Dr Lance Jennings

Clinical Virologist

CDHB, Clinical Associate Professor, Pathology Department, University of Otago

Sunday, August 14, 2016 (Room 5)

8:30 - 9:25 WS #145: Preparing for Acute Viral Outbreaks

9:35 - 10:30 WS #155: Preparing for Acute Viral Outbreaks (Repeated)

Preparing for acute viral outbreaks

Lance Jennings

Clinical Virologist, Canterbury Health Laboratories

South GP CME 14th August 2016

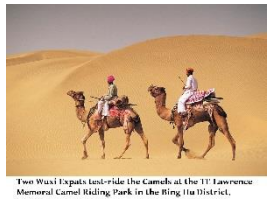
WS #145 & WS # 155

University of Otago
Te Whare Wānanga o Otāgo

Canterbury Health Laboratories
www.chl.co.nz | 0800THELAB









Outline

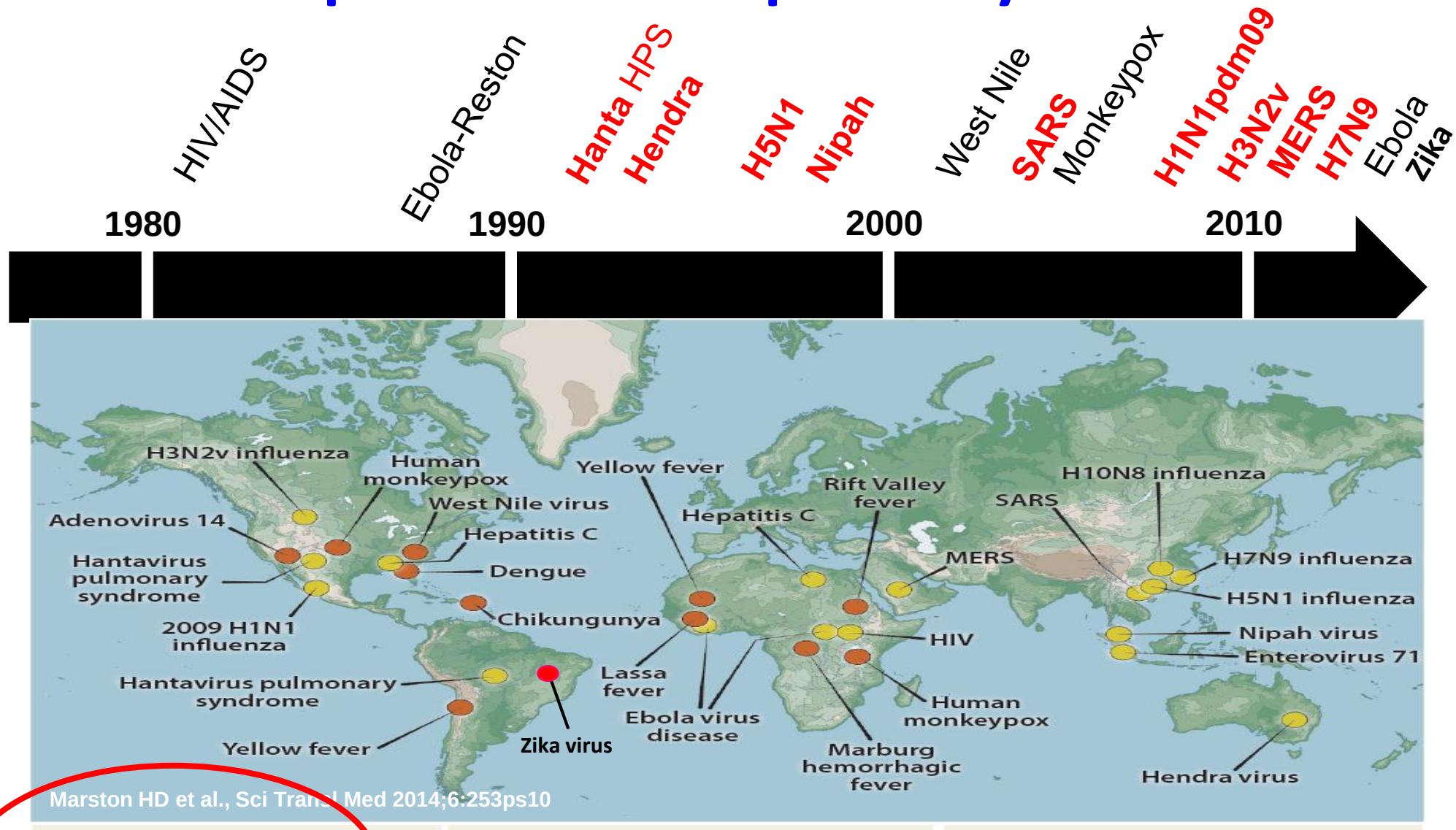
Key to outbreak planning is understanding the problem:

- Increasing number of emerging & re-emerging infectious disease threats
  - Recent/current threats
    - Zika
    - Ebola
    - MERS-CoV
    - Pandemic influenza
- Ongoing ‘seasonal’ respiratory viruses
- Canterbury’s planning strategy for primary care




APRIL 7, 2003
SUBSCRIBER COPY NOT FOR RESALE
INSIDE: 40 PAGES OF WAR COVERAGE
TIME
OPEN-HEARTED MERCY: Kiwi surgeon's Middle East mission
SUBSCRIBE & WIN
TISSOT WATCHES TODAY
www.timeasia.com
FEBRUARY 9, 2004
TIME
Spreads
H7N9 avian flu
The influenza A(H7N9) virus is one subgroup among the larger group of H7 viruses that normally circulate among birds. A number of human infections of the H7N9 virus have been reported in eastern China, including in the Yangtze River Delta region since late
patients have died of severe
TIME
STOPPING EBOLA
THE RISKS AND REALITIES OF THE OUTBREAK
Zika
virus
Danger: Numerous filamentous Eb
particles are seen in green, buddi
chronically infected VERO E6 cell
at 25,000X magnification.
Main image: File photo of health w
taking part in an Ebola care drill

The paradox of the past 13 years



Developments facilitating spread:
Urbanization is changing the face of the planet

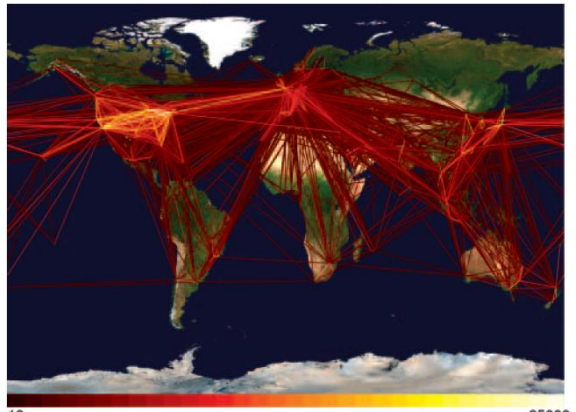
- The urban population has grown from 746 million in 1950 to 3.9 Billion in 2014
  ➡ 11B in 2050

- By 2030, 9% of the world's population will be living in just 41 megacities
  - 10M inhabitants

- Asia accounts for over half of the world's 29 megacities and is home to 53 per cent of the world's urban population
  - Slum population densities 111,325/km^2

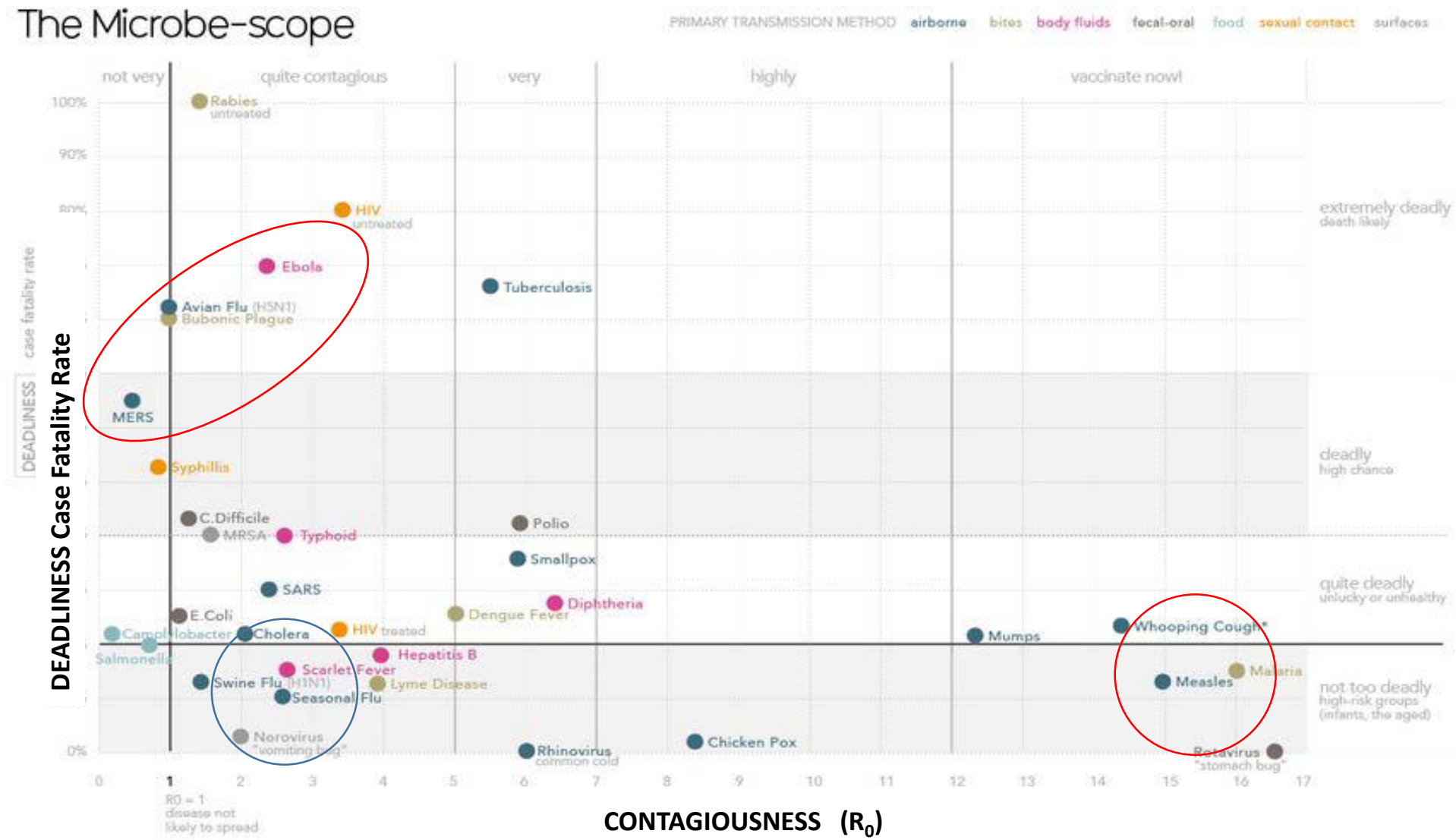
- Between mid-1960s and mid-1990s 150% global increase in demand for meat as protein source
  - Poultry from 4.3B in early 1960s to 21.5B in 2010
  - Pig population to 1B n 2010

- **People, pigs, poultry → pandemics**



http://www.economist.com/node/21642053
http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf

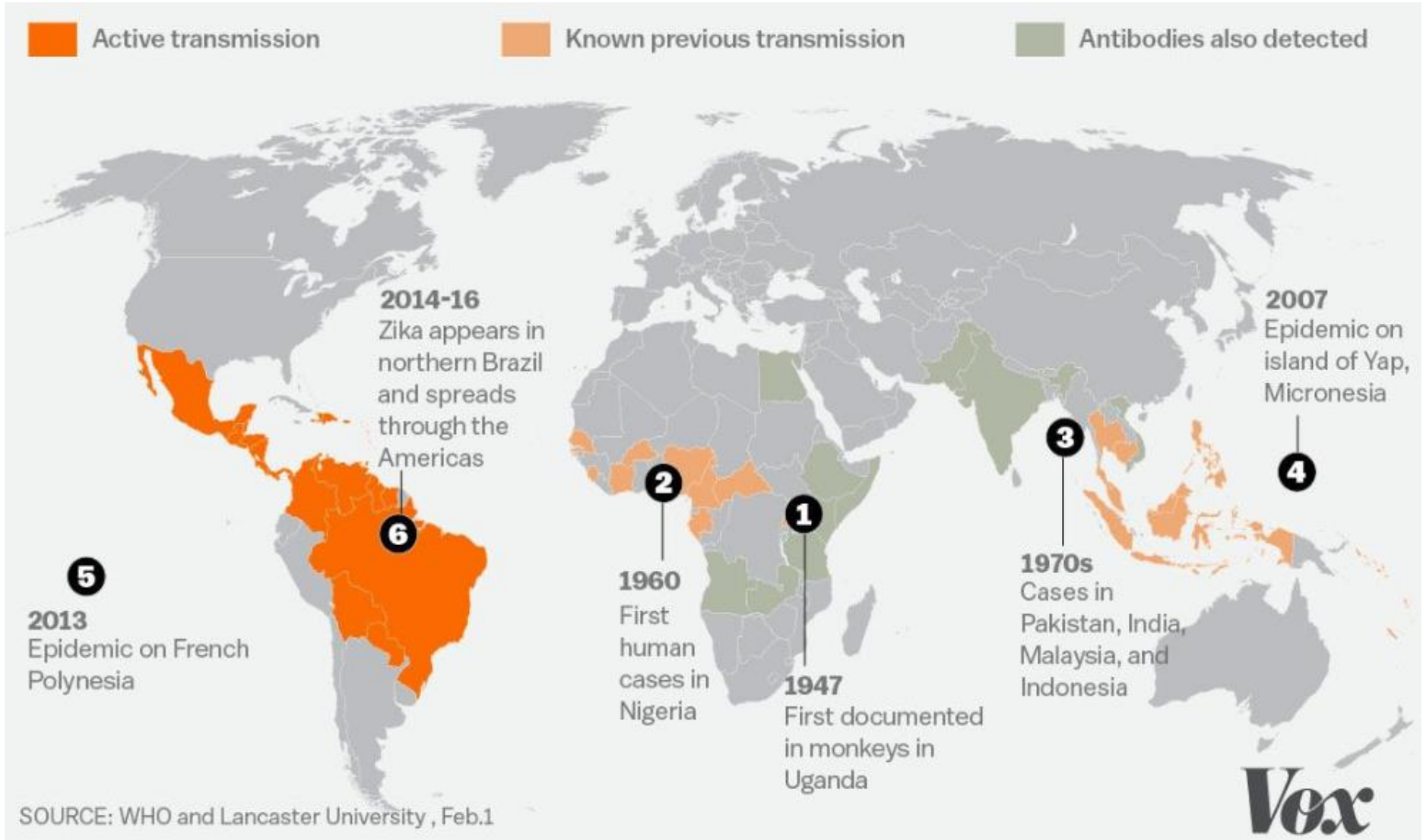
Understanding contagiousness of infectious diseases



Zika

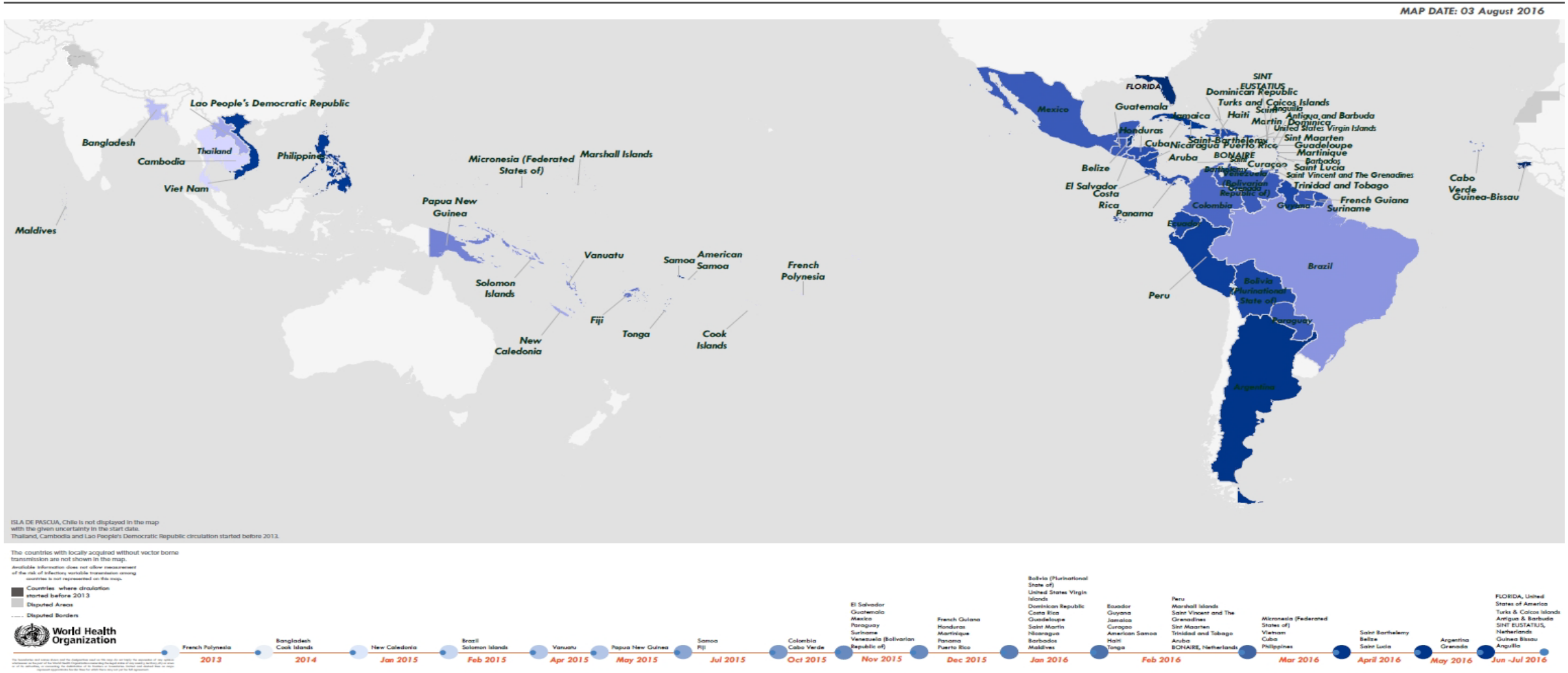
virus

History of Zika virus spread



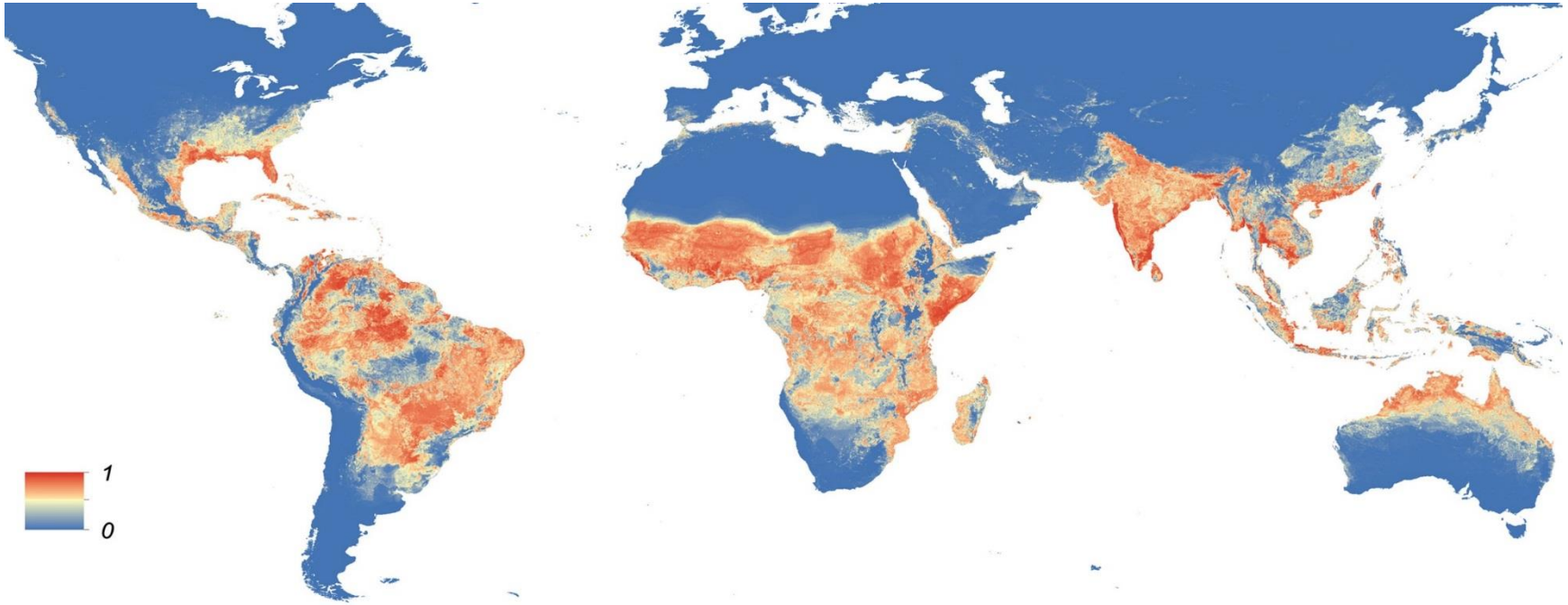
Faye O, et al PLoS Negl Trop 2014;8(1)e2636

Countries, territories showing distribution of Zika virus 2013-1016



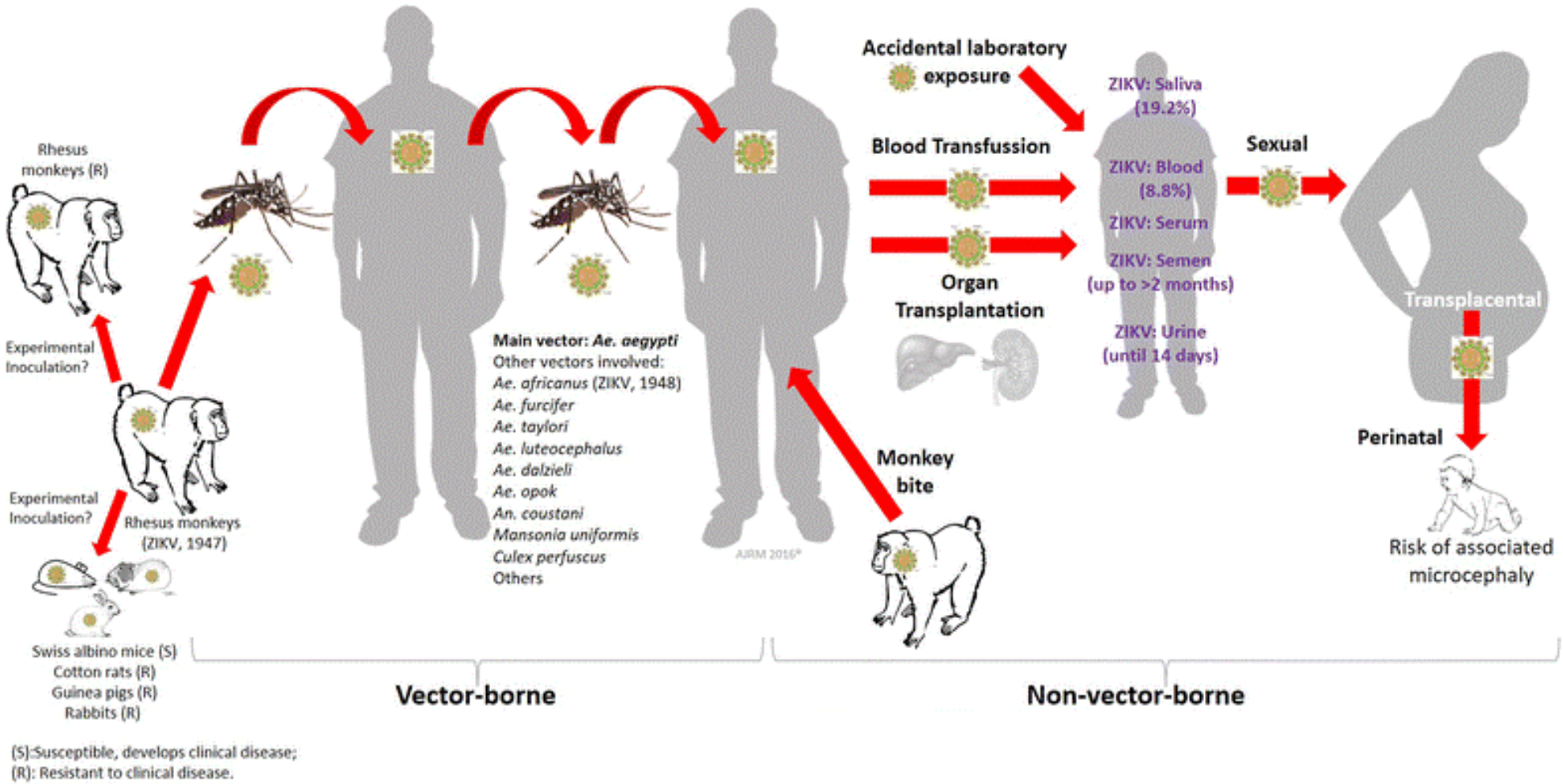
http://www.who.int/emergencies/zika-virus/situation-report/4-august-2016/en/

Aedes ageypti primary competent vector



- Diurnal biting – 2 hours after sunrise, several hours before sun set (day time biters *c.f. Anopheles)*
- Females bite (need blood to lay eggs).
- Eggs are laid in any vessel filled with water, just above the water line.
- Eggs can persist for >6 months, hatching is triggered by water coming in to contact with the eggs. Mature into adult mosquito, can be as quick as 7-8 days.

Zika virus modes of transmission



(S):Susceptible, develops clinical disease;
(R): Resistant to clinical disease.

Clinical

- Incubation 3-12 days
- Symptoms include:
  - Fever, low-grade
  - Arthralgia (small joints hands & feet)
  - non-purulent conjunctivitis/conjunctival hyperaemia (Zika specific)
  - myalgia and headache.
  - Macular or papular rash, often starts on the face and then spreads throughout the body. (confused with measles, rubella, chikungunya & dengue)
  - Less frequently, retro-orbital pain and gastro-intestinal signs are present.
- **Asymptomatic** in **60-80%** individuals

Neurological complications: Microcephaly and Guillain-Barré Syndrome

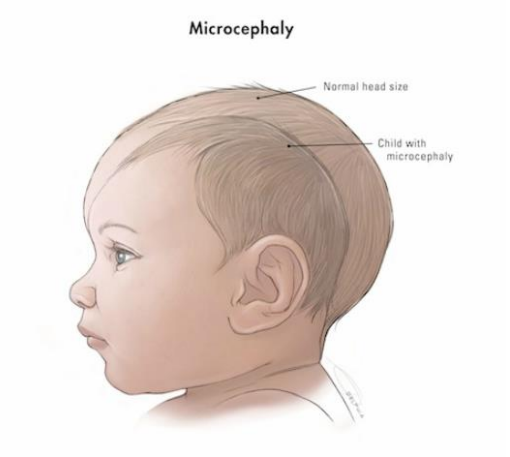
- French Polynesia – 2013 outbreak:
  - 18 severe foetal abnormalities (10 microcephaly),
  - 42 cases of GBS – strong symptomatic association

- Brazil: Typically ~ 163 cases per year (2001-2014) microcephaly
  - 8703 suspected cases (incl. 76 deaths) from Oct 2015 to July 2016 – either severe malformations or microcephaly
  - 1749 confirmed by laboratory criteria
  - 371 (4.3%) still births- 106 confirmed

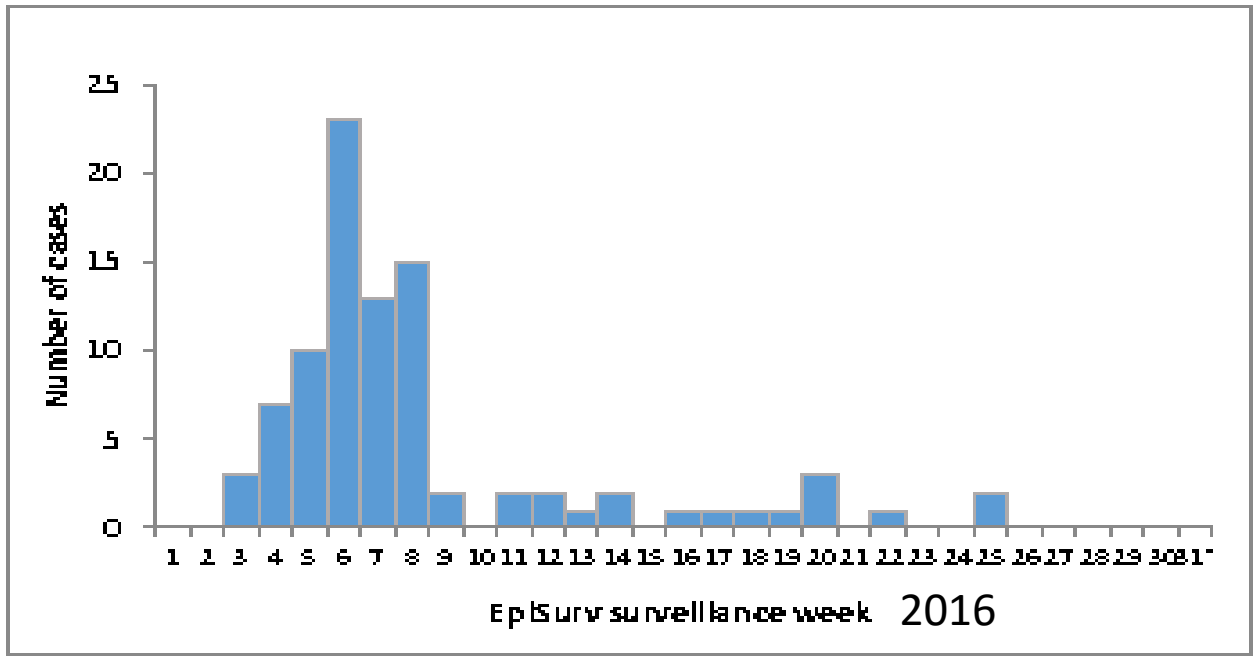
- CDC statement 14 April 2016 that prenatal Zika virus infection is a cause of microencephaly & other serious brain abnormalities in developing fetuses

- WHO: Scientific consensus is that Zika virus is a cause of microcephaly and GBS.
- **http://who.int/emergencies/zika-virus/situation-report/28 -july-2016/en.**

Neurological complications



Zika in New Zealand



https://surv.esr.cri.nz/PDF_surveillance/ZikaWeekly/20160803Zikaweekly.pdf

Zika virus infection (confirmed and probable) cases notified in New Zealand,
1 January–2 August 2016

Sex	Age group (years)	Number of cases[1]		Total cases
		Confirmed	Probable	
Female	<1			0
	1–4	1		1
	5–14	2		2
	15–24	15		15
	25–44	28	2	30
	45–64	17		17
	65+	2		2
Female total		65	2	67
Male	<1			0
	1–4			0
	5–14	1		1
	15–24	3	1	4
	25–44	8	1	9
	45–64	11	1	12
	65+	2		2
Male total		25	3	28
Total		90	5	95

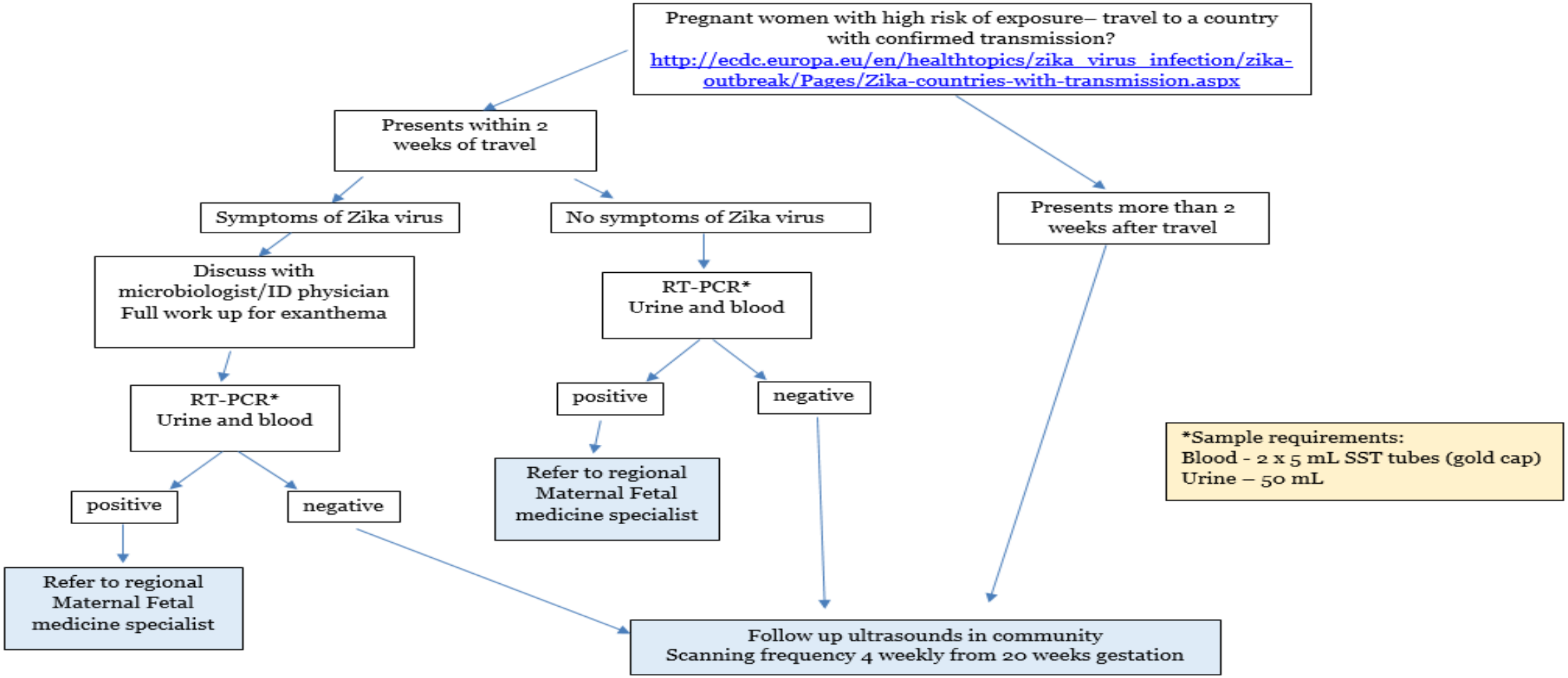
Overseas travel information for Zika virus cases notified in New Zealand,
1 Jan–2 Aug 2016

Country travelled to during the incubation period for the disease	Number of confirmed cases[1,2]
Tonga	53
Samoa	22
Fiji	9
American Samoa	2
Australia[3]	1
Indonesia	1
Nicaragua	1
Papua New Guinea	1
United States of America[4]	1
Venezuela	1
No overseas travel	1

Diagnostics

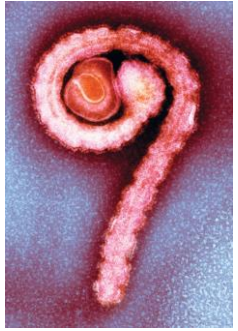
- RT-PCR most useful in acute infection
- Blood sample
  - Viremia for 3-7 days after symptoms develop.
- Urine sample
  - may have RNA for up to 14 days.
- After 14 days serology can be useful
- BUT
- Cross-reactivity (significant)
- Possibly No IgM production if previous exposure to another Arbovirus (many, many Pacific Islanders with Dengue IgG)
- May not make IgM at all… or it can persist for >1 year
- If previous exposure – could initially make the IgM for the ORIGINAL infection from a DIFFERENT virus (e.g. Dengue).
- **Laboratories with both PCR & serology available:** LabPLUS; ESR; CHLabs

Interim testing and referral algorithm for pregnant women

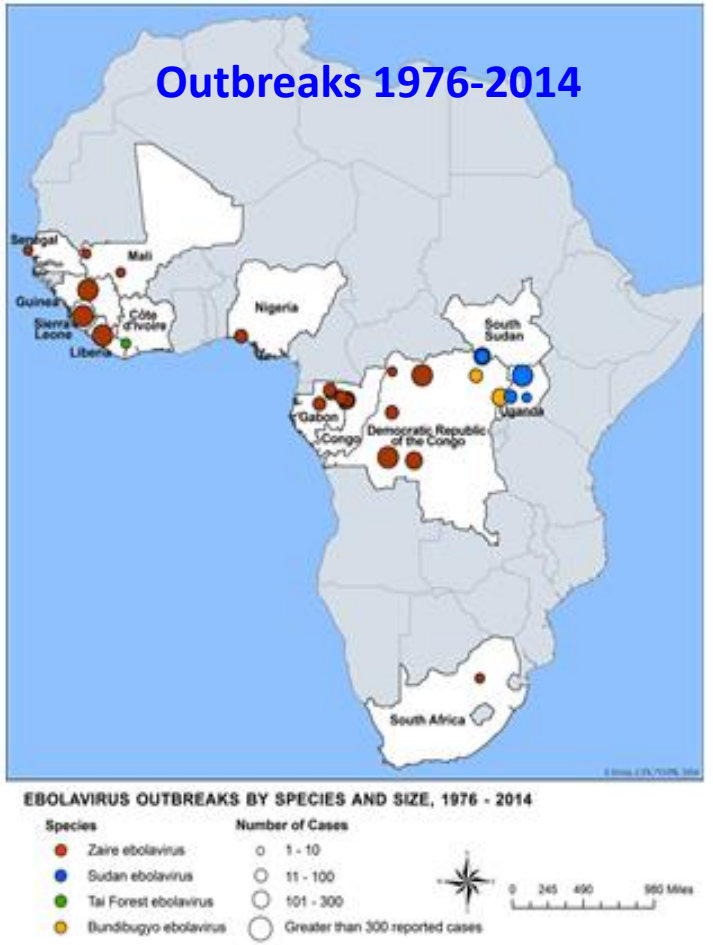


http://www.health.govt.nz/our-work/diseases-and-conditions/zika-virus#about

What is Ebola?

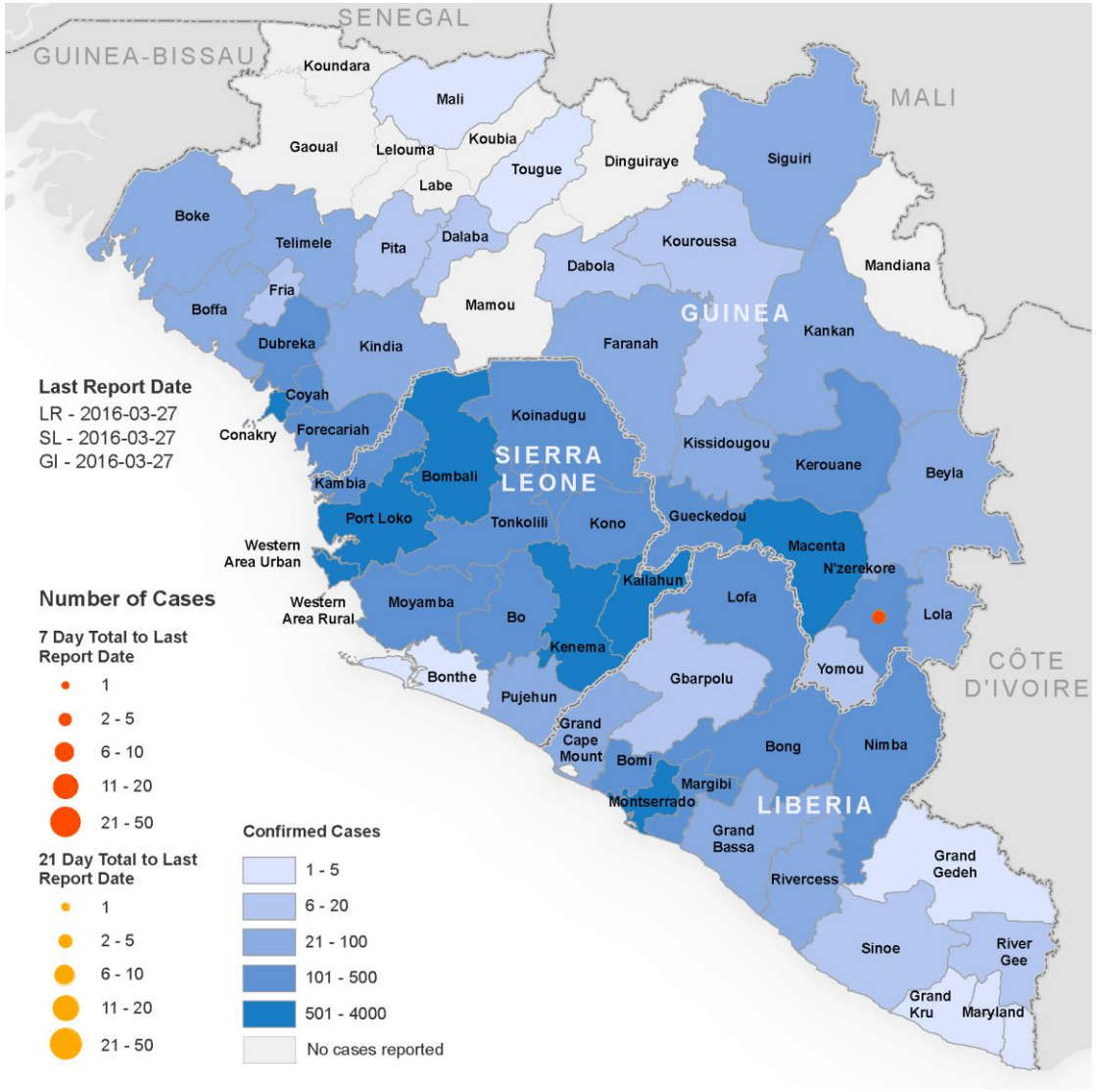


- The Ebola virus causes an acute, serious illness in humans and nonhuman primates (monkeys, gorillas, and chimpanzees).
- Ebola virus disease (EVD), formally Ebola haemorrhagic fever, first appeared in 1976 in 2 outbreaks in the Sudan & Zaire (now Democratic Republic of Congo)- in a village near the Ebola River
- Outbreaks have mainly occurred in remote villages in Central & West Africa



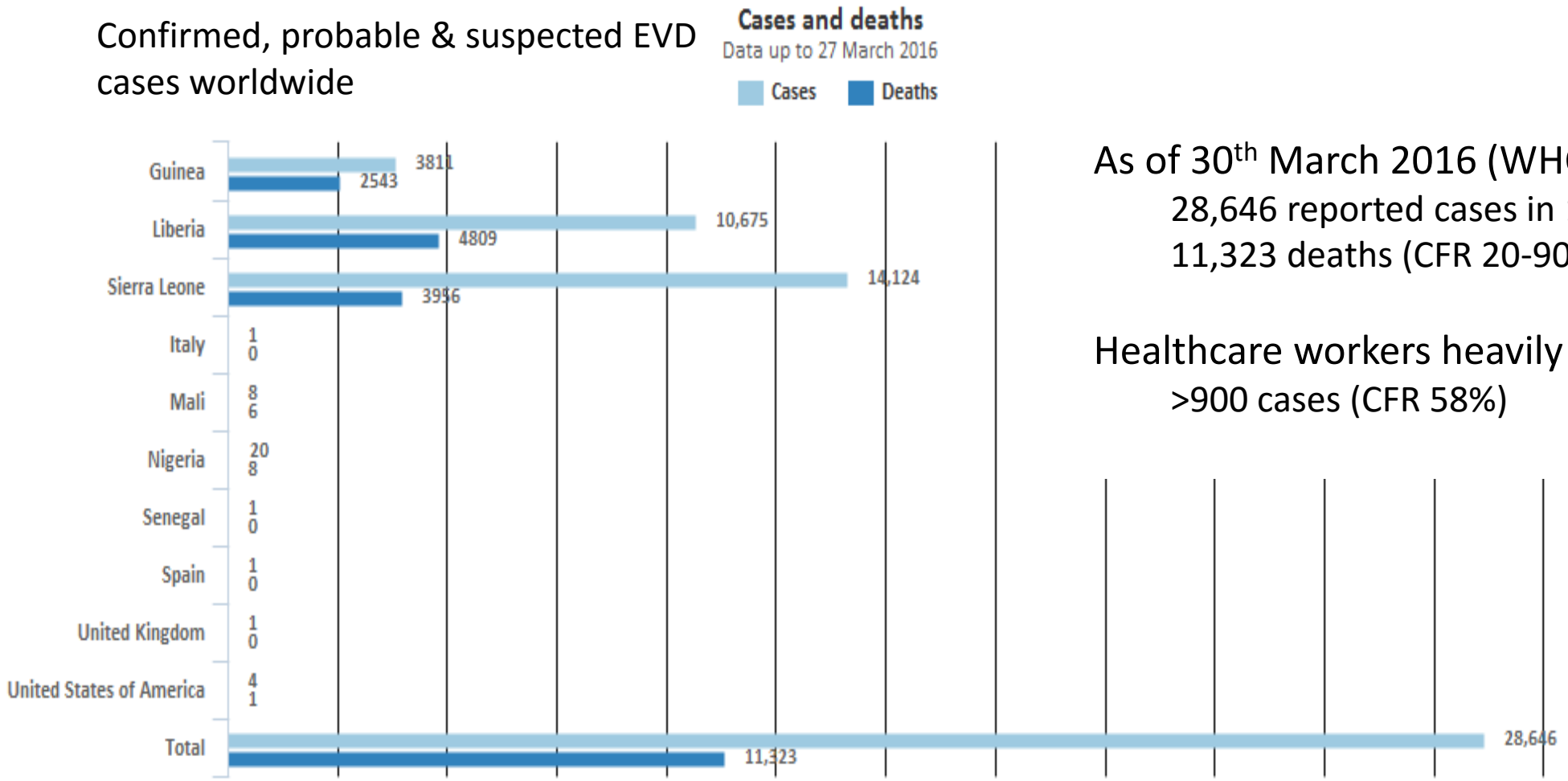
http://www.cdc.gov/vhf/ebola/outbreaks/history/distribution-map.html

2013 (Mar 2014)-2016 EVD outbreak



End of the Public Health Emergency of International Concern regarding the Ebola virus disease outbreak in West Africa, 29 March 2016

Confirmed, probable & suspected EVD cases worldwide



As of 30th March 2016 (WHO)

- 28,646 reported cases in 10 countries
- 11,323 deaths (CFR 20-90%~40%)

Healthcare workers heavily impacted

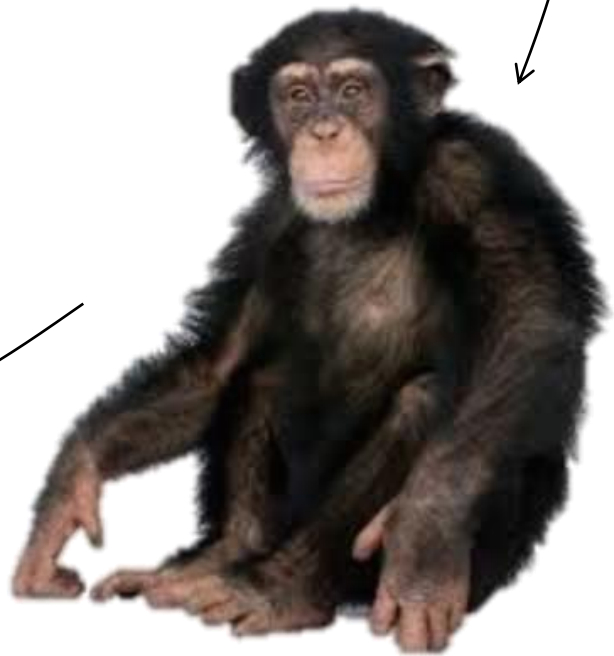
- >900 cases (CFR 58%)

http://apps.who.int/ebola/current-situation/ebola-situation-report-30-march-2016

Ebola virus disease (EVD)

Pteropidae fruitbats considered Ebola virus (Filoviridae) natural hosts

Cross-species transmission Bush-meat, hunting and butchering



Reperant et al., Science 2015

EVD Transmission

Ebola only spreads when people are sick.
A patient must have symptoms to spread the disease to others.

MONTH						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

After 21 days, if an exposed person does not develop symptoms, they will not become sick with Ebola.

CDC

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CS250531

How do you get the Ebola virus?

Direct contact with:

1. **Bodily fluids of a person who is sick with or has died from Ebola** (blood, vomit, pee, poop, sweat, semen, spit, other fluids)

2. **Objects contaminated with the virus** (needles, medical equipment)

3. **Infected animals** (by contact with blood or fluids or infected meat)

CDC

Features of the outbreak

- Outbreak severity
  - Mutations to the viral genome may have contributed to its ability to infect cells so easily. Specifically, NS1 codon usage adaptation may have enabled viral replication in human cells

- Factors contributing to difficulties in control
  - Scale of the outbreak (Guinea, Liberia, Sierra Leone)
  - Healthcare infrastructure (Infection Prevention and Control)
  - Unsafe burials
  - Concealment of cases in communities

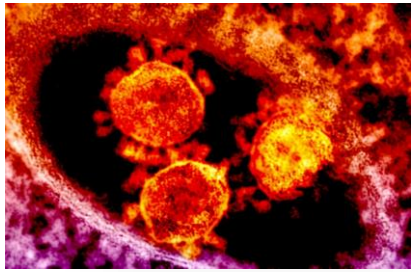
- WHO measures to manage residual risks
  - Outbreak control relies on a package of interventions:
  - Case management, surveillance and contact tracing, a good laboratory service, safe burials and social mobilisation

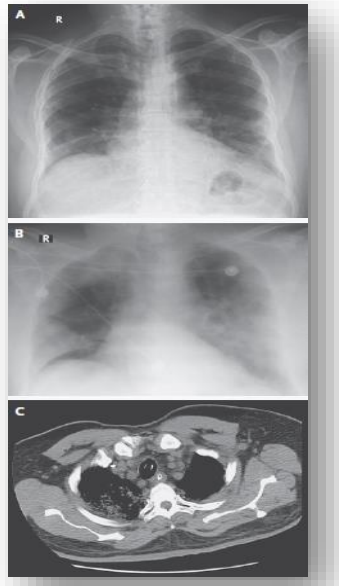
Controlling infection in Health Care settings

- Health-care workers
  - Standard precautions when caring for patients, regardless of their presumed diagnosis.
  - Include
    - basic hand hygiene,
    - respiratory hygiene,
    - use of personal protective equipment (to block splashes or other contact with infected materials),
    - safe injection practices
    - safe burial practices
- **HCWs** caring for patients with **suspected or confirmed Ebola** virus should apply extra infection control measures to prevent contact with the patient's blood and body fluids and contaminated surfaces or materials such as clothing and bedding.
- When in close contact (within 1 metre) of patients, HCWs should wear face protection (a face shield or a medical mask and goggles), a clean, non-sterile long-sleeved gown, and gloves (sterile gloves for some procedures).
- **Laboratory workers** are also at risk. Samples taken from humans and animals for investigation of Ebola infection should be handled by trained staff and processed in suitably equipped laboratories.


EPA

Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

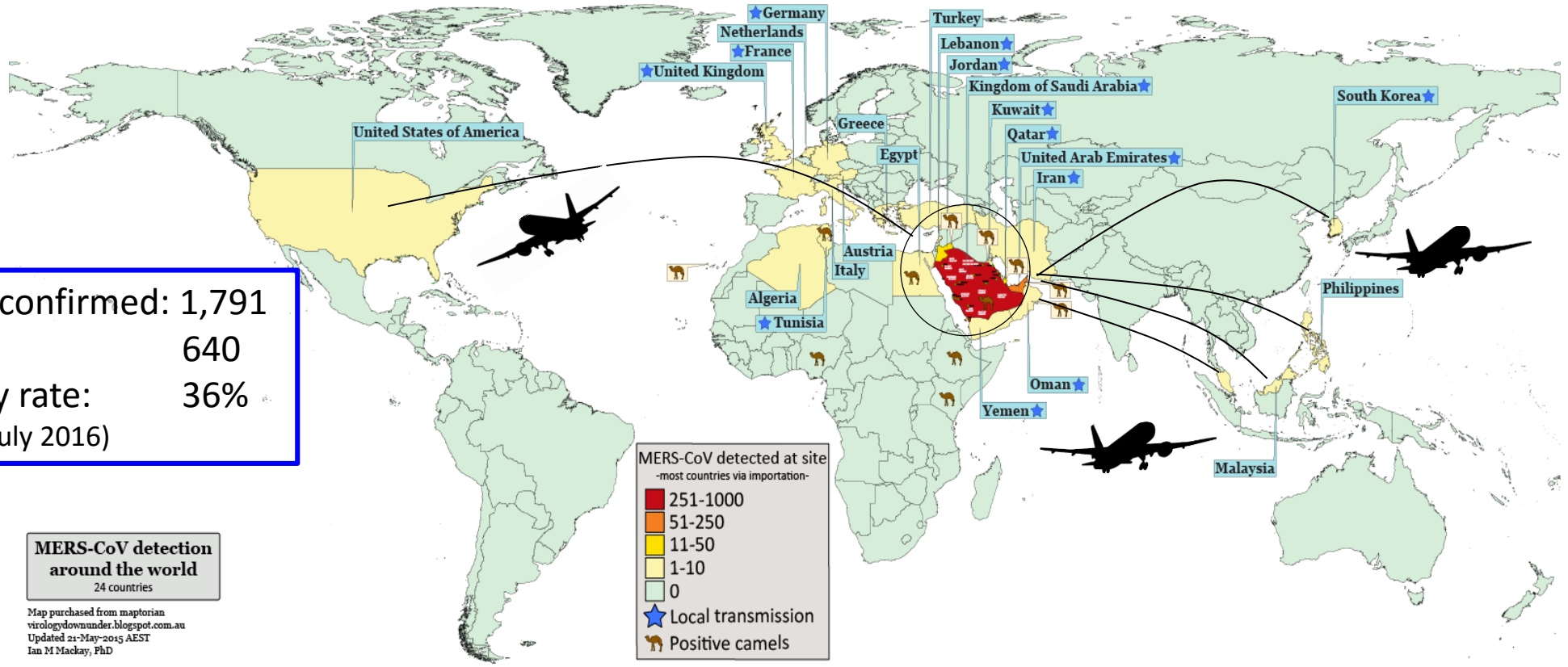




Zaki et al NEJM 2012

MERS-CoV human cases

Laboratory confirmed: 1,791
Deaths: 640
Case fatality rate: 36%
(Sep 2012-25 July 2016)

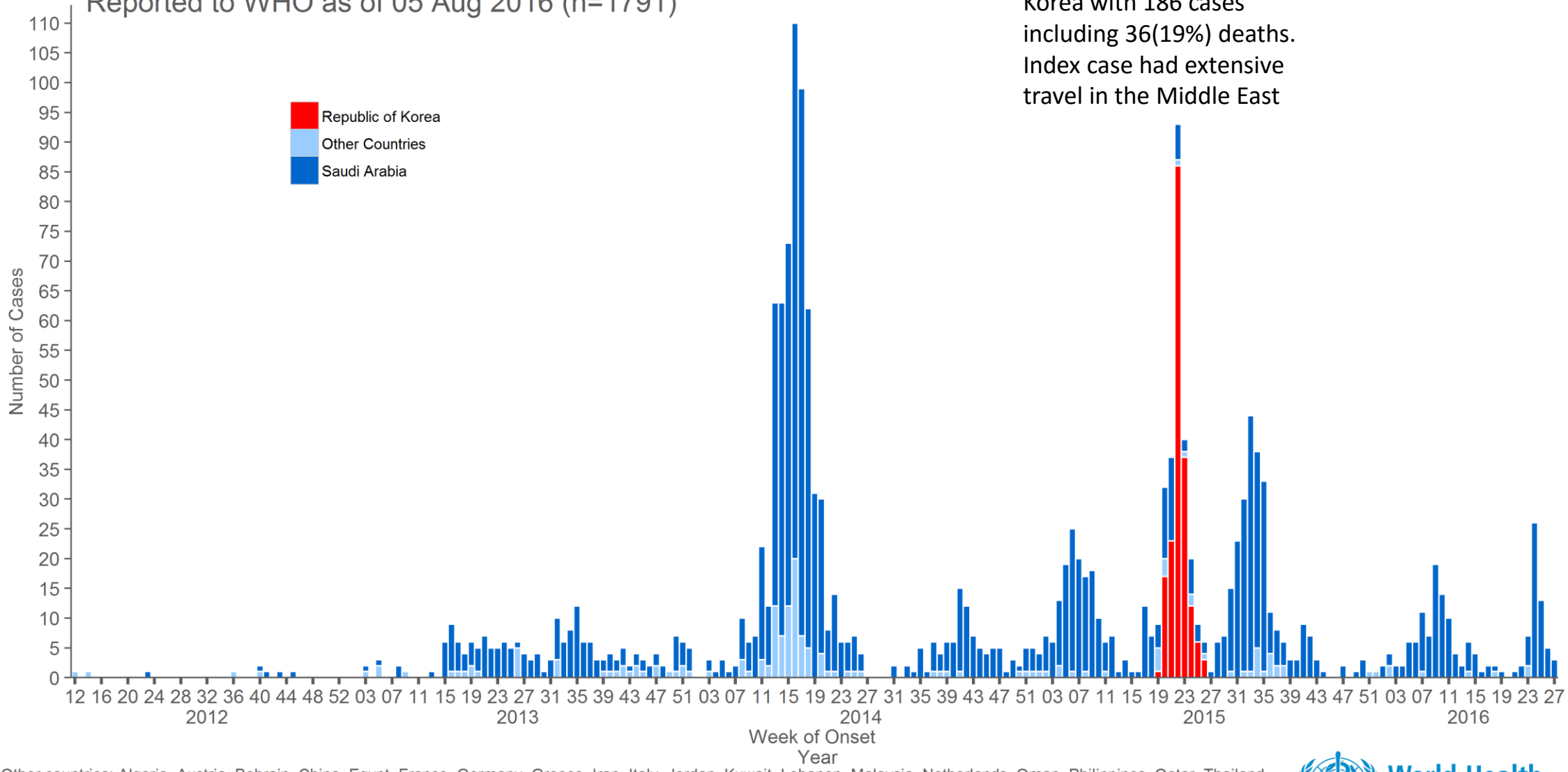


MERS-CoV now detected in 27 countries (25 July 2016)
http://www.who.int/emergencies/mers-cov/en/

Confirmed global cases of MERS-CoV

Reported to WHO as of 05 Aug 2016 (n=1791)

Cluster of cases in Republic of Korea with 186 cases including 36(19%) deaths. Index case had extensive travel in the Middle East



Other countries: Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman, Philippines, Qatar, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States of America, Yemen

Please note that the underlying data is subject to change as the investigations around cases are ongoing. Onset date estimated if not available.

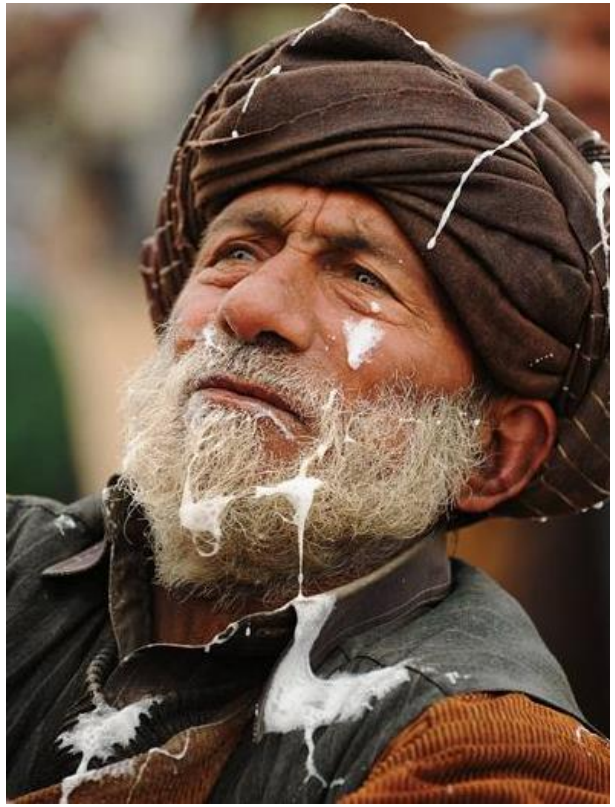
World Health Organization

The role of camels?

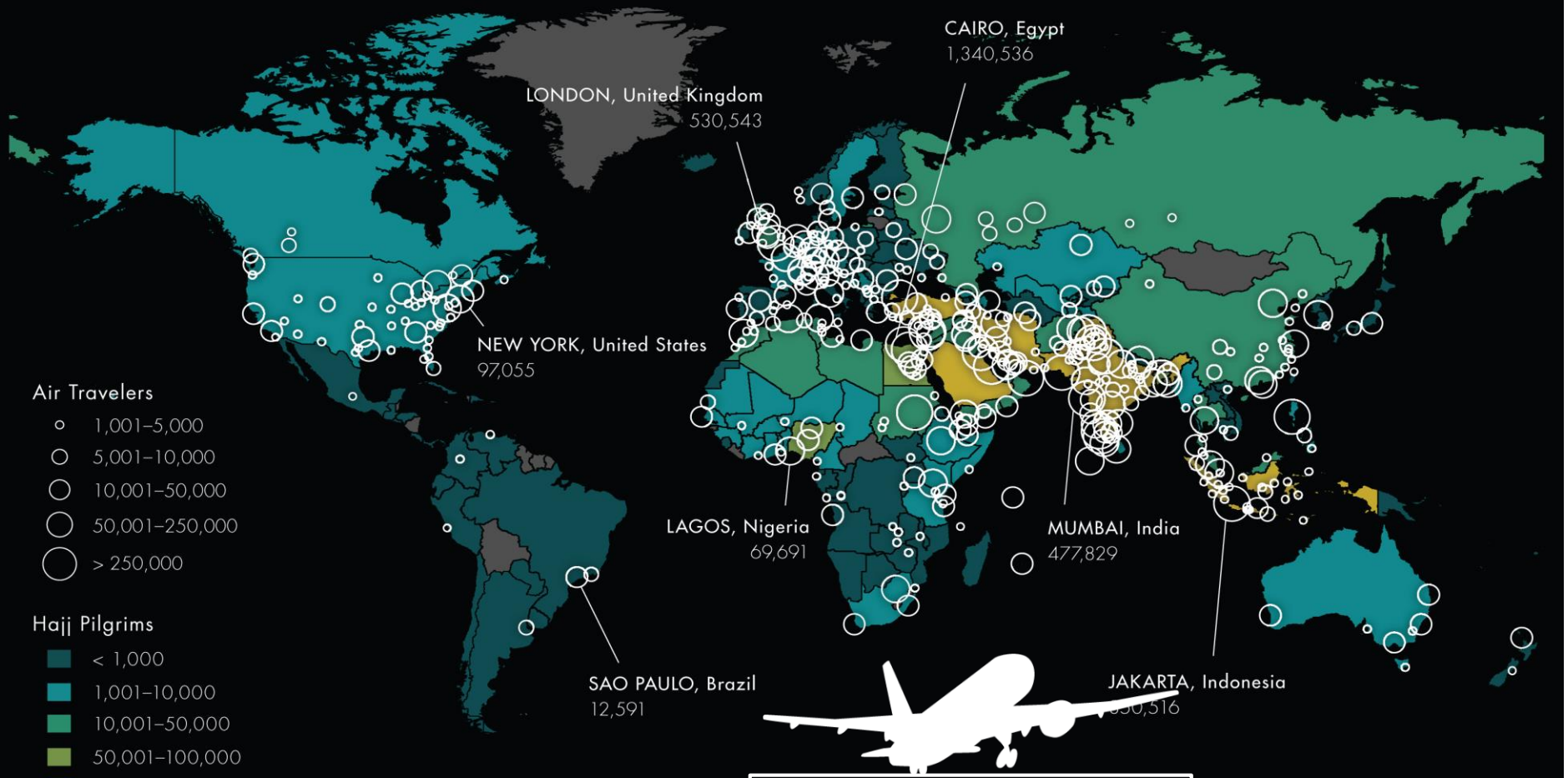
Dromedary camels: carriers of MERS-CoV

Haagmans et al., Lancet ID 2013

Reusken et al Emerg Infect Dis 2015;21:1422-25



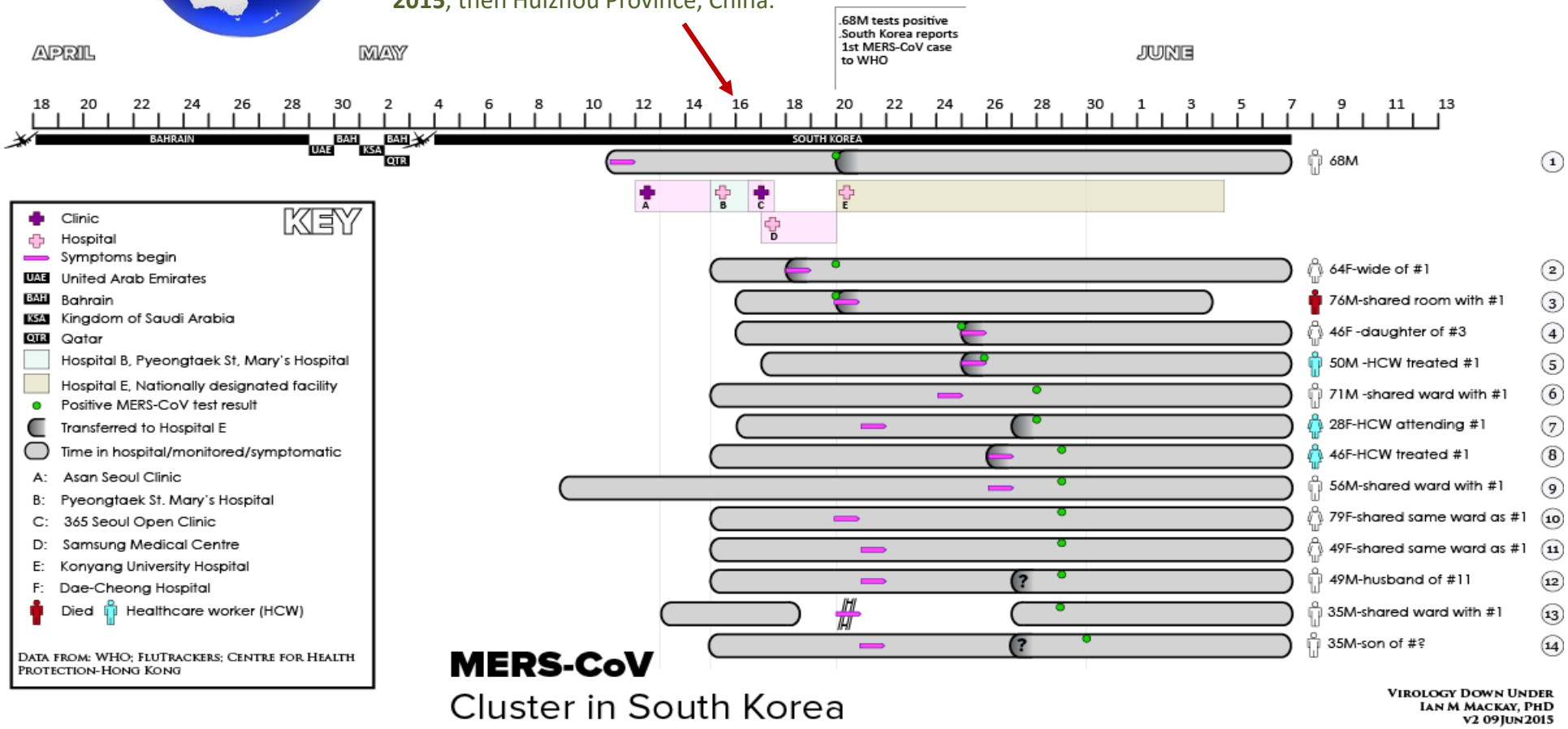
Air travelers and Hajj pilgrims



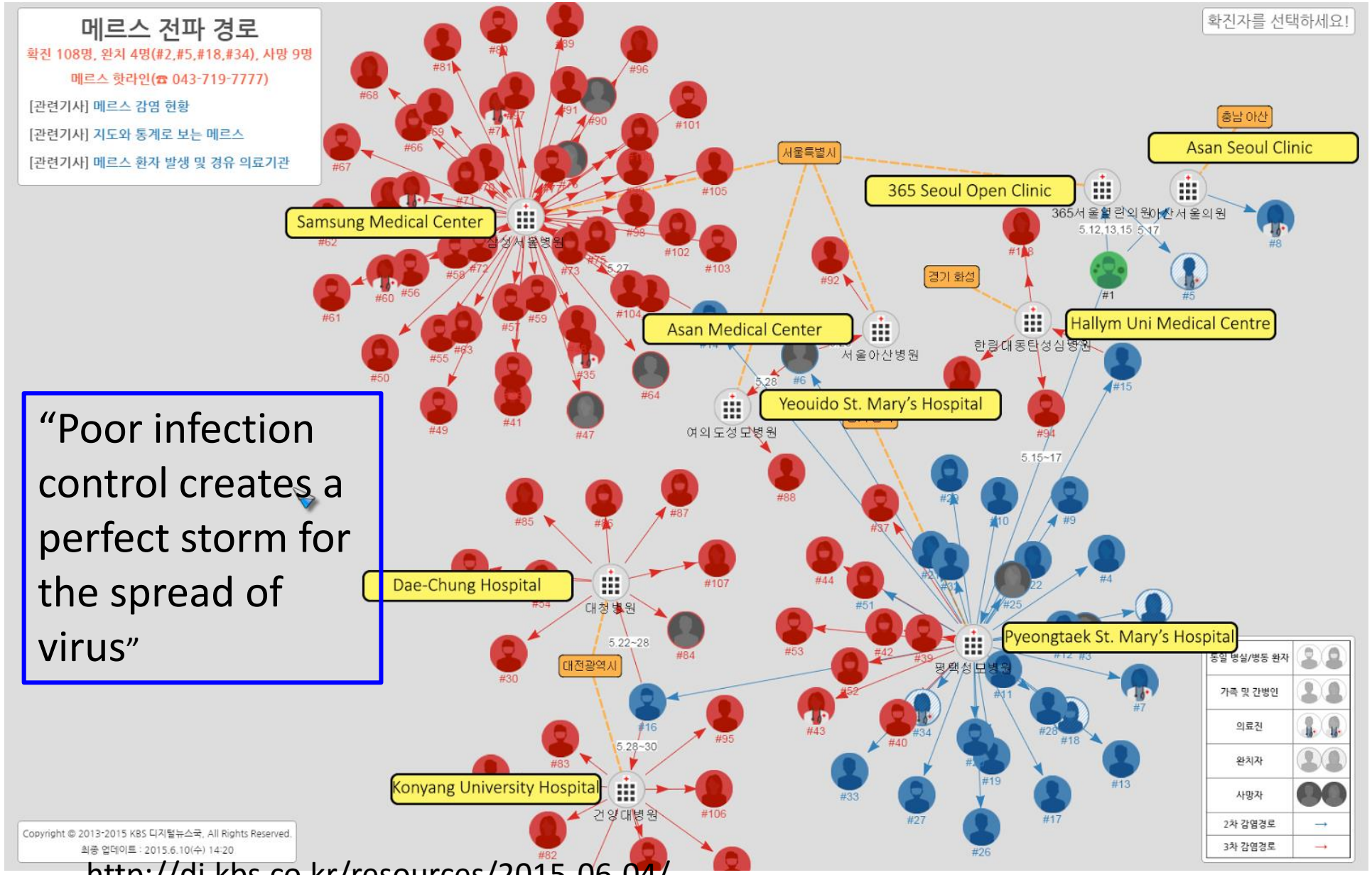
7 million Umrah pilgrims to the Holy City of Makkah between mid-May & mid-July 2015

Cluster in Republic of Korea

Visited father at hospital B on 16 May 2015. Escaped quarantine and left the country. Arrived in **Hong Kong 26 May 2015**, then Huizhou Province, China.



Cluster in Republic of Korea



"Poor infection control creates a perfect storm for the spread of virus"

http://dj.kbs.co.kr/resources/2015-06-04/

Human influenza

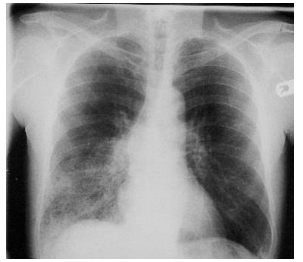
Three presentations

Seasonal influenza

(A: H3N2, H1N1; B)

Avian influenza A:

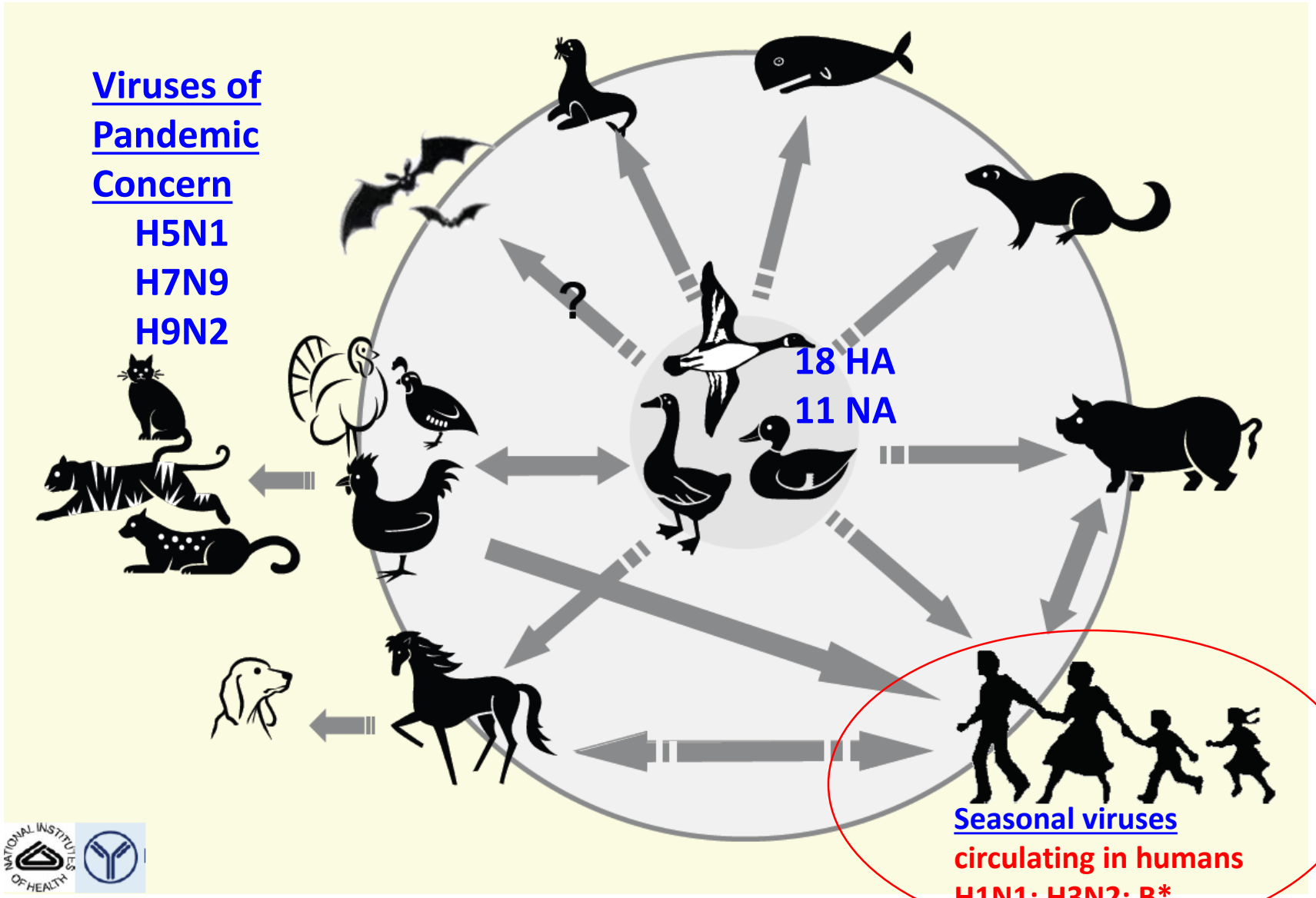
H5, H6, H7, H9, H10…



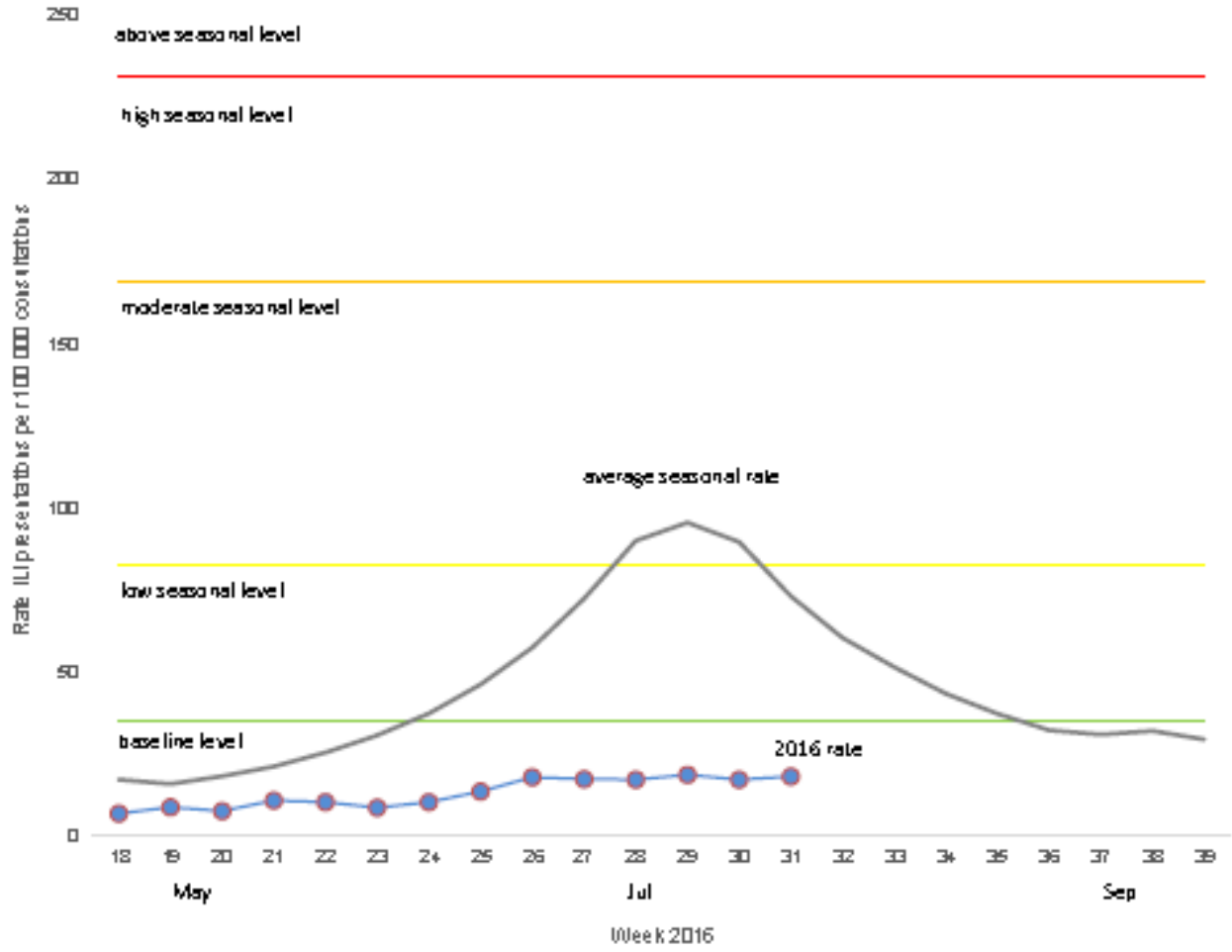
Pandemic influenza

(A: H1N1, H2N2, H3N2, H1N1…?)

Animal-human interface of influenza A viruses

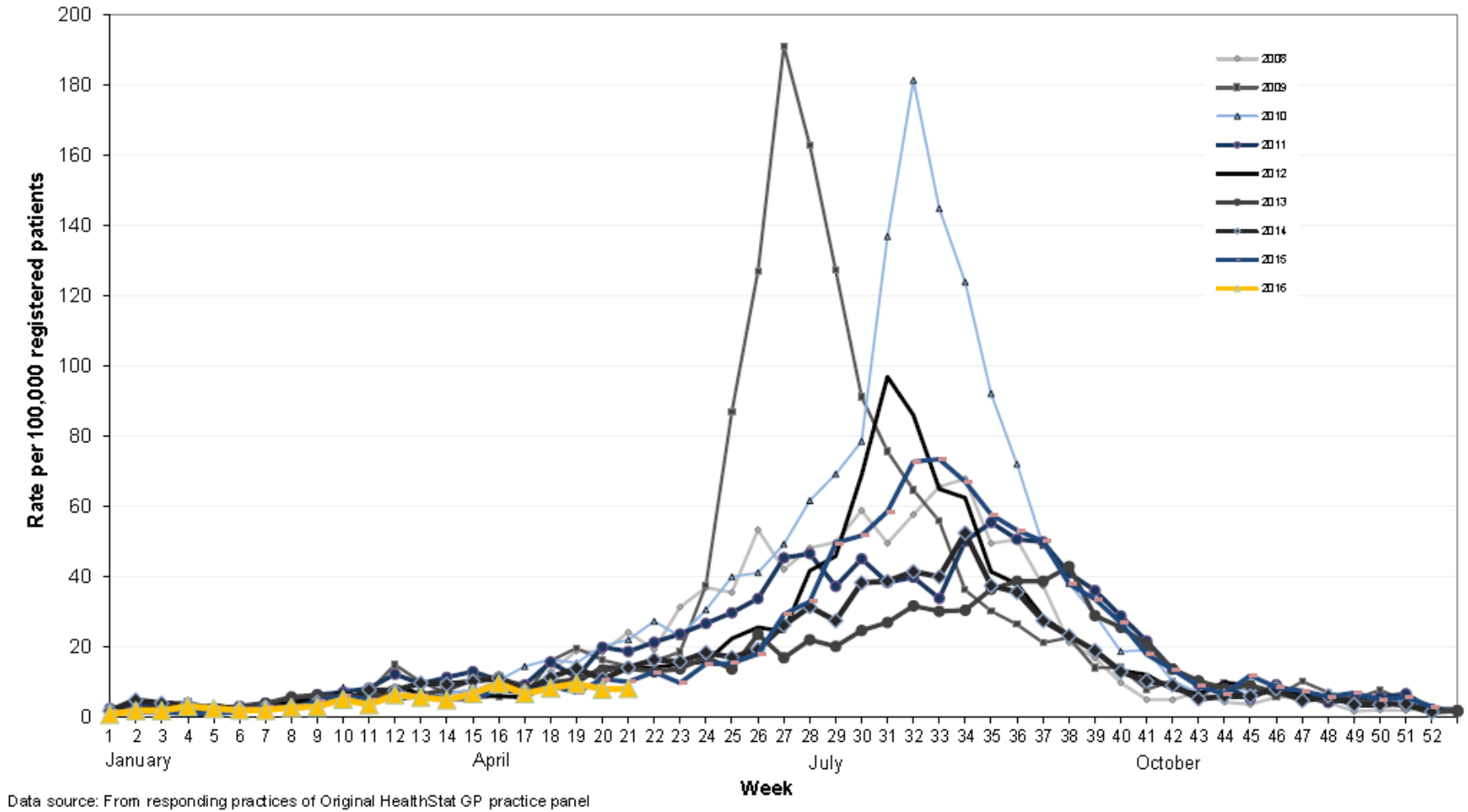


Influenza-like illness (ILI) 2016 compared to average seasonal rate



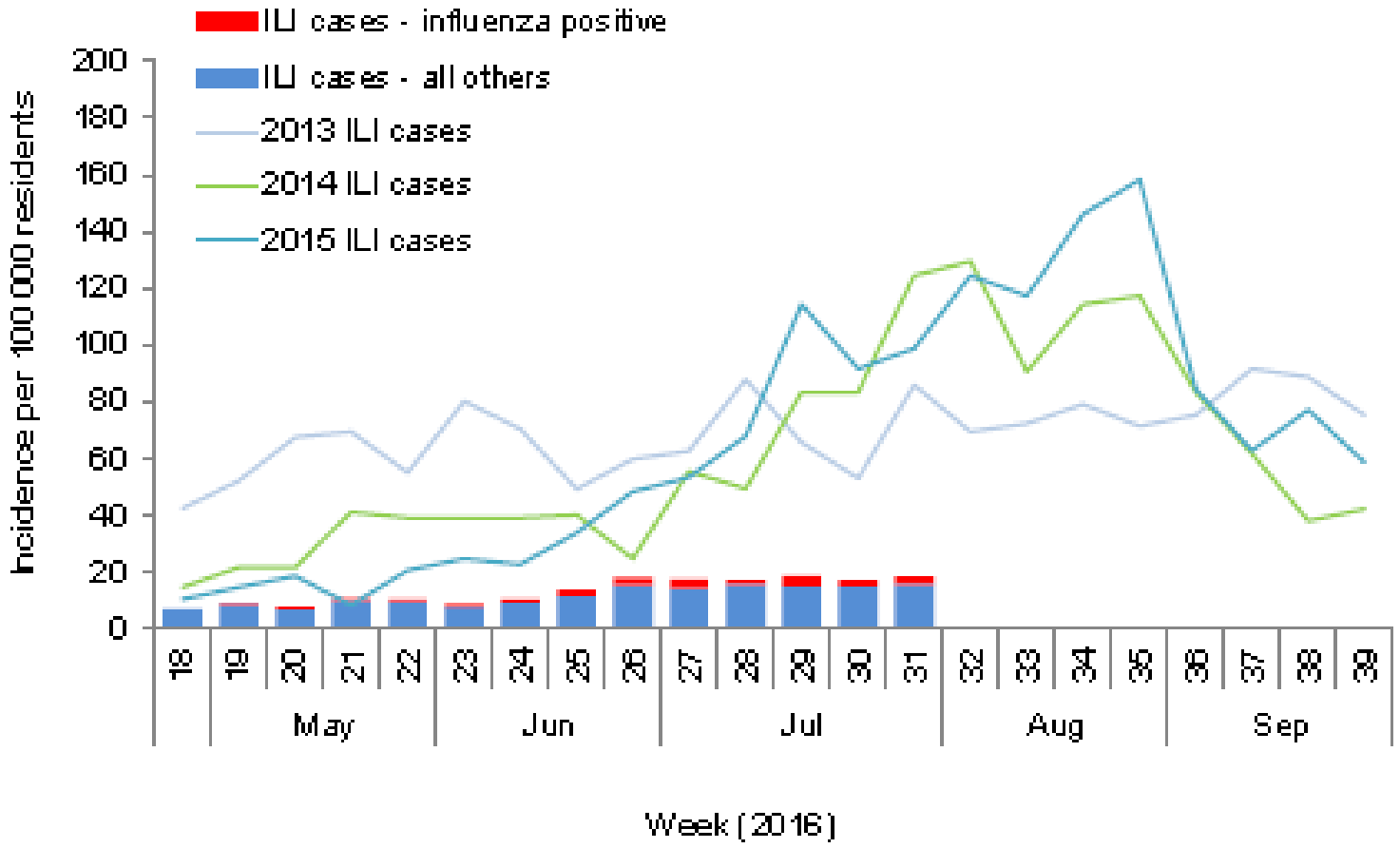
https://surv.esr.cri.nz/PDF_surveillance/Virology/FluWeekRpt/2016/FluWeekRpt201631.pdf

Weekly GP ILI presentation, all ages 2008-2016



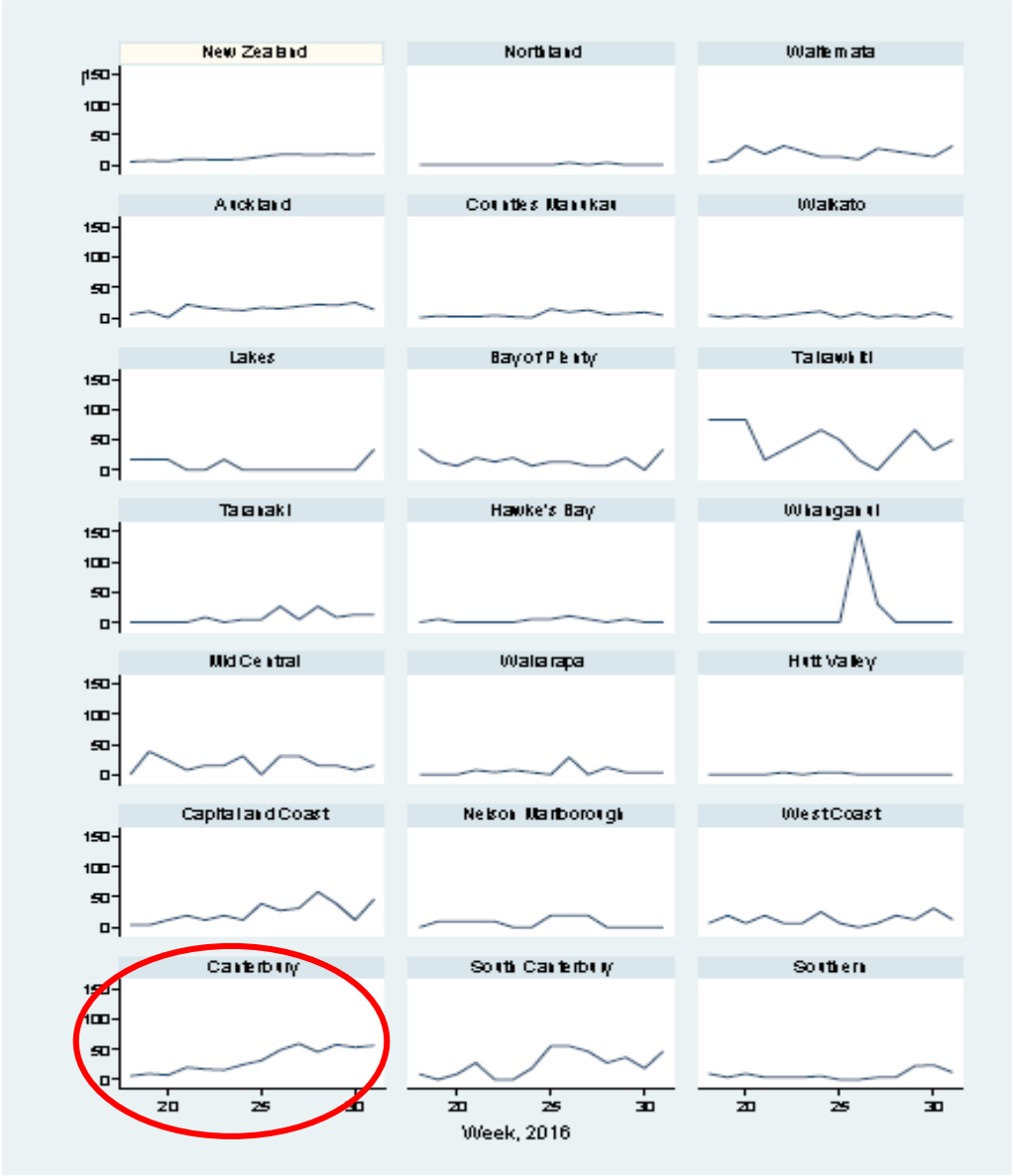
Data source: From responding practices of Original HealthStat GP practice panel

Influenza-like Illness & influenza incidence 2016



https://surv.esr.cri.nz/PDF_surveillance/Virology/FluWeekRpt/2016/FluWeekRpt201631.pdf

ILI consultation rate per 100,000 registered by DHB

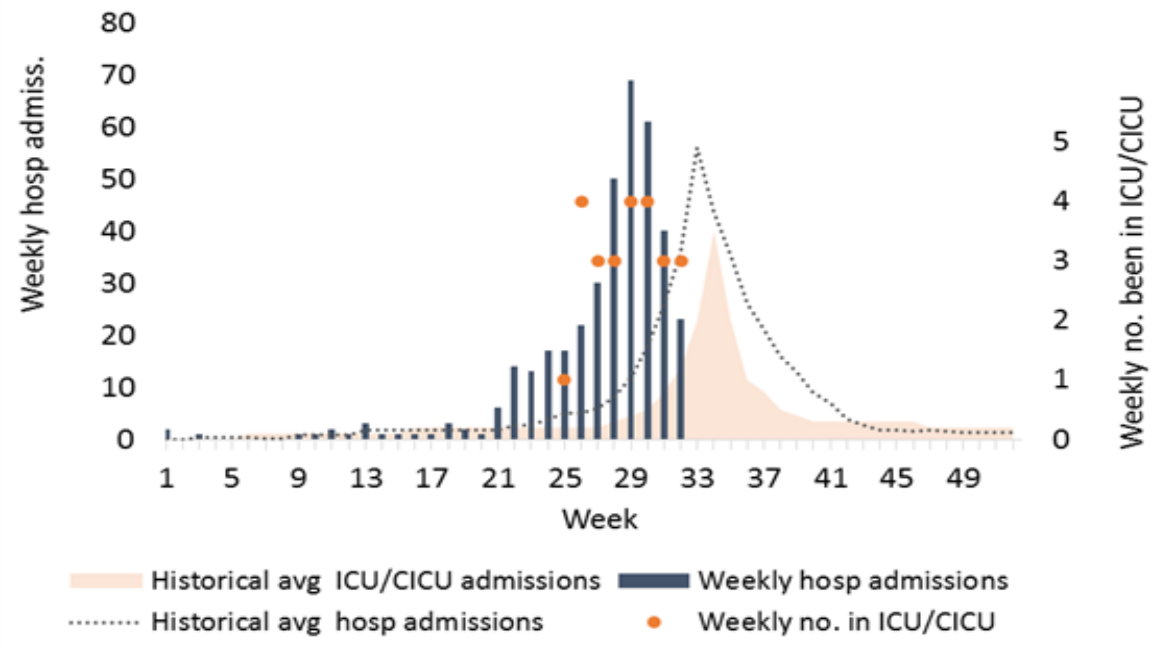


PHU, CDHB 12 Aug 2016

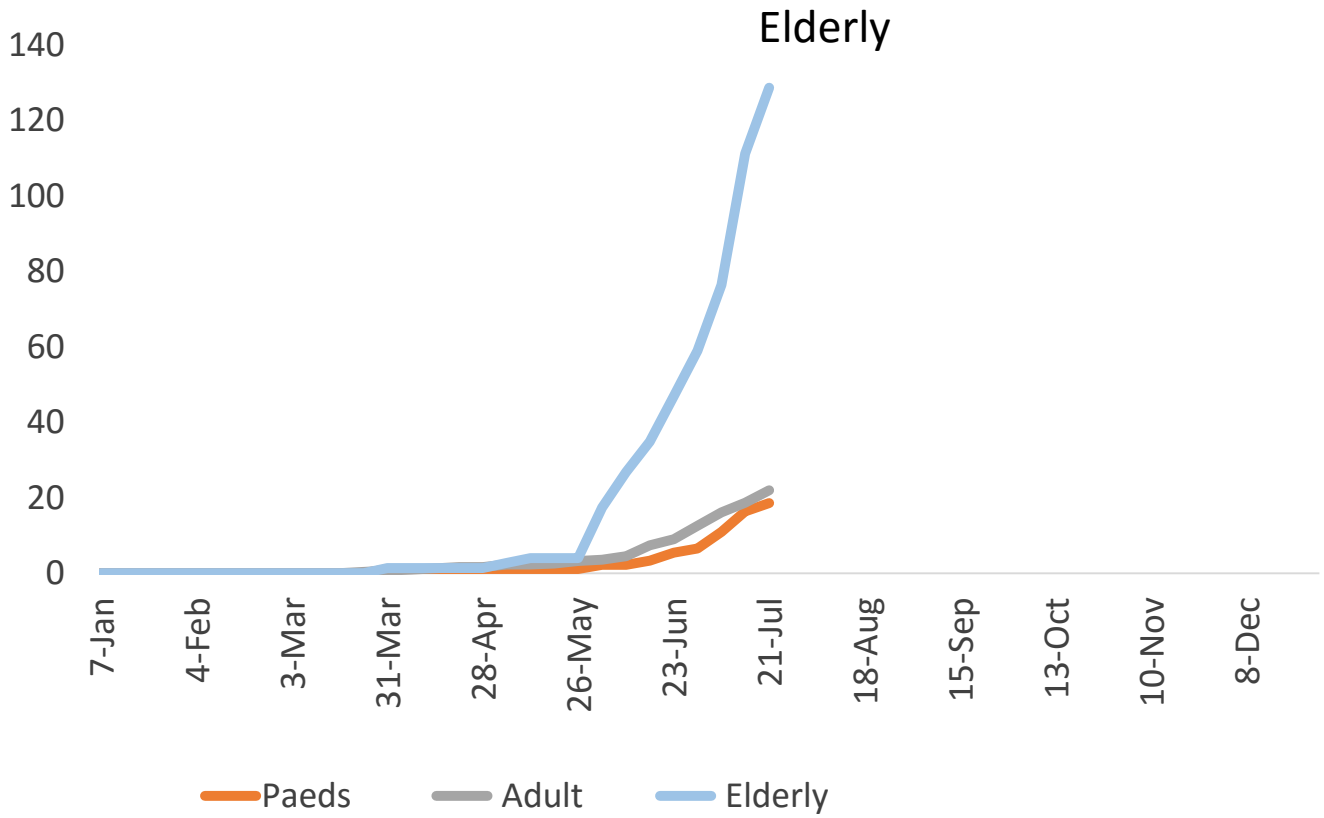
Canterbury: influenza identifications & hospital admissions

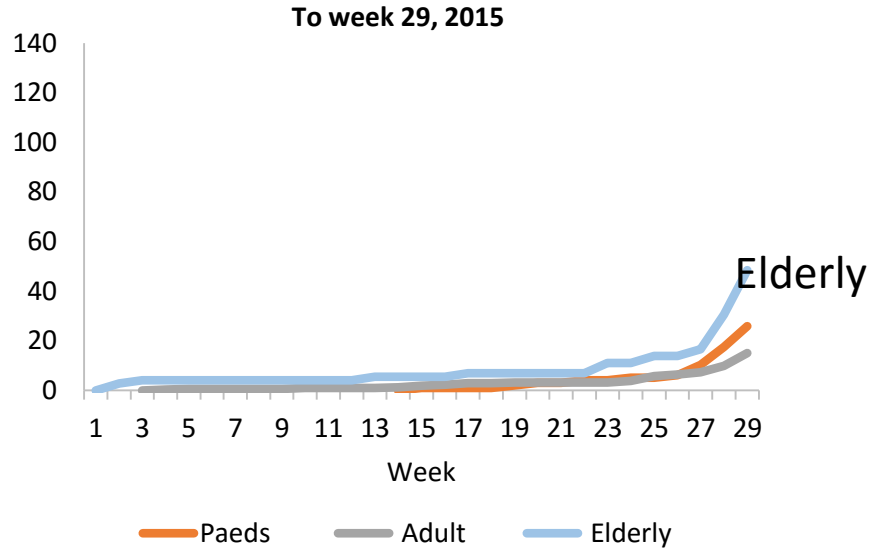
Influenza type	This week	Last week	Year to date
A(H1N1)pdm09	6	7	49 (7%)
A(H3N2)	67	81	653 (91%)
B	2	1	12 (2%)

Severity measures

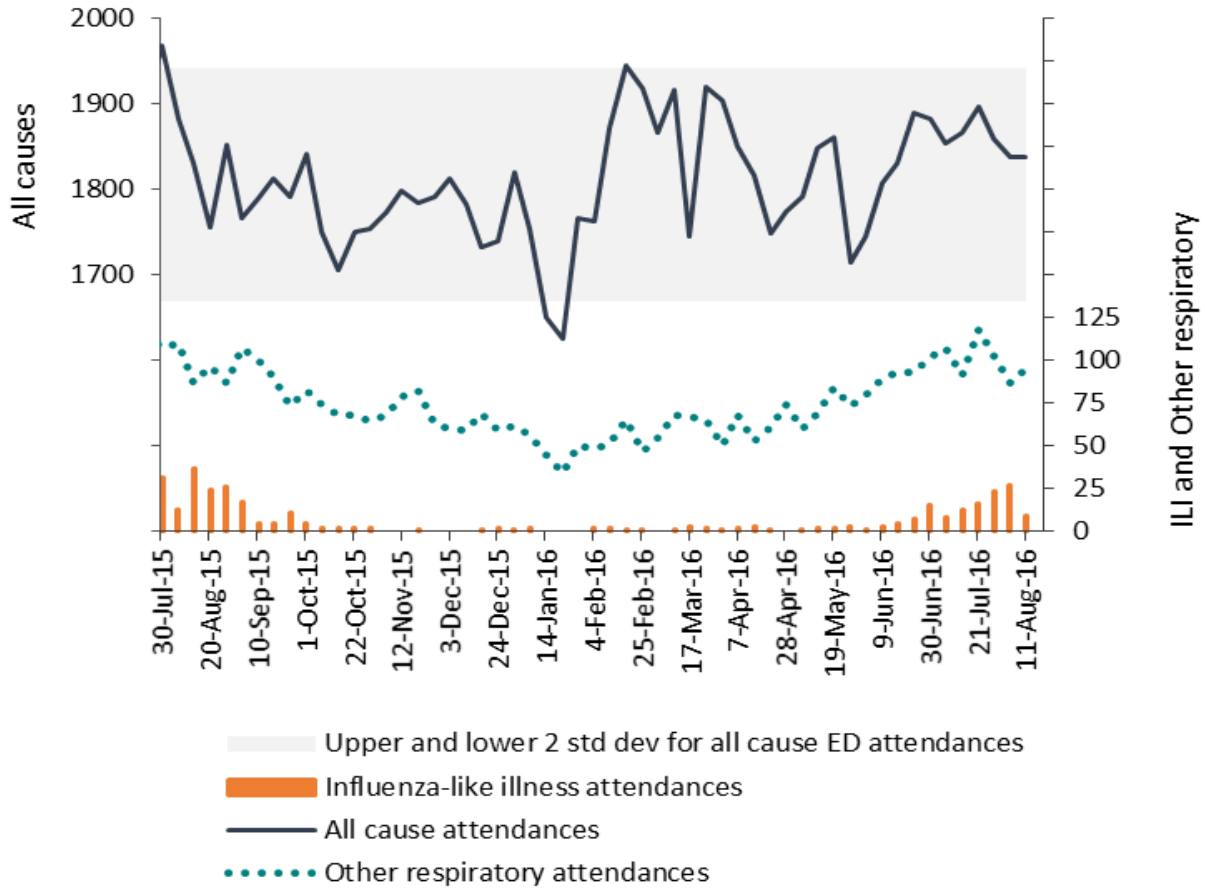


Canterbury: cumulative admission rates by age 2016



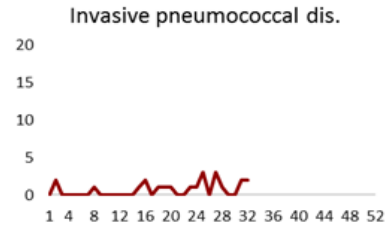


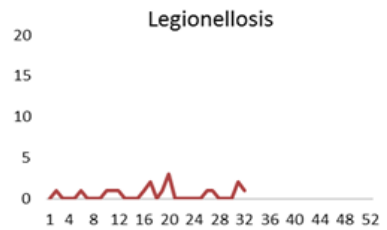
Canterbury: ED attendances all cause, respiratory and ILI, 2016

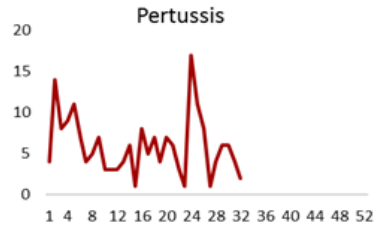


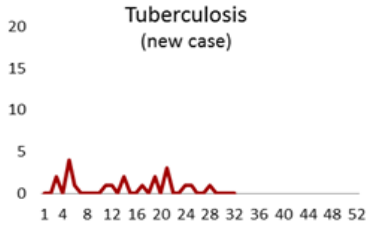
PHU, CDHB 12 Aug 2016

Canterbury: respiratory pathogen identifications

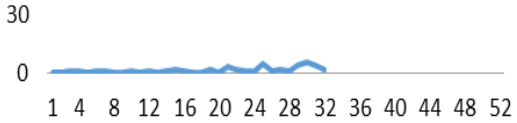




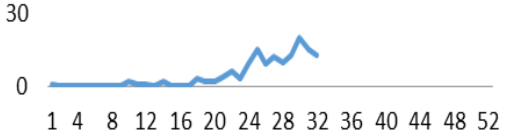




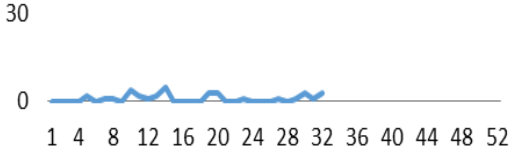
Adenovirus



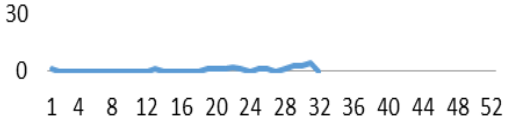
Coronavirus



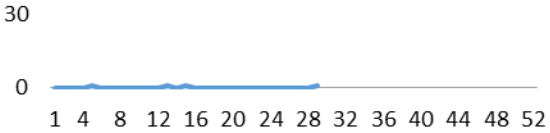
Enterovirus



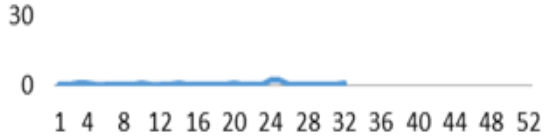
human Meta-pneumovirus



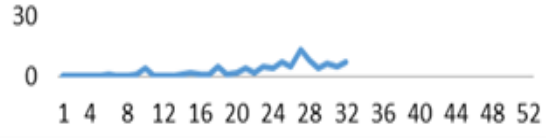
Parechovirus



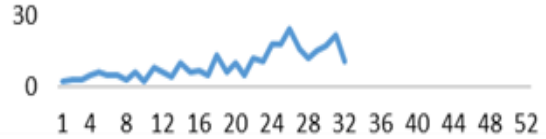
Mycoplasma



Parainfluenza 1-4

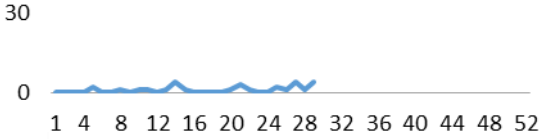


Rhinovirus

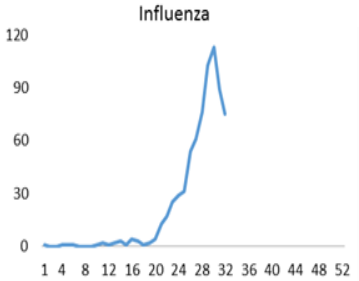


Respiratory Syncitial virus

Bocavirus



CPH CDHB 12 Aug 2016



2016 Canterbury Primary Care Flu Response Plan

Objective: to ensure that General Practice, Pharmacy, Community Nursing and Aged Care Facilities are appropriately prepared

Canterbury Flu Group 2016

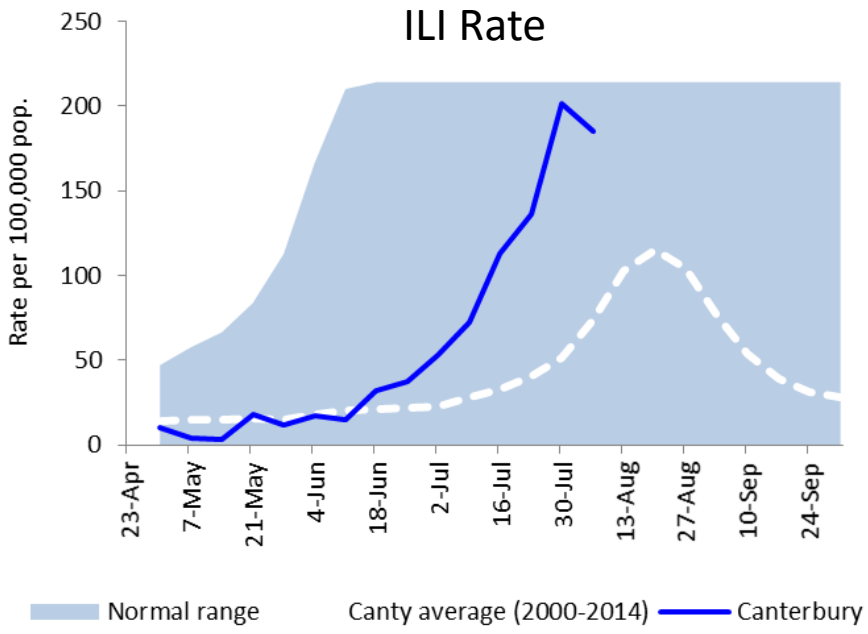
Canterbury Primary Response Group

Dr Phil Schroeder,
Chairman

2016 Primary Care Flu Response Plan

Winter Demand in Primary Care is challenged by:

1) Respiratory Viruses and influenza like illness (ILI)
   a) GP Consults Canterbury 40,000 weekly
   b) Very High ILI Year: peak week 1250 new cases
   c) Represents 4 new patients per GP per week
2) Chronic illness presentations
3) Staff illness
4) Free under 13s



Practice preparedness

- having response strategies in place before the winter season
- Having access to epidemic information

Canterbury Primary Response Group

2016 Primary Care Flu Response Plan

Canterbury Primary Response Group

Normal Response Strategies

Correct signage

Safe waiting areas

potential red/green streaming

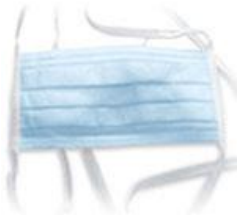
Patients PPE available

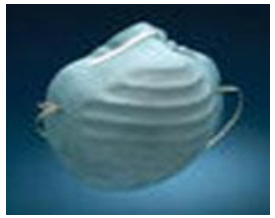
promote hand hygiene "5 moments for hand hygiene" approach

promote respiratory hygiene/cough etiquette

Face masks/medical masks/respirators in healthcare

Medical Masks



Standard:

Duck bill

Moulded cone

Other masks


Cloth & Paper masks:
No regulations exist.
Used in poor resource countries

Respirators

Respirators:
N95 & Elastomeric

Medical Masks:

- **Operating theatre**: reduce transfer infectious fluids to sterile sites
- **Source control**: coughing patients
- **Respiratory protection**: protection from splashes of blood/body fluids ? Droplet protection (Medical devices so testing for respiratory protection not required)

Respirators

- respiratory filtering devices that **provide protection** against inhalation of small and large airborne particles

2015 Primary Care Flu Response Plan

Canterbury Primary Response Group

Normal Response Strategies

Assessment of patient risk :

Any patient presenting has potential to be infectious

Requires a case definition

ILI definition: An acute respiratory illness with onset during the last 10 days with: a history of fever or measured fever of ≥38°C , cough and requiring a general practice consultation.

Other emerging pathogens: MoH website

Considering a travel and exposure history

Knowledge of countries affected by Zika; MERS-CoV; Avian influenza; accessible on MoH website

Knowledge of high risk activities

2016 Primary Care Flu Response Plan

Canterbury Primary Response Group

Normal Response Strategies

Patient streaming

- Triage (options)
- Allocation of Staff
- Managing medical certificates
- Faxing and delivery of scripts
- Casual/non-registered patients

Triage

Self
Online
Phone
Flu Line
Car Park
Reception
Another Practice

2015 Primary Care Flu Response Plan: Toolkit

Normal Response Strategies

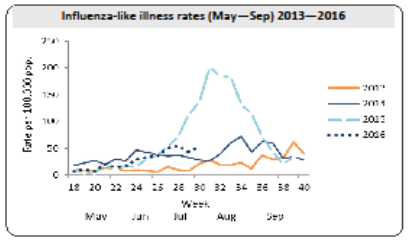
Accessing up to date respiratory virus information

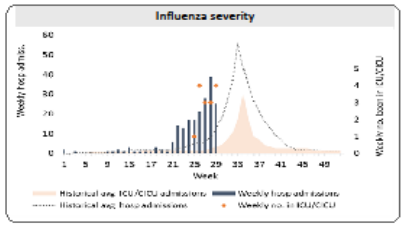
CANTERBURY PRIMARY RESPONSE GROUP UPDATE
Tuesday 2nd August 2016

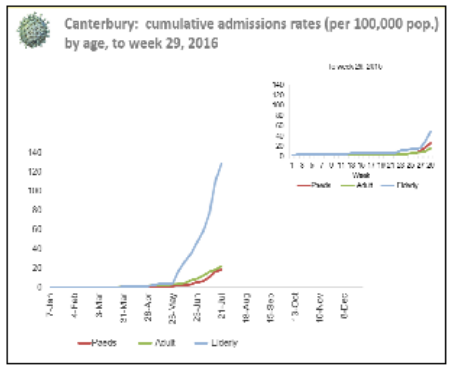
Canterbury Primary Response Group

Important information for all GP teams, Community Pharmacists, Community Nursing and Aged Care Facilities – Please share this with everyone in your team

- While Canterbury Influenza Like Illness levels in 2016 are running at a low rate, respiratory infections are having a profound effect on the Emergency Department and Hospital admissions with gridlock already being experienced on occasions.
- Canterbury swabs continue to show a preponderance for Influenza Type"A"H3N2 to date.
- Hospitalisation rates for those with influenza seem abnormally high for our elderly patients (over 65 yrs). Many of those elderly being admitted have received their annual vaccination suggesting that there may be issues with vaccine effectiveness against H3N2.
- ICU admissions for influenza are also tracking high currently (in all age groups).
- Given the high numbers of ED attendances and Hospital admissions you may well want to adopt your winter capacity plans in your practice or facility.
- To best provide for your patients during this period activities might include:
  - Ensuring good signage, masks, alcohol hand-wash availability for all presenting with coughs and colds.
  - Changing booking systems to allow for same day triaged appointments and/or extended hours.
  - Consideration limiting holidays of doctors and staff over these busiest months (August/September).
  - Consider using acute demand services to either deal to acute cases and/or repeat visits required.







Kind regards,
Dr Phil Schroeder
Canterbury Primary Response Group

Canterbury Primary Response Group

2016 Primary Care Flu Response Plan

Normal Response Strategies

Capacity management over peak season:

- Staffing (number, illness, holidays, etc.)
- Buildings (physical limitations)
    - potential red/green streaming
- Equipment:
    - Prepare PPE Packs with gloves, masks, goggles and gowns.
    - Instructions for use
    - Training in correct practices before hand.

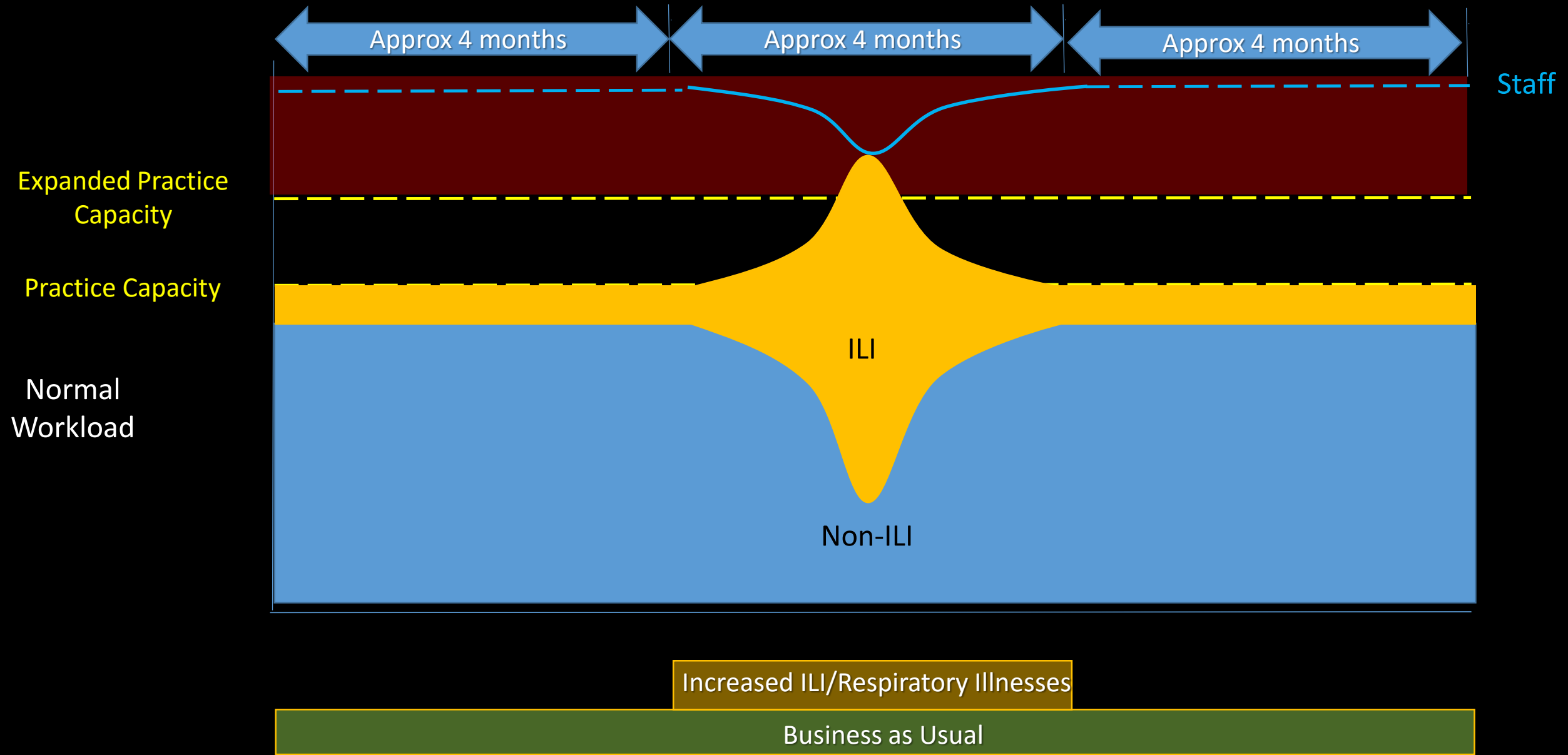
If capacity exceeded for practice, means patients are referred elsewhere or appointment deferred until a later day

Where do patients go? Are there other options?

Canterbury Primary Response Group

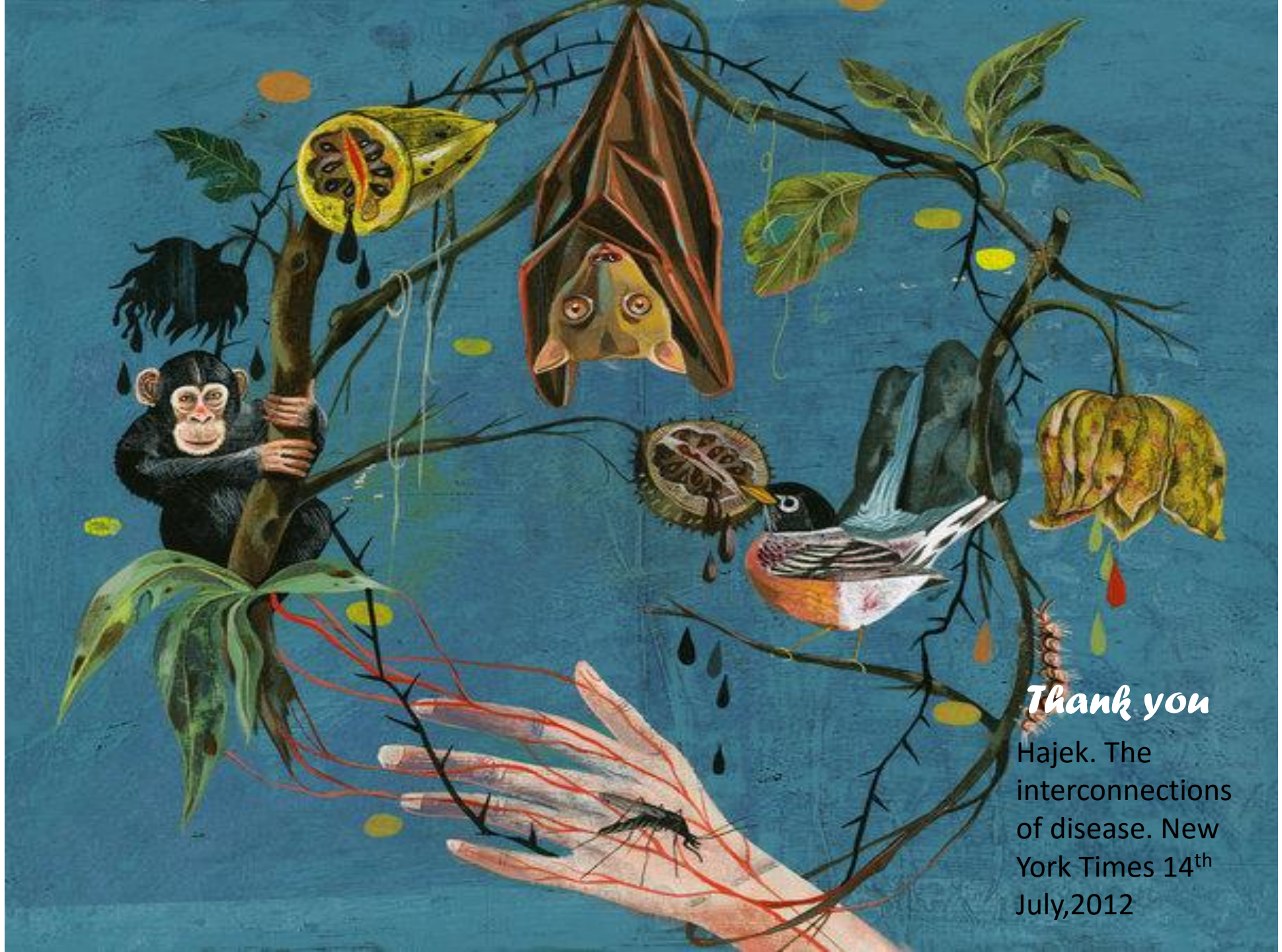
2016 Primary Care Flu Response Plan

Impact of Annual Winter Illnesses



Summary

- Emerging & re-emerging infectious disease threats are ongoing
- New Zealand is very much part of the global community
- Preparedness requires a knowledge of these threats
- In primary care, the winter respiratory season, occurs every year
- Simple response strategies, can become part of routine practice



Thank you

Hajek. The interconnections of disease. New York Times 14th July,2012