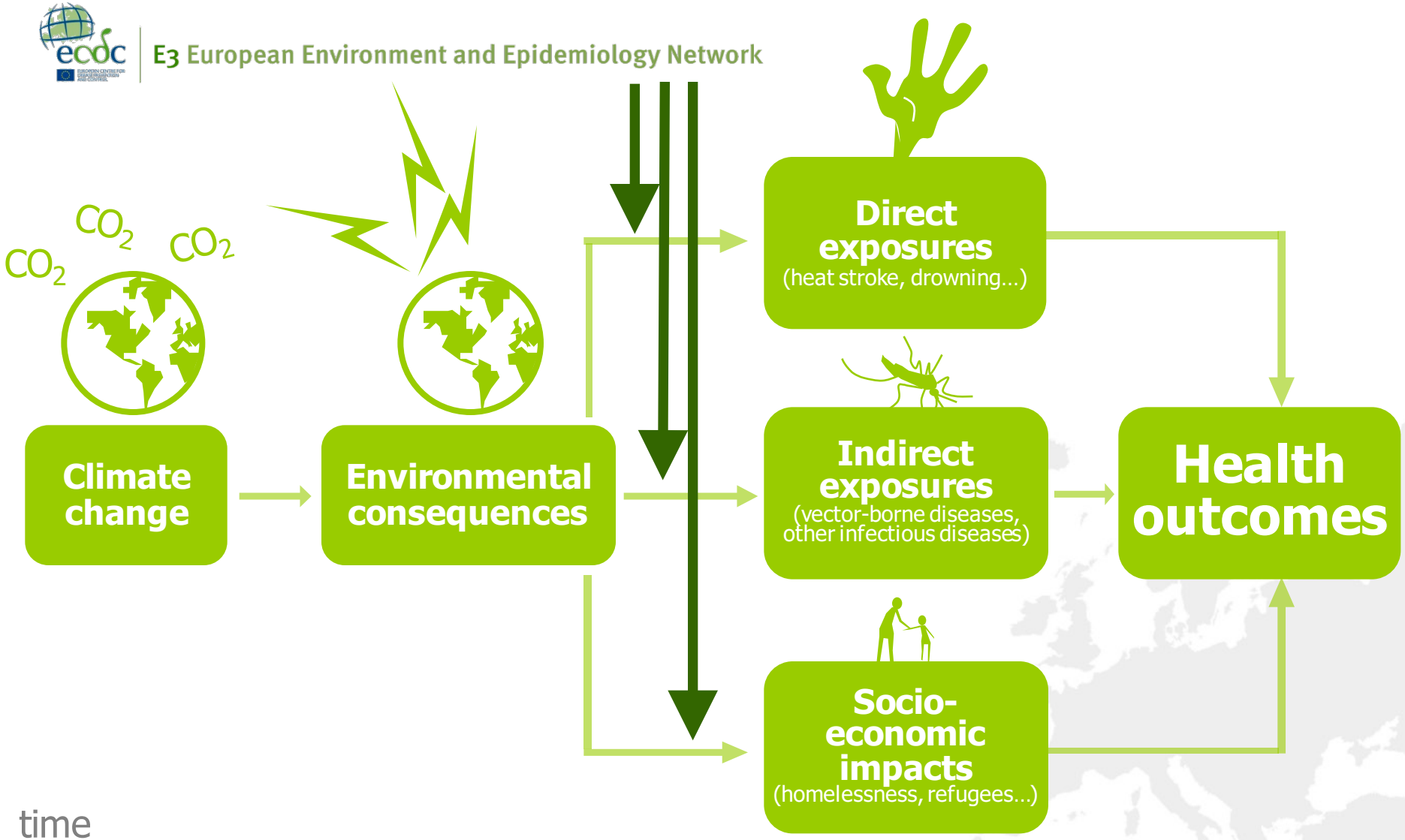
Bogich TL, Chunara R, Scales D, Chan E, et al. (2012) Preventing Pandemics Via International Development: A Systems Approach. PLoS Med 9(12): e1001354. doi:10.1371/journal.pmed.1001354

Climate change



Source: IPCC; http://www.climatechange2013.org/images/figures/WGI_AR5_FigSPM-10.jpg

Climate change



Biodiversity, globalisation and communicable disease in Europe

Vector-borne disease

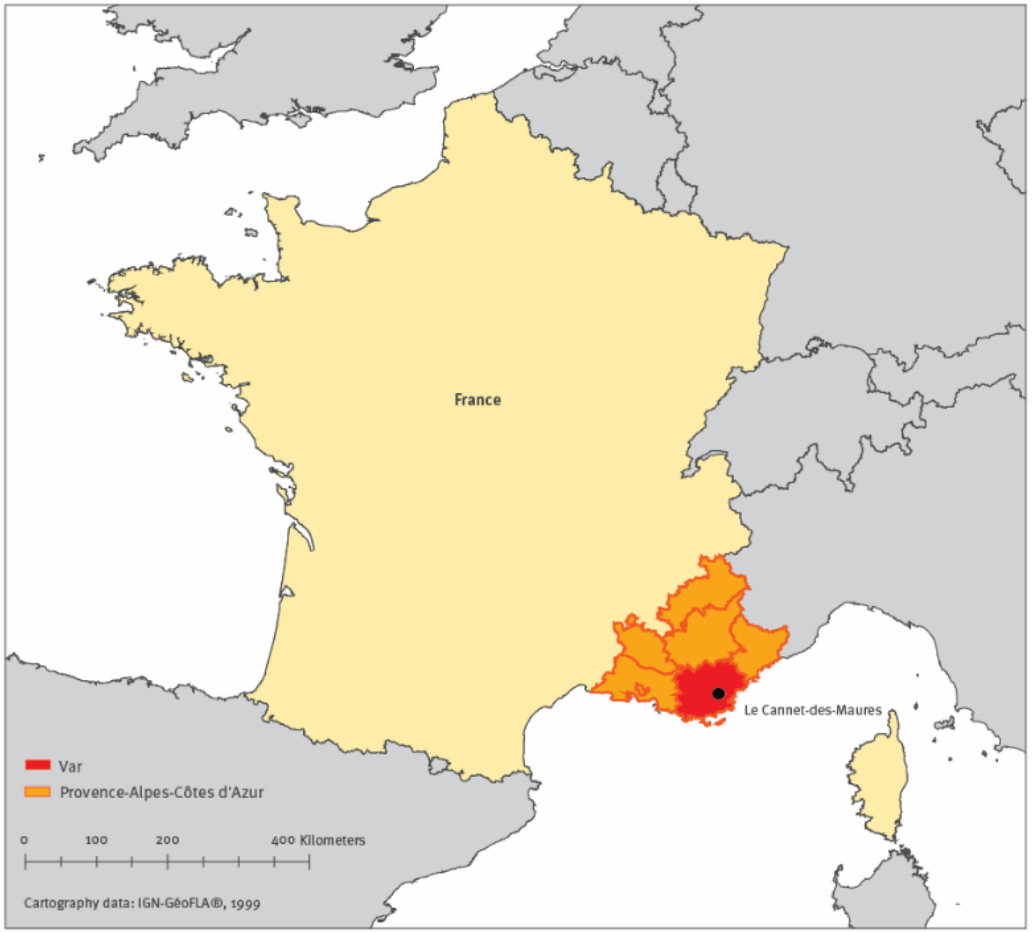
AMR

Food-borne disease

Image: NAP (2011) What you need to know about infectious disease

Vector-borne disease

Chikungunya in Europe, 2017



- 2 clusters of local Chikungunya transmission in August 2017

- 13 confirmed cases

Source: Calba et al., Eurosurveillance, 2017 22(39)

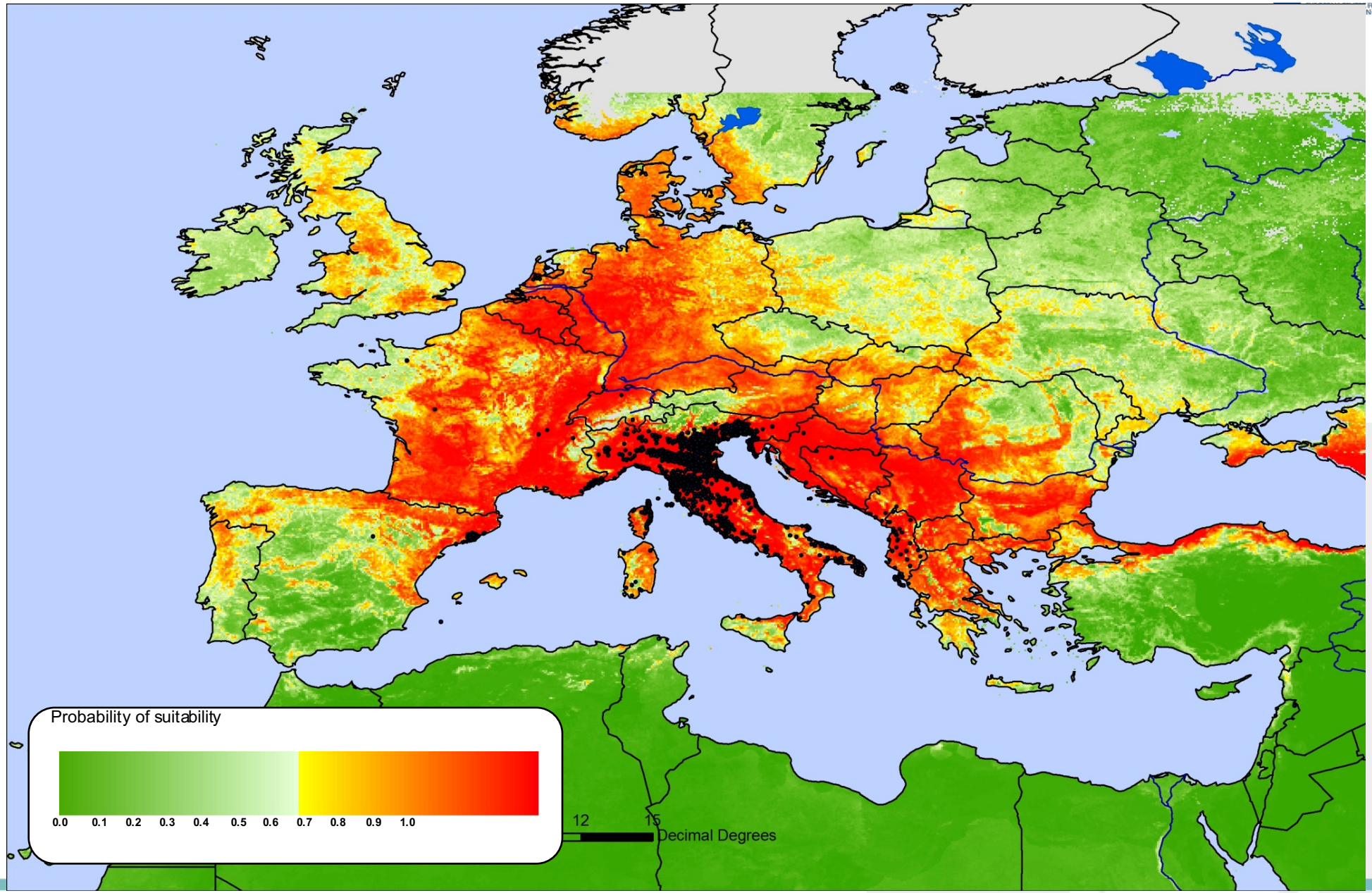
Chikungunya in Europe, 2017

- 239 confirmed and probable Chikungunya cases in Lazio

- 6 cases in Calabria

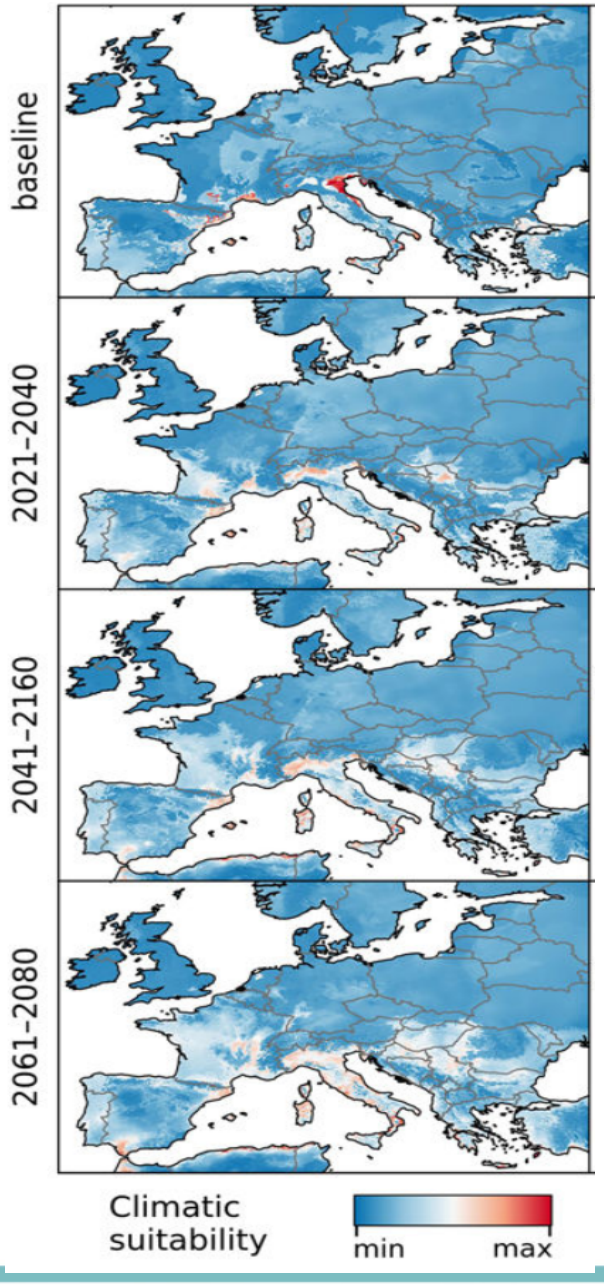
Source: ECDC, https://ecdc.europa.eu/en/news-events/epidemiological-update-chikungunya-europe-2017-0

Climatic suitability for *Aedes albopictus*



Source: ECDC

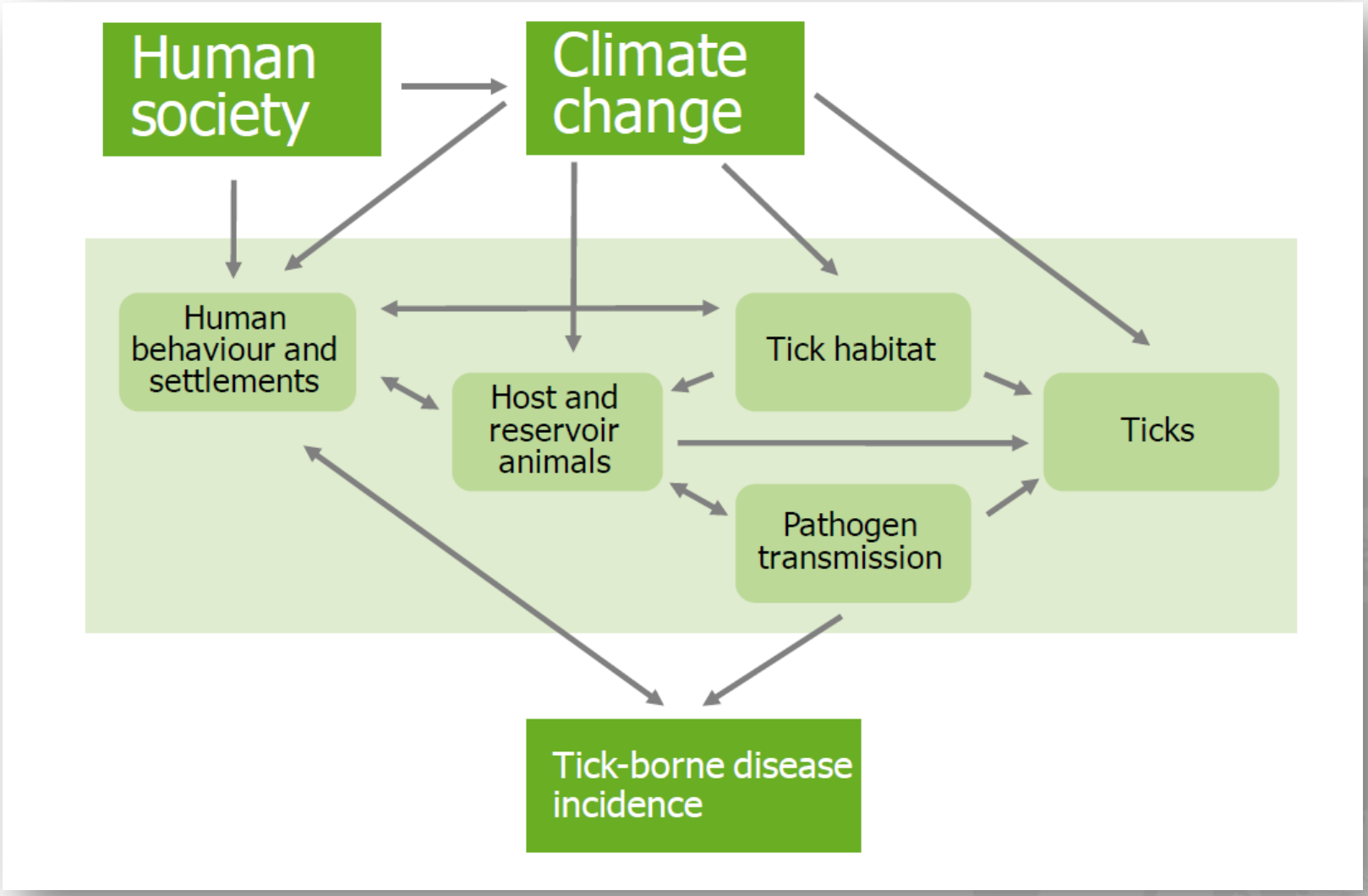
Climate change and chikungunya in Europe



- Moderate expansion of climatic suitability across much of central Europe, notably in France and Italy
- Large areas surrounding the Rhine and Rhone rivers in Germany and France, respectively, are also projected to increase in suitability.
- Some parts of the region of highest current suitability in northern Italy are projected to experience a decline in suitability due to increased summer droughts, which will reduce the habitat suitability for the vectors.

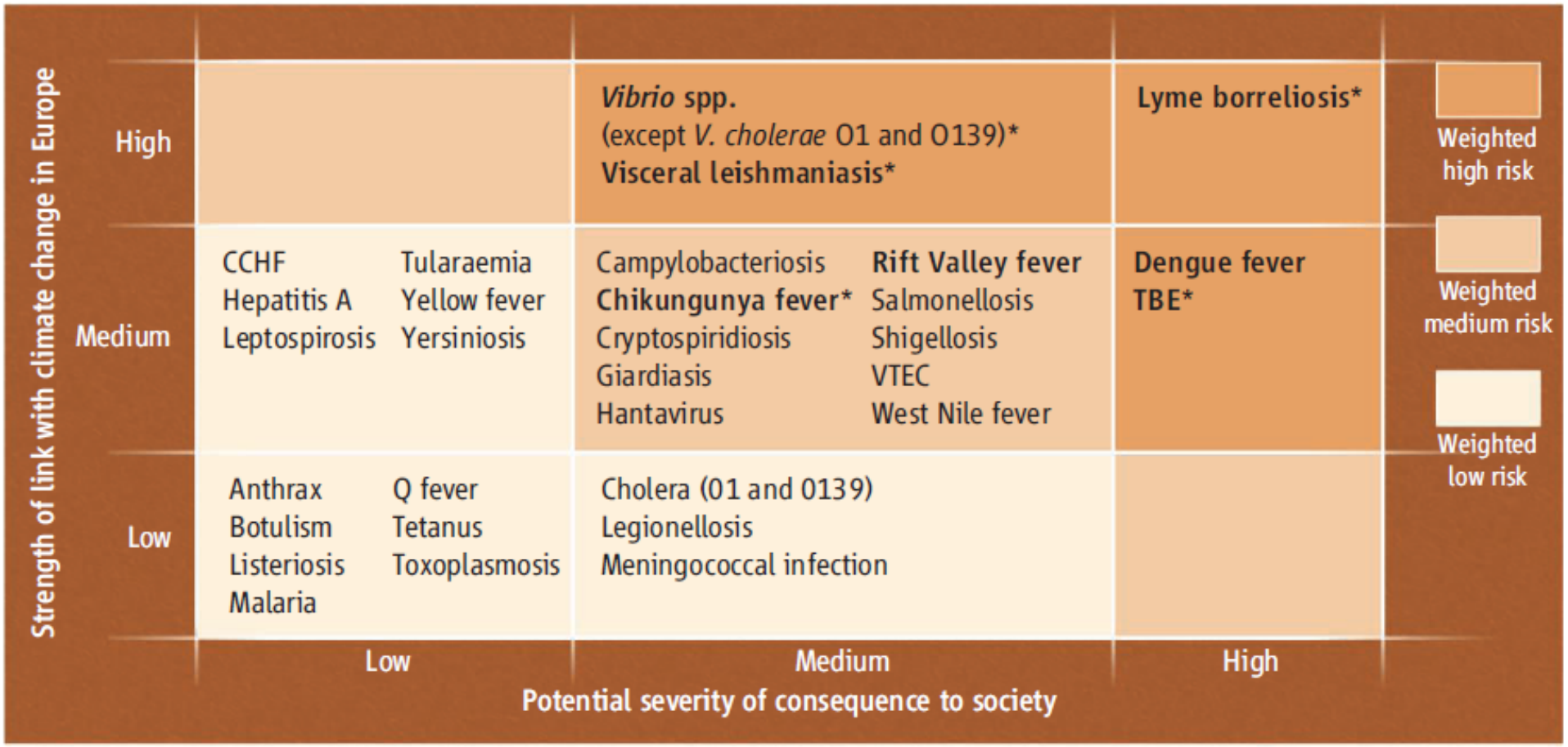
Source: Tjaden et al., 2017, Scientific Reports

Tick-borne diseases



Source: ECDC

Climate related disease risks in Europe



Weighted risk analysis of climate change impacts on infectious disease risks in Europe. CCHF, Crimean-Congo hemorrhagic fever. Candidates for suggested changes to disease-specific surveillance are in bold. Asterisks indicate diseases currently notifiable in some EU member states but not legally reportable to ECDC.

Source: Lindgren, Andersson, Suk, Sudre, Semenza (2012). *Science* 336: 418-419.

Understand risks in greater detail

- **e.g. VectorNet**

- Network of medical and veterinarian entomologists and public and animal health professionals, working in the field of vectors or vector-borne diseases;

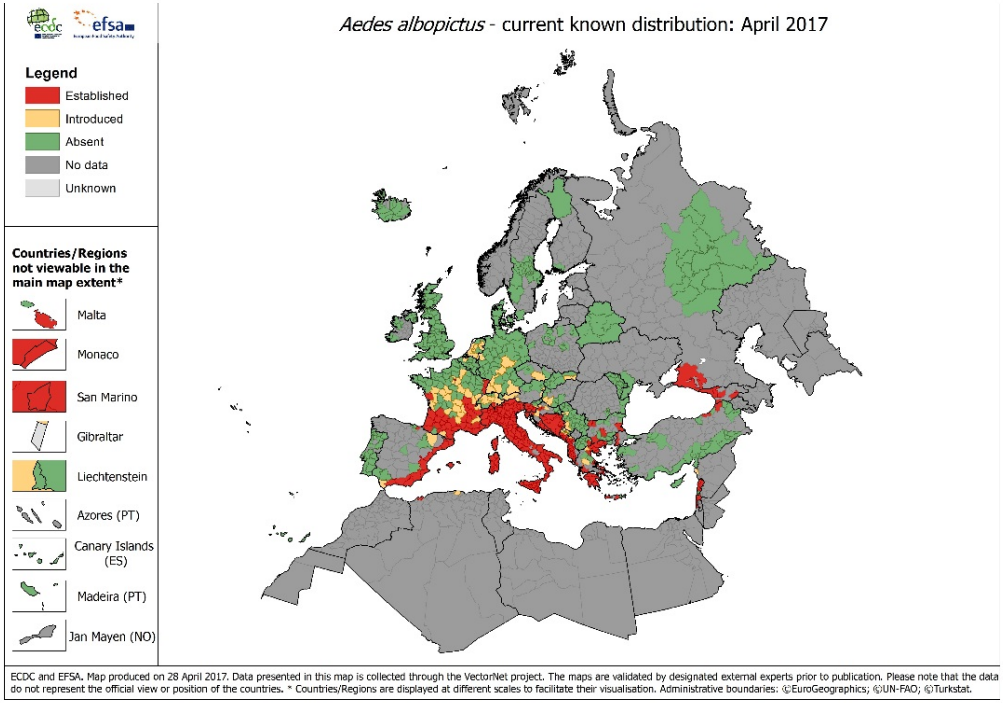
- To carry out targeted entomological surveillance

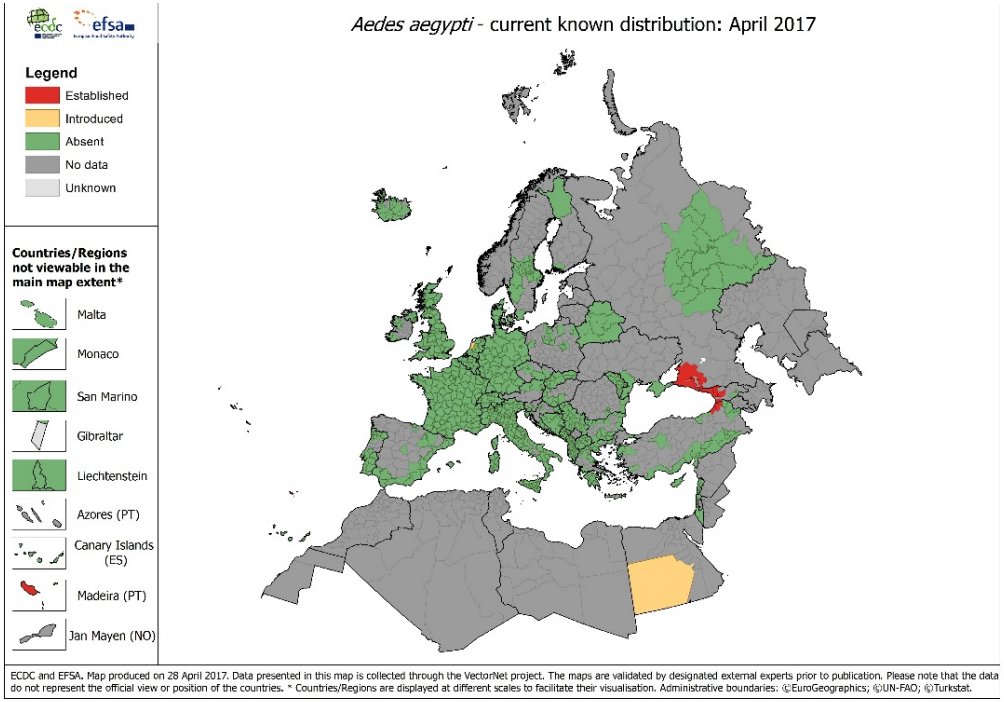
- To collect information on the geographical distribution of priority vectors for human and animal health:

- To deliver ad-hoc scientific advice to support ECDC and EFSA; => increase synergies

Vector distribution maps in Europe and neighbouring countries

Aedes albopictus and ***Aedes aegypti*** established/introduced/absent





EUROPEAN ANTIBIOTIC AWARENESS DAY

A EUROPEAN HEALTH INITIATIVE

English (en)

Plan a campaign | For healthcare workers | Get informed | Get involved | Campaigns in Europe | News | About

Communicating to professionals in hospitals and long-term care facilities

Up to half of all antibiotic use in hospitals is unnecessary of inappropriate. Antibiotic misuse in hospitals is a major driver of antibiotics resistance. What can be done?

View materials

New communication toolkit | Patient stories | Data and reports

#KeepAntibioticsWorking: join us on social media!

As a healthcare professional, **what can you do to keep antibiotics working?** What can a patient association do to contribute? What can policymakers do at European level? What can a parent do? Everyone can join the campaign on European Antibiotics Awareness Day- posting his/her own **message**, **picture** or **video** using the **#KeepAntibioticsWorking** hashtag. Tell the world what you do, in your professional or personal life, at individual or collective level, to use antibiotics responsibly and **#KeepAntibioticsWorking**!

Read about the #KeepAntibioticsWorking campaign

https://antibiotic.ecdc.europa.eu

e.g. Collaboration between EU agencies on surveillance of AMR and AMC

Surveillance of AMR and antimicrobial consumption in humans (EARS-Net, ESAC-Net, HAI-Net, FWD-Net)

Surveillance of antimicrobial consumption in animals (ESVAC)

Surveillance of antimicrobial resistance in animals and foods

Joint Interagency Antimicrobial Consumption and Resistance Analysis report (JIACRA)

First report published in January 2015

Second report published in July 2017

30 January 2015
636088/2013

ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals[1]

Joint Interagency Antimicrobial Consumption and Resistance Analysis (JIACRA) Report

Abstract

The ECDC, the EFSA and the EMA have for the first time jointly explored associations between consumption of antimicrobials in humans and food-producing animals, and antimicrobial resistance in bacteria from humans and food-producing animals, using 2011 and 2012 data currently available from their relevant five EU monitoring networks. Combined data on antimicrobial consumption and corresponding resistance in animals and humans for EU MSs and reporting countries were analysed using logistic regression models for selected combinations of bacteria and antimicrobials. A summary indicator of the proportion of resistant bacteria in the main food-producing animal species was calculated for the analysis, as consumption data in food-producing animals were not available at the species level. Comparison of antimicrobial consumption data in animals and humans in 2012, both expressed in milligrams per kilogram of estimated biomass, revealed that overall antimicrobial consumption was higher in animals than in humans, although contrasting situations were observed between countries. The consumption of several antimicrobials extensively used in animal husbandry was higher in animals than in humans, while consumption of antimicrobials critically important for human medicine (such as fluoroquinolones and 3rd- and 4th-generation cephalosporins) was higher in humans. In both humans and animals, positive associations between consumption of antimicrobials and the corresponding resistance in bacteria were observed for most of the combinations investigated. In some cases, a positive association was also found between antimicrobial consumption in animals and resistance in bacteria from humans. While highlighting findings of concern, these results should be interpreted with caution owing to current data limitations and the complexity of the AMR phenomenon, which is influenced by several factors besides antimicrobial consumption. Recommendations to address current data limitations for analyses of this type were identified. In any case, responsible use of antimicrobials in both humans and animals should be promoted.

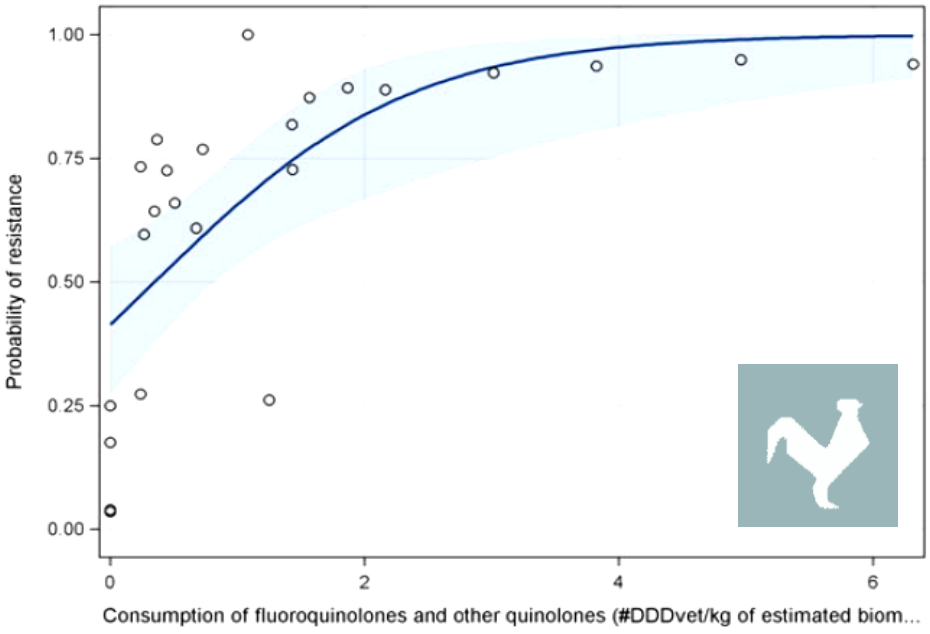
[1] For citation purposes: ECDC (European Centre for Disease Prevention and Control), EFSA (European Food Safety Authority) and EMA (European Medicines Agency). ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals. Stockholm/Parma/London: ECDC/EFSA/EMA, 2015. EFSA Journal 2015;13(1):4006, 114 pp. doi:10.2903/j.efsa.2015.4006

Joint Interagency Antimicrobial Consumption and Resistance Analysis (JIACRA): examples

Poultry

Quinolone consumption and probability of resistance to quinolones in *Campylobacter jejuni* from poultry, EU/EEA, 2014

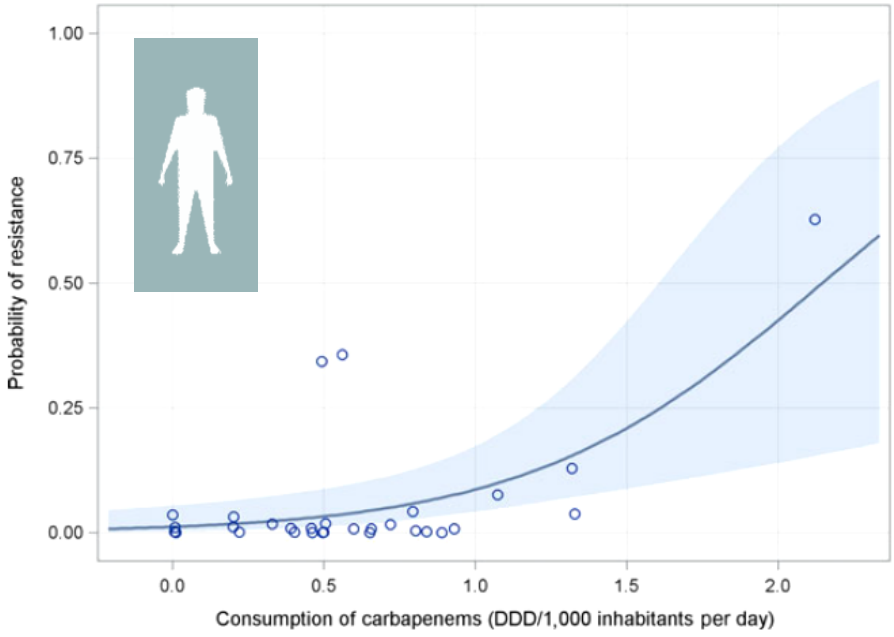
OR = 2.71 [1.57 – 5.63], p < 0.001



Humans

Carbapenem consumption and probability of resistance to carbapenems in invasive *Klebsiella pneumoniae* from humans, EU/EEA, 2015

OR = 1.23 [1.08 – 1.42], p = 0.002



Each dot represents one country.

Source: EFSA Journal, 27 July 2017.

Environment outside of hospitals wards / hospitals

- 6 hospitals in Brooklyn, NY
- 15 ceftazidime-resistant *Acinetobacter baumannii* from **environmental surfaces within a 0.5 mile radius from the hospital** (vs none if >0.5 mile)
- Emergency room door, clinic door, restaurant door, bakery door, diner door, pizza parlor door, donut shop door, deli door, grocery door, internet cafe bathroom, internet cafe door, subway door, subway hand railing, ...

Source: Rose M, et al. Am J Infect Control 2014;42:346-8.

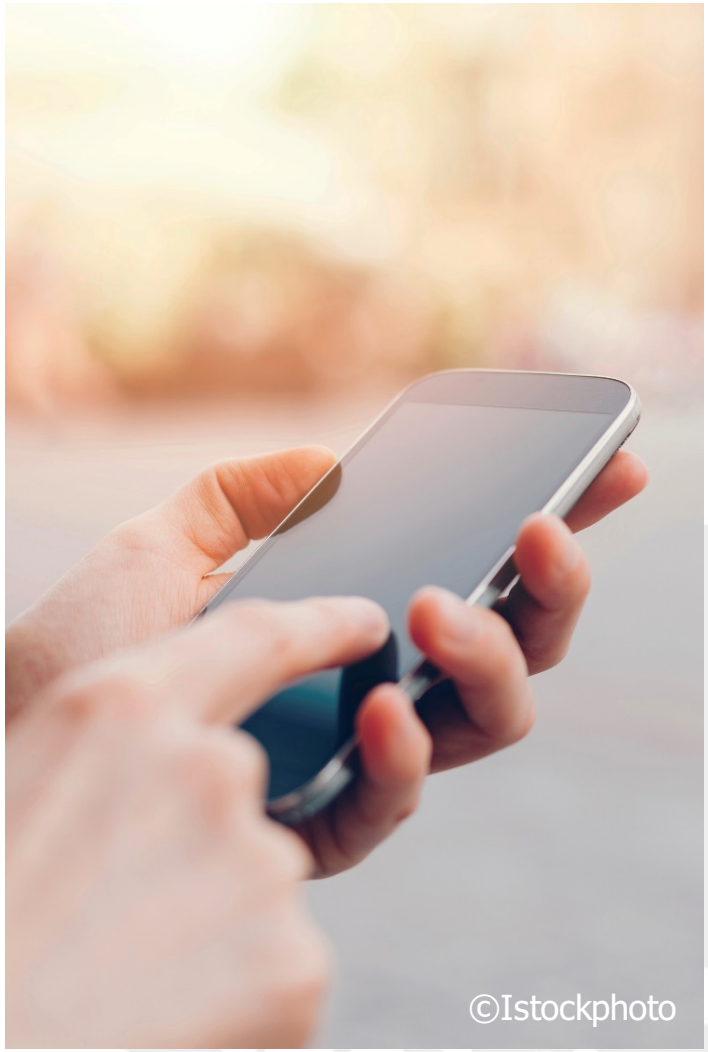
Public transportation (busses, metro)

- **Porto (Portugal)**
  - 36% of 199 buses with MRSA
  - 2 of 3 major clones are the same as in hospitals
  - Association between proportion of MRSA contamination and bus serving more than 3 hospitals
- **Midwestern U.S. (urban)**
  - 63% of 40 buses with MRSA
- **New York Subway**
  - *Acinetobacter baumannii* at 220/466 stations sampled

Source: Conceição T, et al. PLoS ONE 2014;8(11): e77812; Lutz JK, et al. Am J Infect Control 2014;42:1285-90; Afshinnekoo E, et al. Cell Systems 2015; 1: 1–15. http://dx.doi.org/10.1016/j.cels.2015.01.001.

Mobile communication devices

- **Review of literature**
  - 9-25% mobile communication devices with pathogenic bacteria
  - 0-10% with MRSA
- **UK**
  - 16% of 390 mobile phones in 12 cities contaminated with *E. coli* (London School of Hygiene and Tropical Medicine and Queen Mary, University of London)

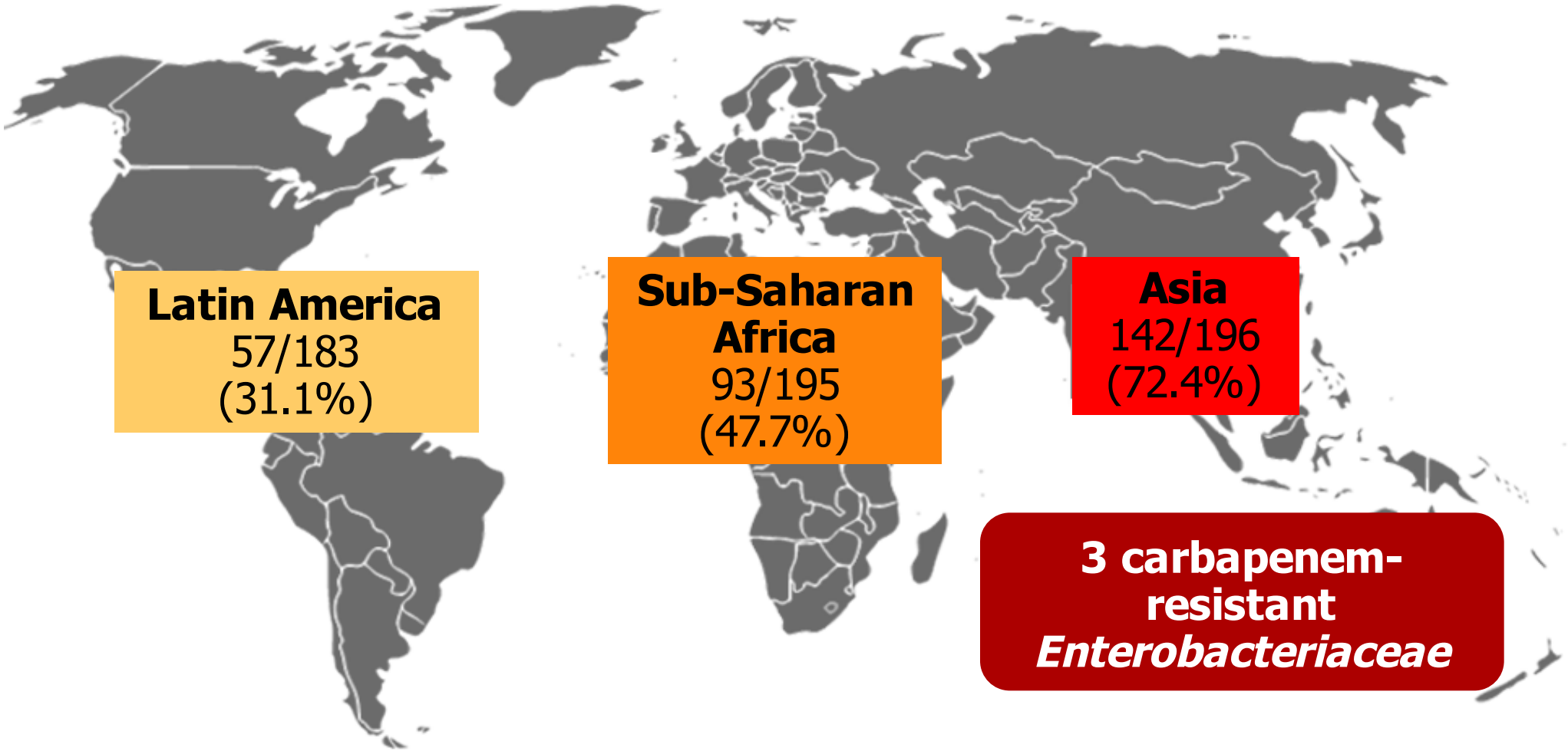


Source: Brady RRW, et al. J Hosp Infect 2009;71:295-300. Batty D. The Guardian 13 Oct 2011.

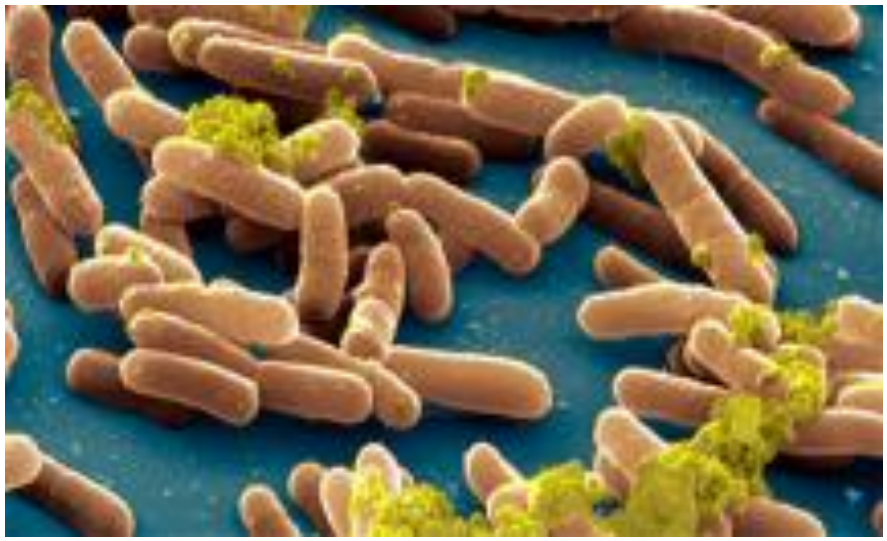
International travel

Date	Departure	Destination
Today	14:10	MULTIDRUG-RESISTANT MICROORGANISMS
Today	14:35	MULTIDRUG-RESISTANT MICROORGANISMS
Today	14:40	MULTIDRUG-RESISTANT MICROORGANISMS
Today	14:45	MULTIDRUG-RESISTANT MICROORGANISMS
Today	14:55	Baxjö
Today	15:00	Holmen
Today	15:00	MULTIDRUG-RESISTANT MICROORGANISMS
Today	15:00	MULTIDRUG-RESISTANT MICROORGANISMS
Today	15:05	MULTIDRUG-RESISTANT MICROORGANISMS
Today	15:05	MULTIDRUG-RESISTANT MICROORGANISMS
Today	15:10	Wasserdam
Today	15:15	MULTIDRUG-RESISTANT MICROORGANISMS
Today	15:15	Mørup

Frequency of fecal carriage of multidrug-resistant *Enterobacteriaceae* in international travellers, February 2012-April 2013



Source: Ruppé E, et al. Clin Infect Dis 2015 Apr 22. pii: civ333
Ruppé E, et al. Eurosurveillance 2014 Apr 10;19(14). pii: 20768.



Food-borne diseases

EU key collaborators for foodborne diseases

EURL for *Campylobacter*, Sweden

Food – and Waterborne Diseases and zoonoses network (FWD-Net):
EU and EEA countries

Food safety, RASFF*

Public health

EURL for *Salmonella*, The Netherlands

EURL for *Listeria monocytogenes*, France

European Food Safety Authority, Italy, and its Zoonoses Monitoring Data Network

EURL for VTEC**, Italy

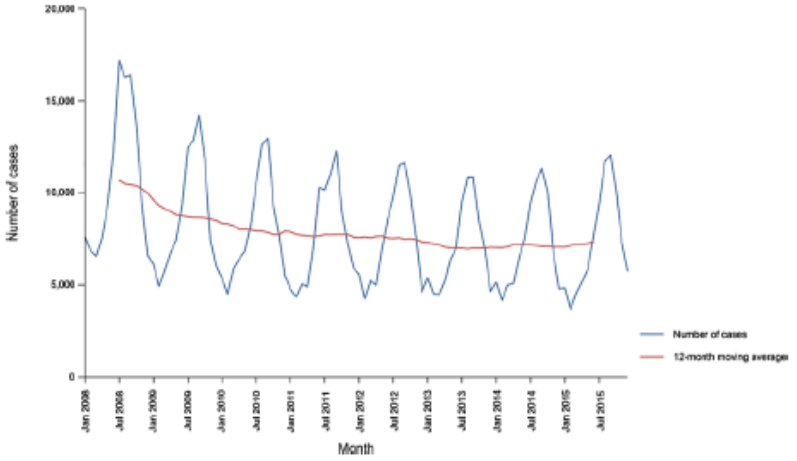
Administrative boundaries: ©EuroGeographics ©UN-FAO ©Turkstat ©GADM

*RASFF = Rapid Alert System for Food and Feed

**EURL for VTEC=European Union Reference Laboratory for verotoxigenic *E. coli*

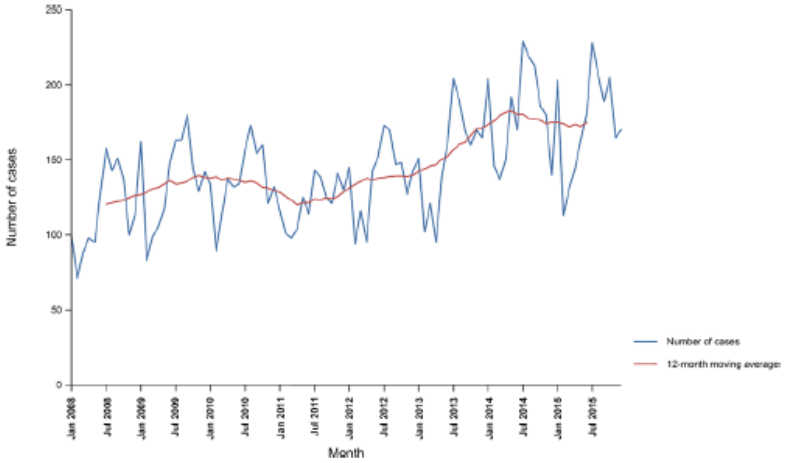
Trends in priority foodborne diseases, 2015

Salmonellosis



Source: Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria, Croatia, Latvia and Romania did not report data to the level of detail required for the analysis.

Listeriosis



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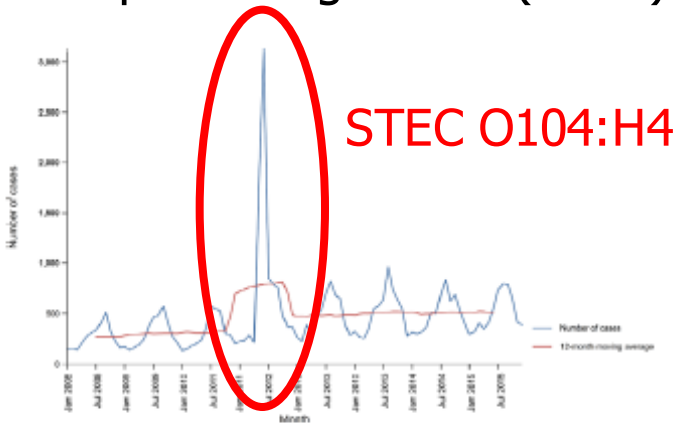
ShigaToxin-producing *E. coli* (STEC)



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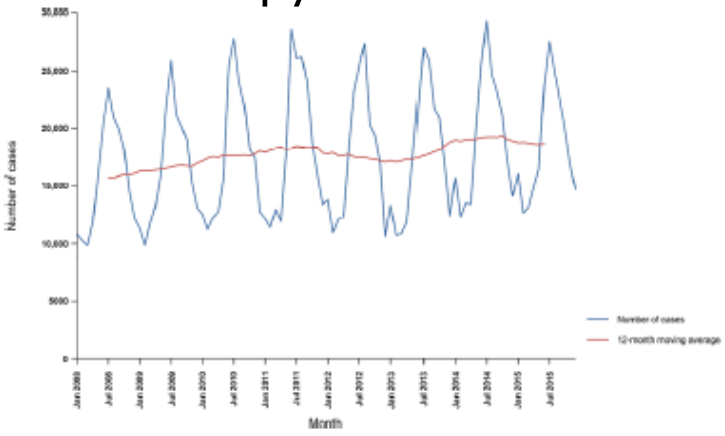
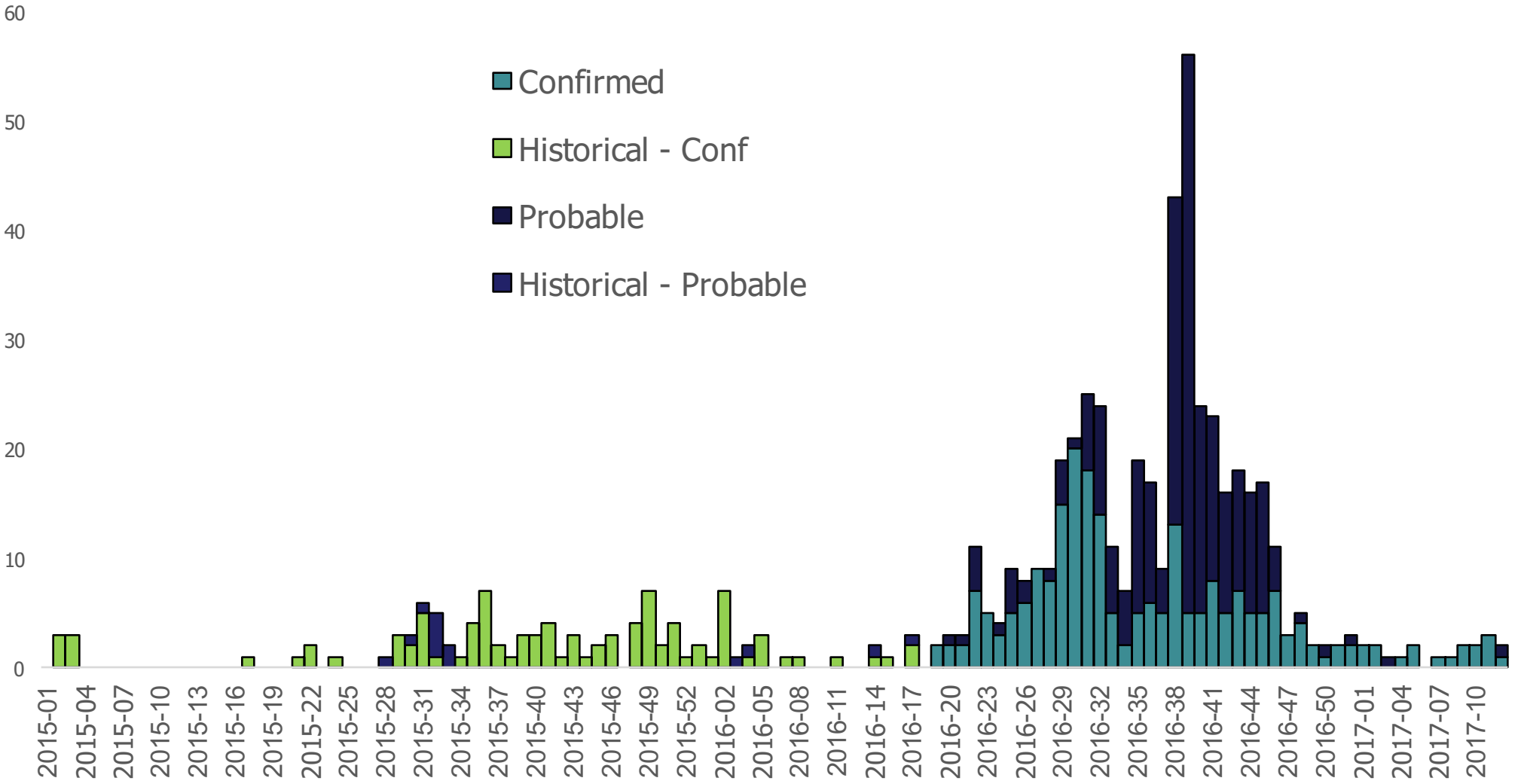
Campylobacteriosis



Source: Austria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Belgium, Bulgaria, Croatia, Portugal and Romania did not report data to the level of detail required for the analysis. In Greece, campylobacteriosis is not under surveillance.

Source: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4634/epdf

S. Enteritidis multicountry outbreak cases by week of statistics* and case classification (n=584), EU/EEA 2015-2017, as of 05/05/2017



*Week of onset, or week of sampling or week of received date at reference lab level

Multi-country outbreak

- RASFF: countries encouraged to perform MLVA on official non-human poultry product samples positive for *S.* Enteritidis since May 2016

- UK and NL: perform food chain distribution analysis on food outlets associated with cluster of confirmed cases

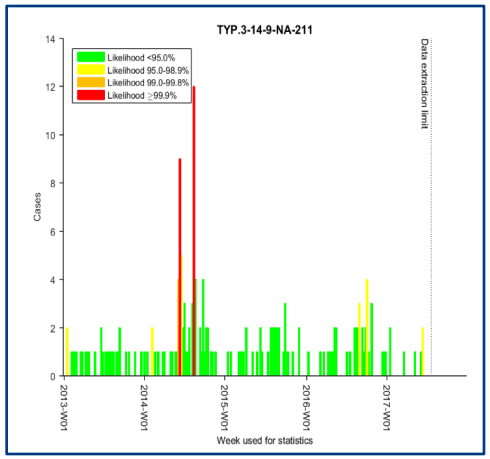
  => Identification of common origin of eggs from a large egg packing station in another country

- NL sampled 5000 eggs from the packing centre and identified positive eggs

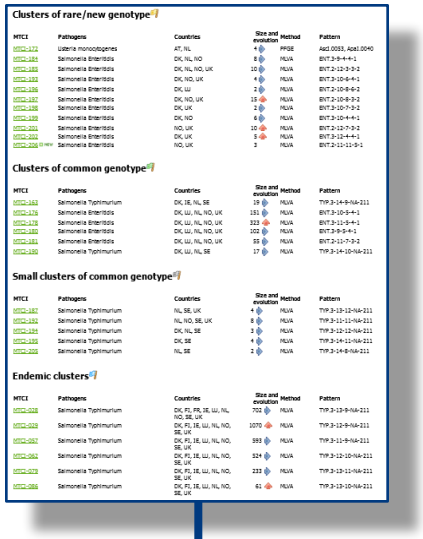
- EU-wide trace-back and forward initiated

Improved signal detection and response to multi-country foodborne outbreaks

MLVA[1] + PFGE[2]



Weekly cluster reports



ECDC Extranet | EPIS FWD

Urgent Inquiry: unusual increase of cases at national level

Whole genome sequencing (WGS) support since 2015

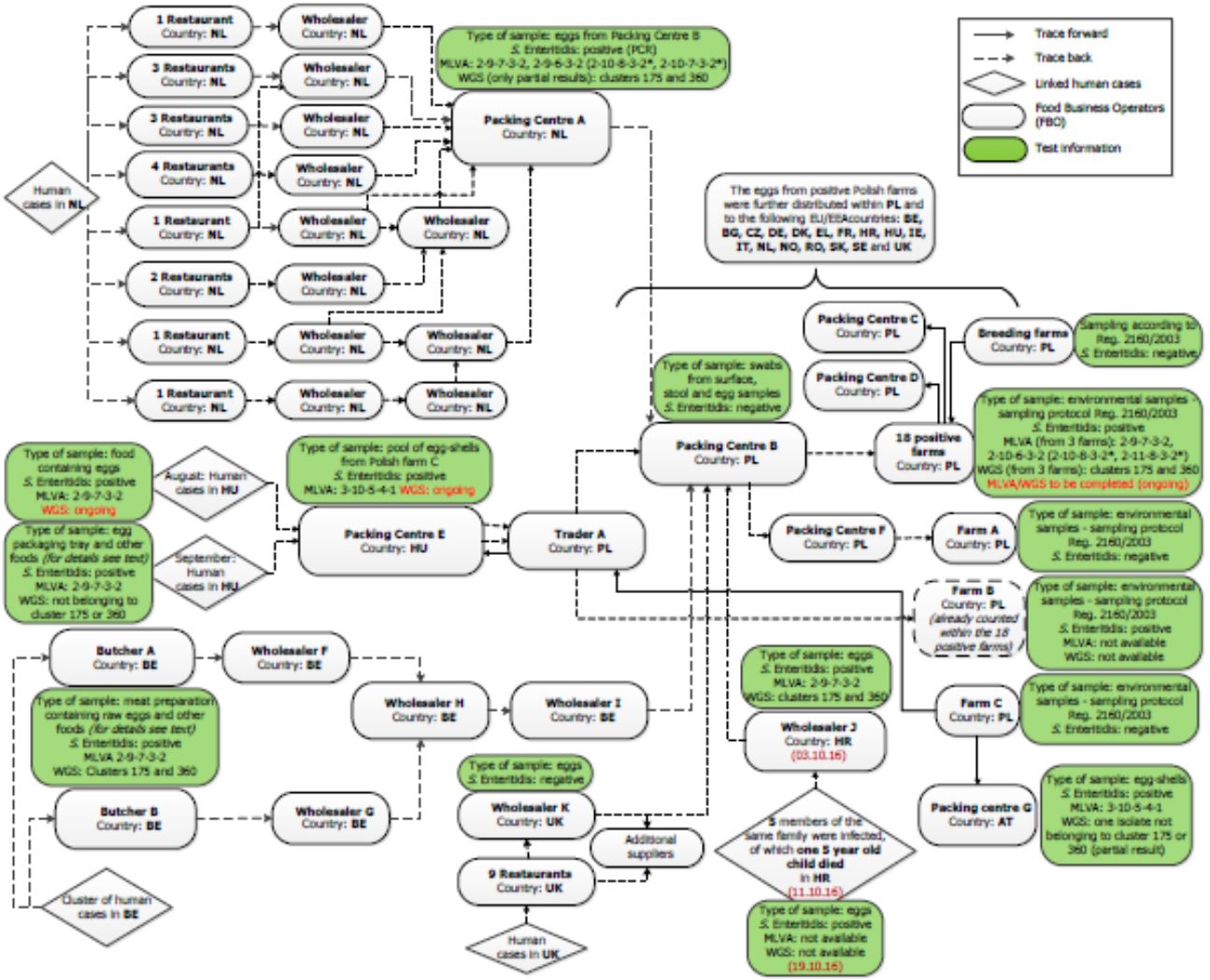
Joint ECDC-EFSA Rapid Outbreak Assessments

[1]MLVA=Multi-Locus Variable number tandem repeat Analysis

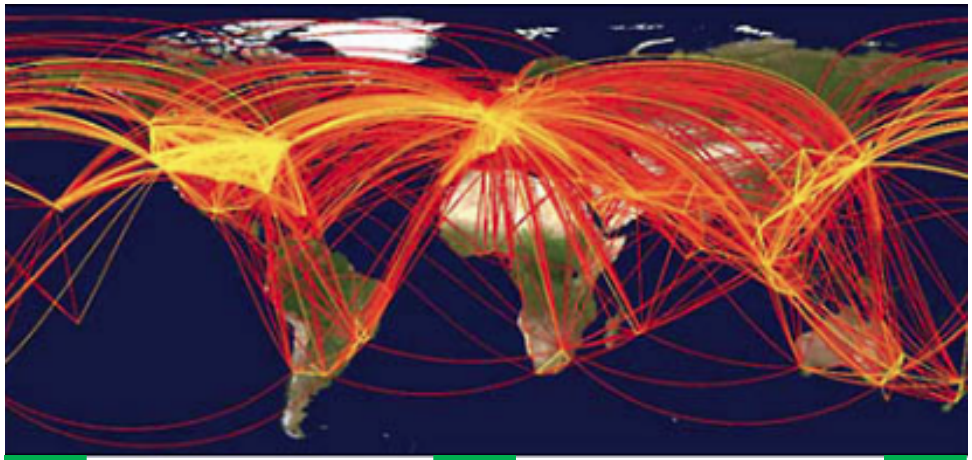
[2]PFGE=Pulsed-field gel electrophoresis

Trace-back investigation at EU level

Figure 5. Graphical representation of traceability and testing information available in RASFF or provided by Member States to EFSA, as of 1 March 2017



Common themes



Vector-borne disease

AMR

Food-borne disease

Image: NAP (2011) What you need to know about infectious disease

Common themes

Risk drivers

- Environmental and ecological factors
- Globalisation in trade and travel

Integrated analyses growing in importance

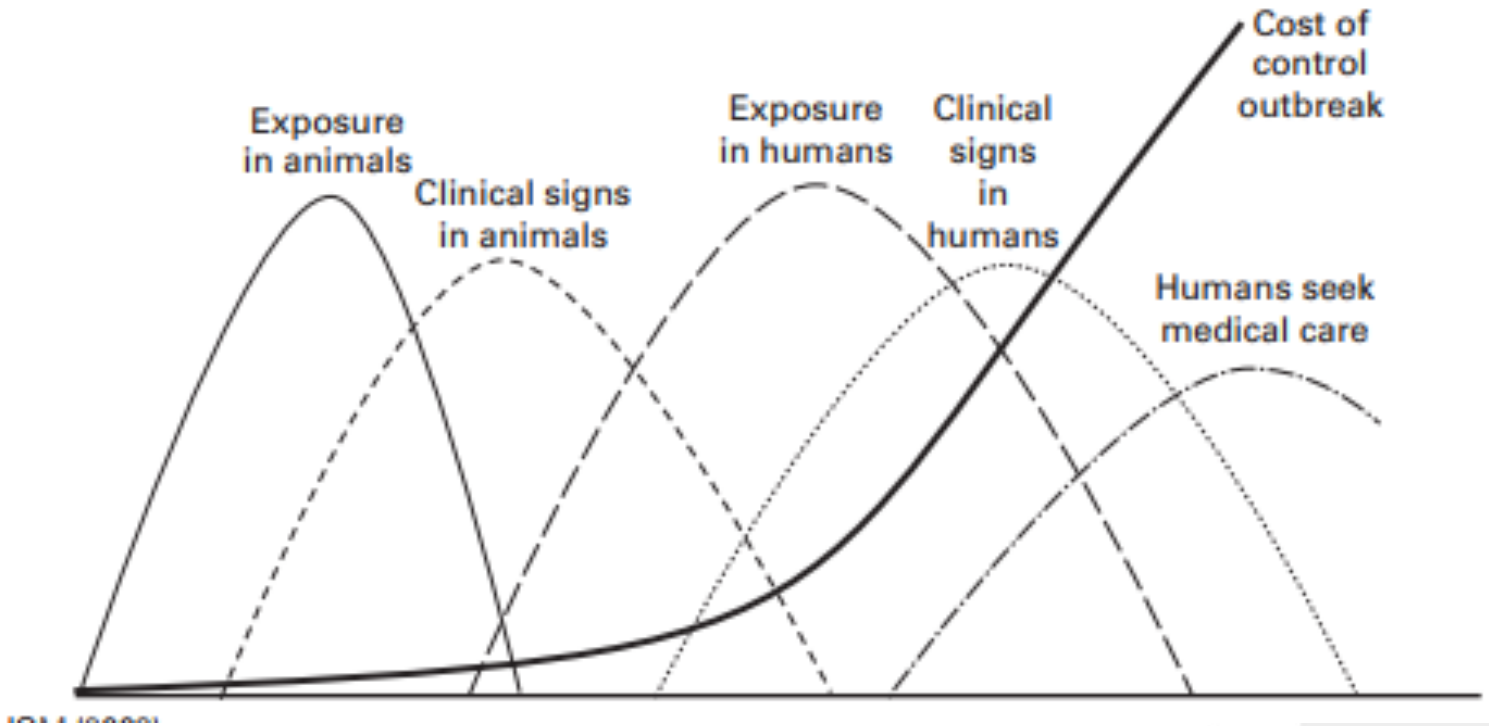
- Identifying, analysing and responding to communicable diseases requires multi-agency and multi-disciplinary collaboration
- 'One Health' needs to be operationalised

Cross-border action also growing in importance

- Disease risks and outbreaks cross borders and so must public health action (e.g. Decision 1082/2013/EU)

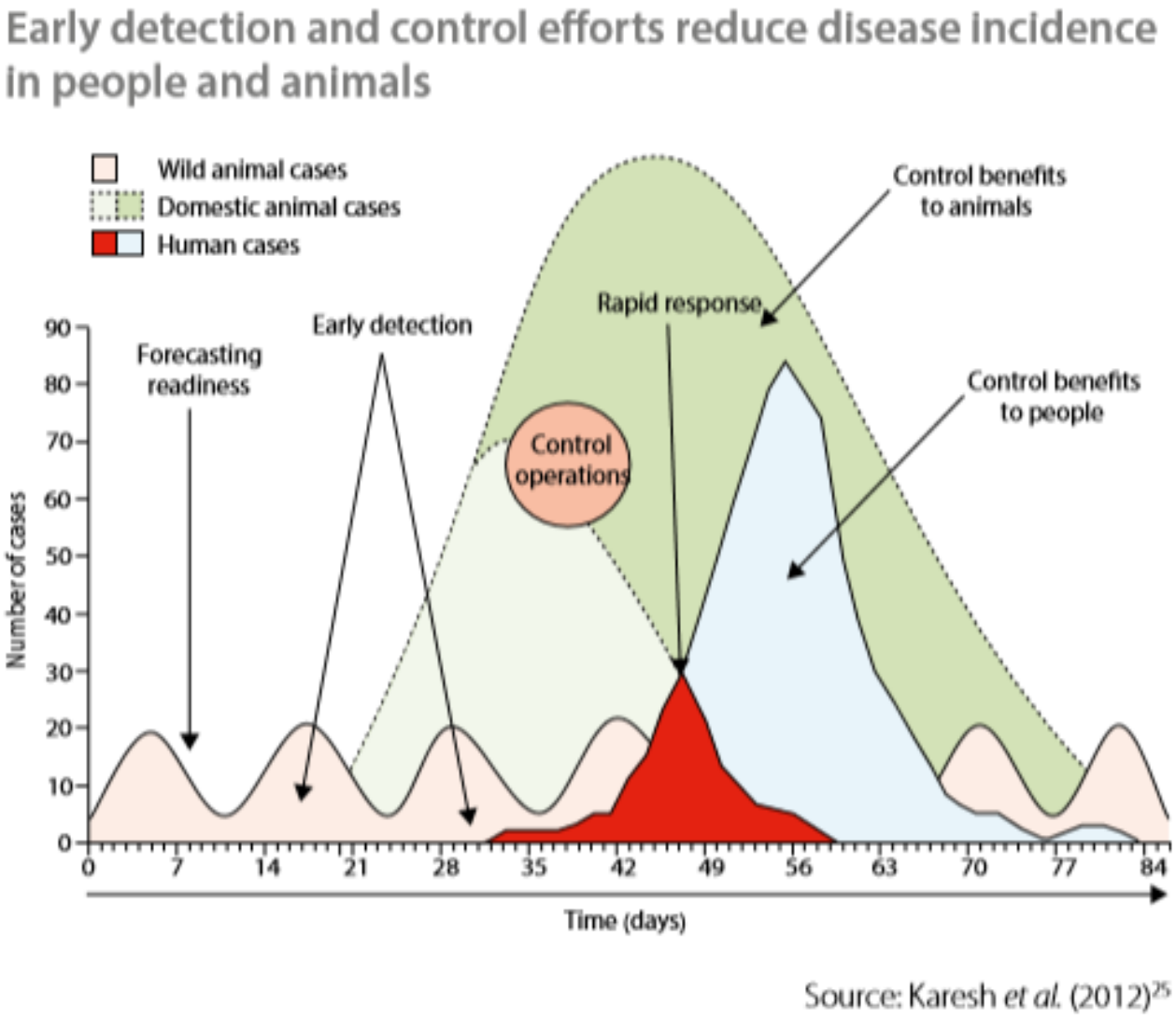
Benefits of cross-sectoral action

Illustrative Relationship between Time of Detection of Emerging Zoonotic Disease and Total Cost of Outbreak



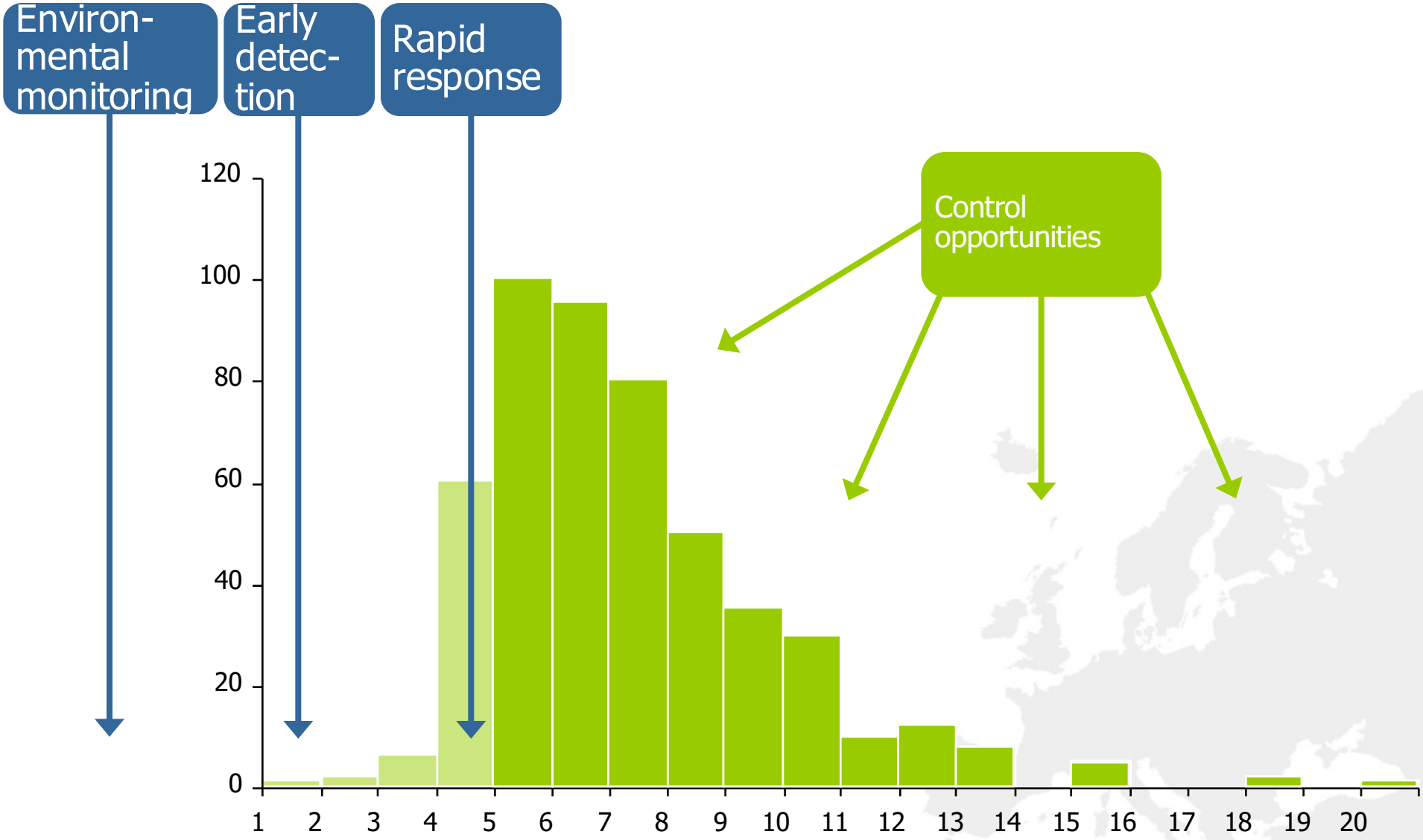
Source: The World Bank (2012), People, pathogens and our planet: The economics of One Health

Earlier detection of risks



Source: Karesh et al. (2012), UNEP

Effective public health response



Thank you!

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