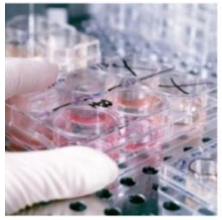
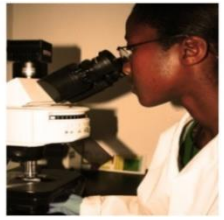
NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service


The 2017-2018 listeriosis outbreak, South Africa: situation update



Dr Juno Thomas
Centre for Enteric Diseases
National Institute for Communicable Diseases

Epidemiology of listeriosis

- Sporadic cases occur worldwide, mostly in persons at high risk
  - Estimated 2 – 4 cases per million population per year in developed countries
- Outbreaks associated with contaminated food products increasingly common
- Nosocomial outbreaks also reported

Surveillance for listeriosis cases

- Requirements for surveillance
  - Diagnostic algorithm: case definition, diagnostic tests
  - Staff members
  - Sampling frame
  - Competent laboratory
- Surveillance system should allow
  - Timely data processing
  - Results and action
    - Interpretation
    - Facilitating appropriate action based on surveillance results

Case definition

- Only those cases that meet the 'confirmed' case definition are included; there are no probable, possible, or suspected cases.

- Confirmed case:
  - A person who has clinical features in keeping with listeriosis (symptoms and signs depend on site and severity of disease*)

    and
  - laboratory confirmation of Listeria monocytogenes (by culture or PCR).

*Types of disease include: febrile gastroenteritis; pregnancy-associated (maternal listeriosis, fetal listeriosis, neonatal listeriosis); bacteraemia; central nervous system disease (including meningitis, meningoencephalitis, rhombencephalitis, cerebral abscesses) ; other focal infections (e.g. mycotic aneurysms, septic arthritis, endocarditis, endophthalmitis, and osteomyelitis).

Passive laboratory-based surveillance

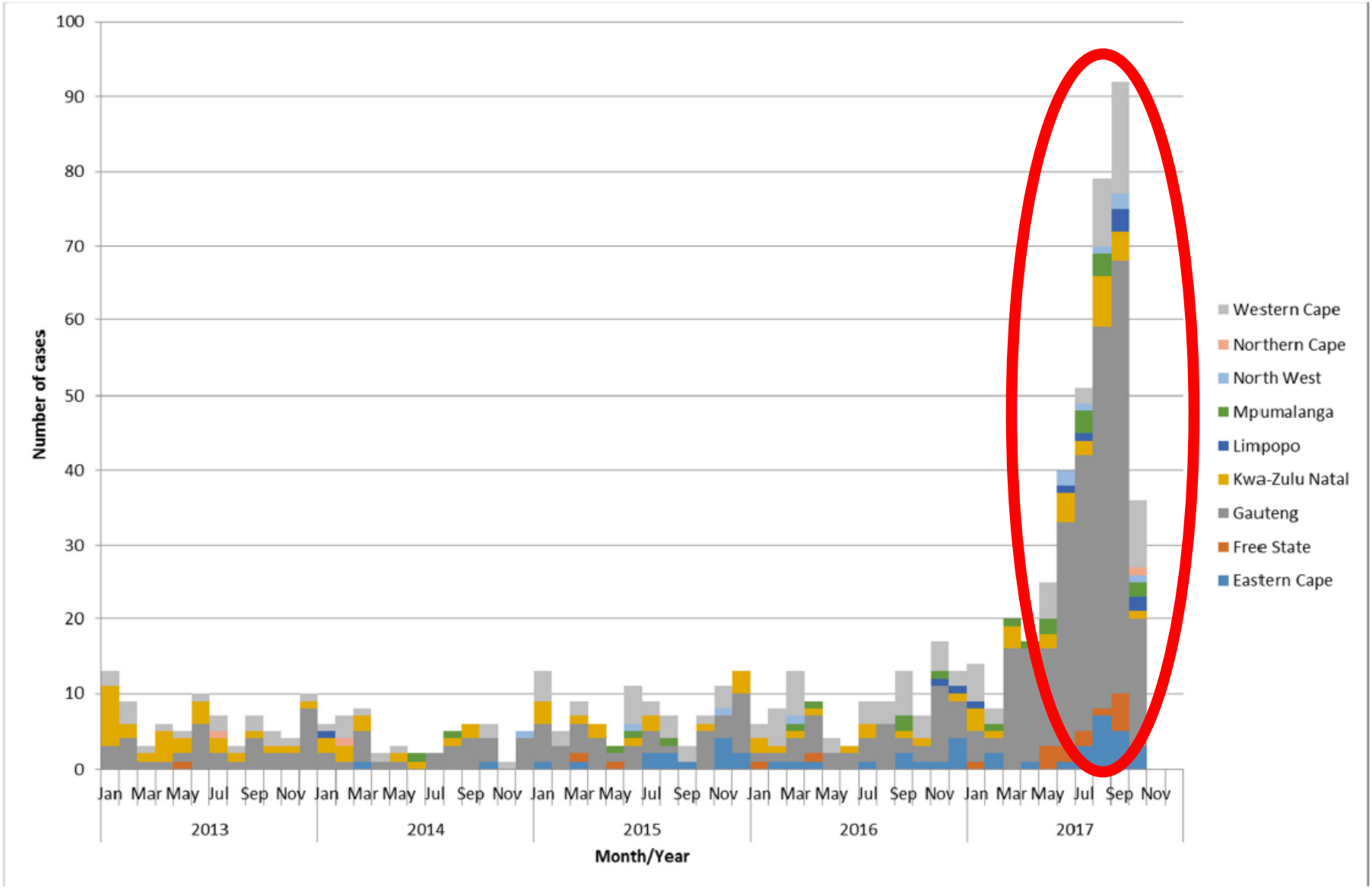
- Laboratory-confirmed cases are reported, then documented
- Epidemiologic analysis of lab-confirmed cases performed
  - Establish trends (time, person, place)
  - Seasonality?
  - Detect unusual signals
    - Time
    - Person
    - Place

Case investigation

- Relies on timely reporting of laboratory-confirmed cases to health department
- Triggers case investigation
  - Patient interview: epidemiologic information and food consumption history
    - Standardised CIF developed by CED, NICD
  - Additional clinical data
  - Visit to patient's home: sample food from refrigerator, freezer
  - Awareness for other cases (?cluster)

- Depending on case investigation – may trigger further traceback investigation
  - Case part of a cluster
  - Food consumption history provides signal

Epidemic curve of laboratory-confirmed cases of *Listeria monocytogenes*, South Africa, 2013-2017



Situation update on listeriosis outbreak, issued 23 April 2018

- As of 17 April 2018, a total of 1 019 laboratory-confirmed listeriosis cases has been reported to NICD since 01 January 2017
- Where age was reported (n=993), ages range from birth to 93 years (median 18 years) and 42% are neonates aged ≤28 days
- Most cases have been reported from Gauteng Province (59%,579/1 019), followed by Western Cape (13%, 127/1 019) and KwaZulu-Natal (7%, 73/1 019) provinces
- Final outcome data is available for 69% (698/1019) of cases, of which 28% (199/698) died.

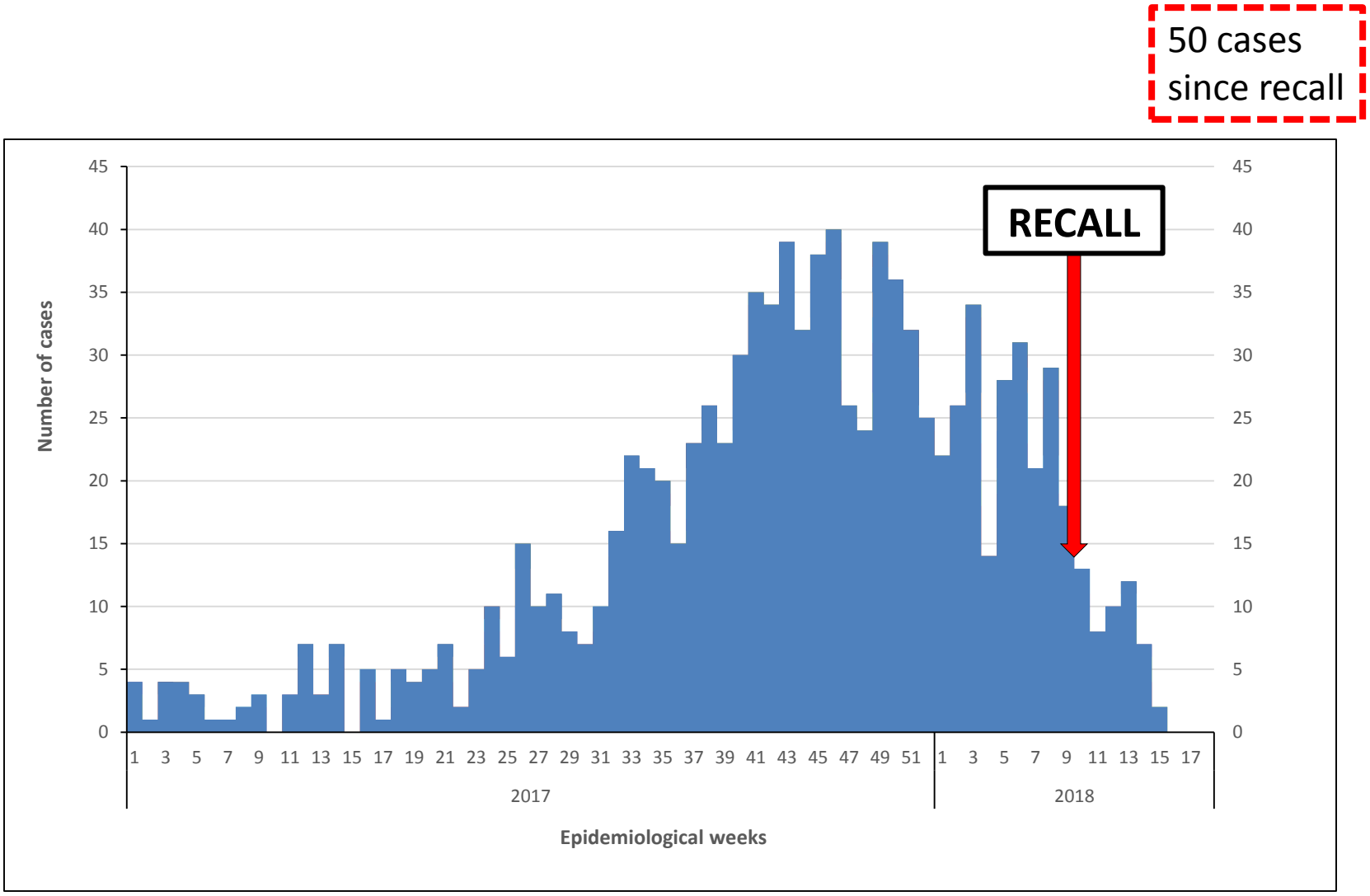


Figure 1: Epidemic curve of laboratory-confirmed listeriosis cases by epidemiological week and date of sample collection, South Africa, 01 January 2017 to 17 April 2018 (n=1 019)

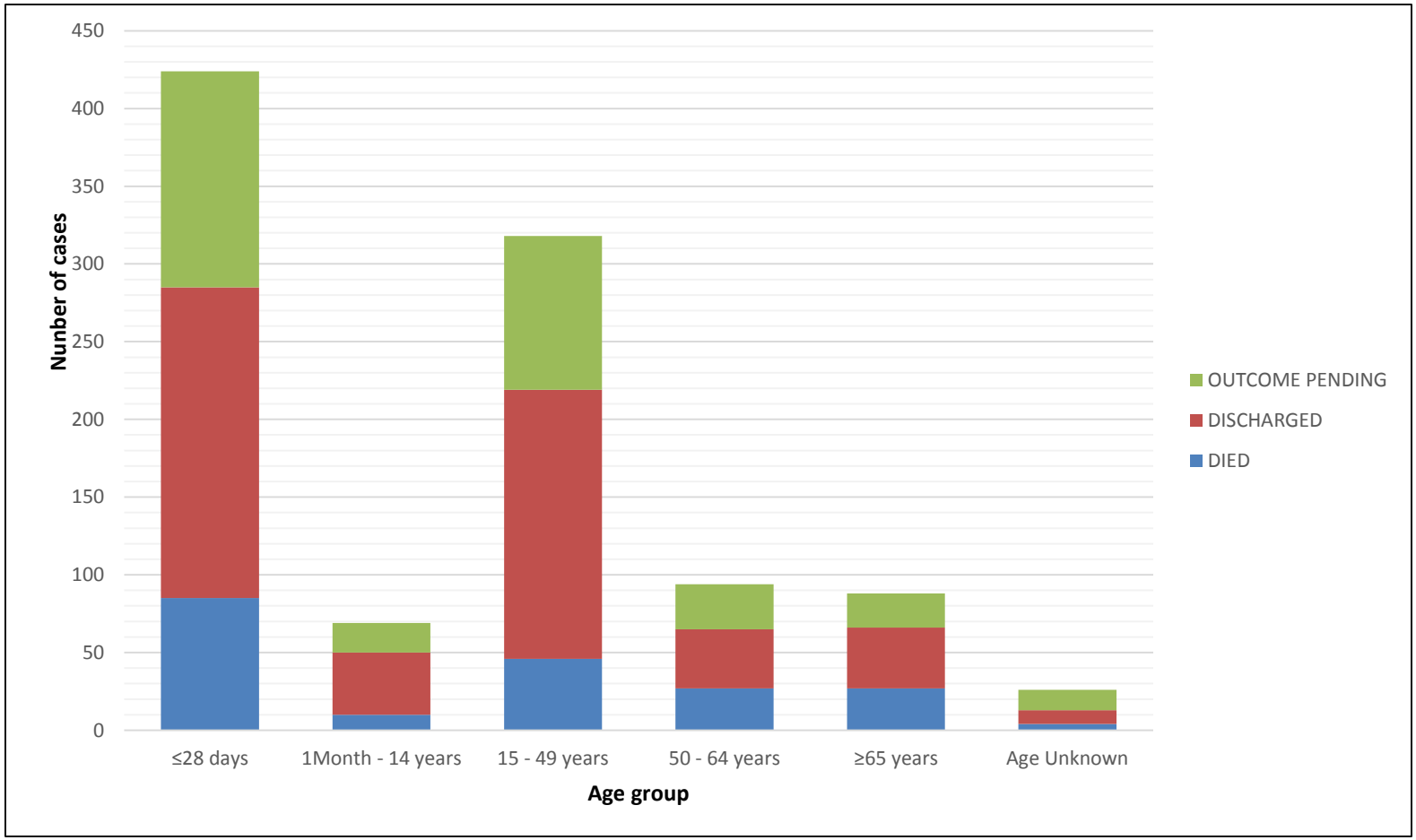


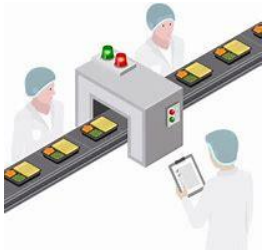
Figure 2: Age distribution and outcome of laboratory-confirmed listeriosis cases, South Africa, 01 January 2017 to 17 April 2018 (n=1 019)

Table 1. Number of laboratory-confirmed listeriosis cases and deaths by province, where outcome data is available:

Province	Outcome available (%)	Number of deaths (%)	Total cases (%)
Gauteng	370 (62.0)	105 (28.4)	597 (58.6)
Western Cape	113 (89.0)	29 (25.7)	127 (12.5)
KwaZulu-Natal	47 (64.4)	18 (38.3)	73 (7.2)
Mpumalanga	45 (95.7)	11 (24.4)	47 (4.6)
Limpopo	33 (63.5)	7 (21.2)	52 (5.1)
Eastern Cape	30 (56.6)	11 (36.7)	53 (5.2)
Free State	30 (85.7)	8 (26.7)	35 (3.4)
North West	25 (86.2)	7 (28.0)	29 (2.8)
Northern Cape	5 (83.3)	3 (60.0)	6 (0.6)
Total	**698 (68.5)**	**199 (28.5)**	**1 019**

Gathering and analysing listeriosis outbreak investigation data

NHLS ICSL: food & environmental sample testing (DoH EHPs)



NHLS: CDW data

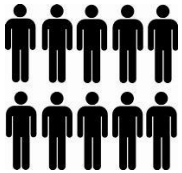
Private pathology laboratories: lab reports

Case investigation forms

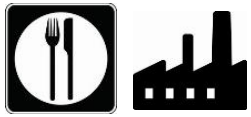
- Voluntary
- Variable completeness

Notifiable medical condition reports: since 15/12/2017

Clinical isolates: NHLS and private labs

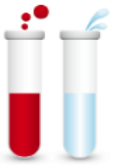


Food & enviro isolates: NHLS and private labs



NICD: Phenotypic confirmation and whole genome sequencing

NICD: PCR on CSF, placenta samples etc



NICD investigation team: in-person and telephonic interviews

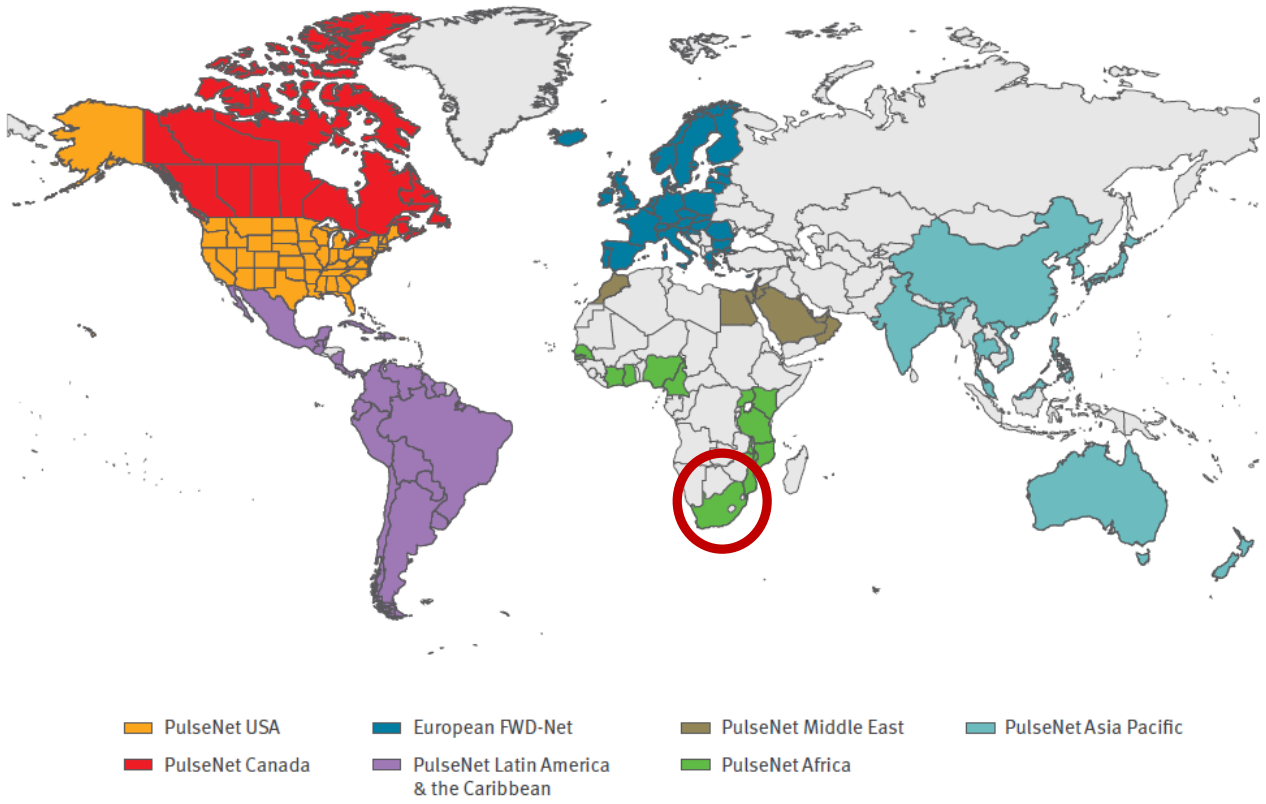
PulseNet International: Vision for the implementation of whole genome sequencing (WGS) for global food-borne disease surveillance

Celine Nadon[1,2], Ivo Van Walle[2,3], Peter Gerner-Smidt[4], Josefina Campos[5], Isabel Chinen[5], Jeniffer Concepcion-Acevedo[4], Brent Gilpin[6], Anthony M. Smith[7], Kai Man Kam[8], Enrique Perez[9], Eija Trees[4], Kristy Kubota[10], Johanna Takkinen[3], Eva Møller Nielsen[11], Heather Carleton[4], FWD-NEXT Expert Panel[12]

Euro Surveill. 2017;22(23):pii=30544.

FIGURE 1

Map of PulseNet International participating countries, May 2017



Whole genome sequencing (WGS): The *Listeria* detective's ultimate tool

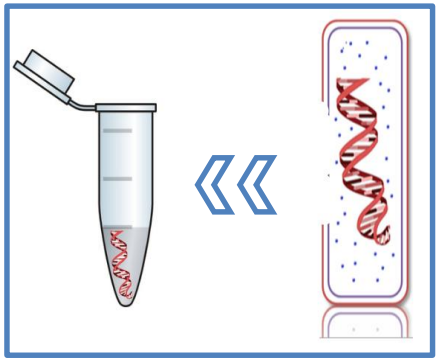
NICD CED

Isolates referred from clinical, public health and private food testing labs

Isolates plated on non-selective media

Presumptive *Listeria monocytogenes*

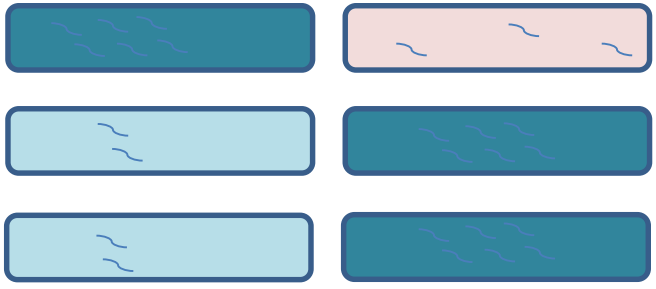
Phenotypic and biochemical confirmation



DNA extraction

NICD CSU

DNA sequencing

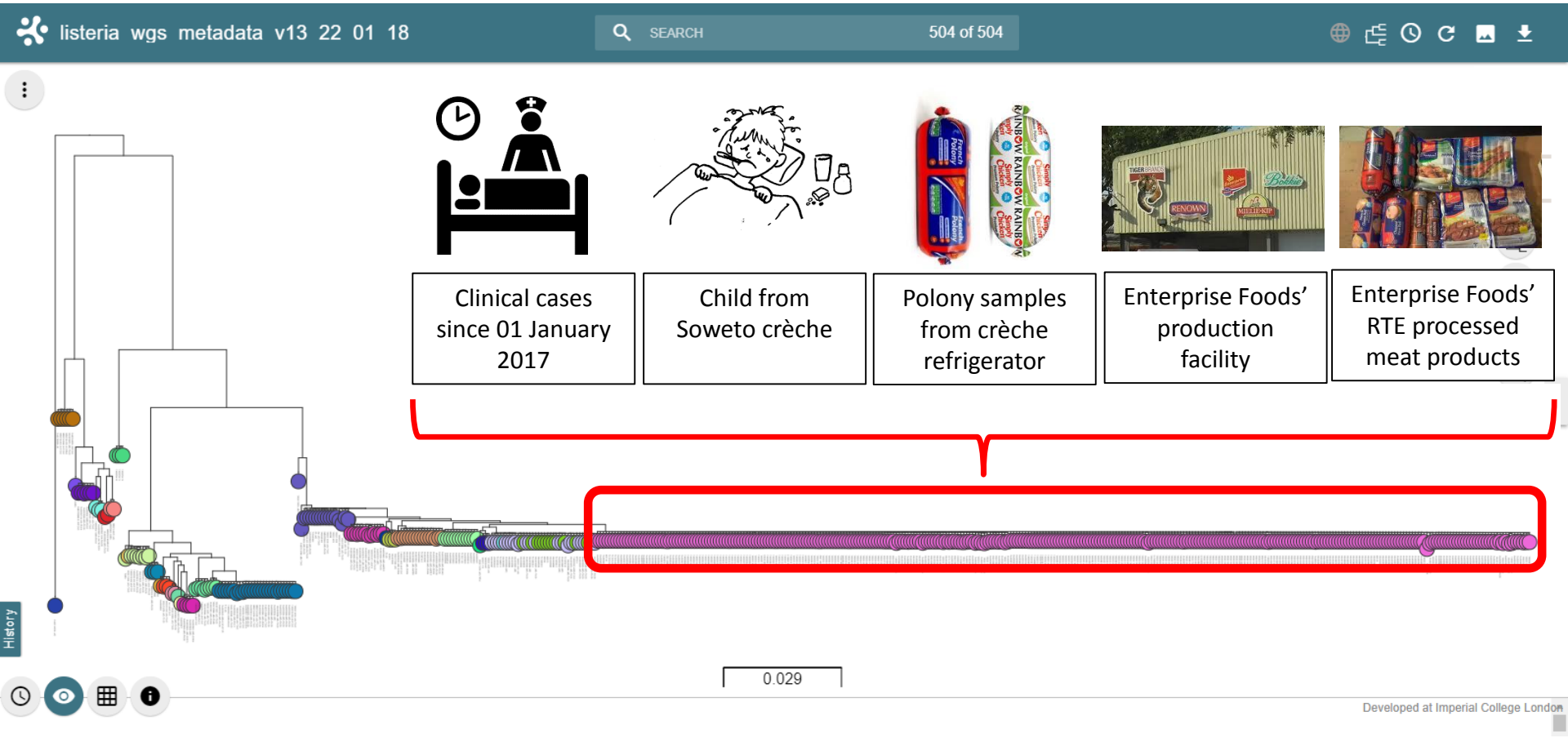


Whole genome sequence analysis

Solving the outbreak

- 12 January 2018: a cluster of febrile gastroenteritis in 9 children attending a crèche in Soweto (Johannesburg), who all consumed polony sandwiches
  - *L. monocytogenes* ST6 (outbreak strain) confirmed in one case
  - *L. monocytogenes* ST6 (outbreak strain) detected in food samples (two different polony brands produced by different manufacturers) collected from refrigerator at crèche
- Investigation of polony manufacturer (Enterprise Foods' production facility in Polokwane)
  - *L. monocytogenes* ST6 (outbreak strain) detected in 28 environmental and product casing swabs
  - *L. monocytogenes* ST6 (outbreak strain) also detected in several RTE processed meat products manufactured at the Polokwane facility

Phylogenetic tree of WGS



Distance and topology calculated by RaXML; indicates ST6 isolates of 92% clinical cases identical, and Enterprise Foods' production facility environmental and product isolates also identical; i.e. confirms exposure to common contaminated food item/s produced at Enterprise Foods' production facility in Polokwane

Acknowledgements

- NICD: CED, EOC & ORU, Sequencing Unit, CRDM
- NHLS laboratories
- Government departments: Health; Agriculture, Forestry and Fisheries; Trade and Industry
- Private healthcare sector
- Several private sector food microbiology laboratories
- WHO
- US CDC
- Institut Pasteur