

Countdown from five : Dealing with the top antimicrobial resistant threats



Health

Multi resistant organisms – why worry?

- ▶ Disease burden
- ▶ Cost
- ▶ Mortality
- ▶ Increasing incidence
- ▶ Limited or no treatment
- ▶ Impact of infection control measures
- ▶ Transmission
- ▶ Preventable



Approach to control

- ▶ Understand causes and contributing factors
- ▶ Reduce unnecessary use of antibiotics in people, animals
 - ▶ GPs / Hospital / Veterinarians / Agriculture growth
- ▶ Surveillance of incidence
 - ▶ Monitor impacts / Identify infected / Control spread
- ▶ Research
 - ▶ New antibiotics / effective AMS / reduce transmission



World Health Organization

“...this serious threat is no longer a prediction for the future; it is happening right now in every region of the world and has the potential to affect anyone, of any age, in any country.”

- ▶ Antimicrobial resistance is one of the key global health issues facing our generation.
- ▶ No one country can act in isolation.
- ▶ Increasing international travel, medical tourism and global trade provide the opportunities for resistance to spread across all borders.



WHO

- ▶ AMR in bacteria
 - ▶ *Klebsiella pneumoniae* - carbapenem
 - ▶ *E. coli*
 - ▶ Gonorrhoea - third generation cephalosporin
 - ▶ *Staphylococcus aureus*
 - ▶ Enterobacteriaceae – colistin
 - ▶ Tuberculosis
- ▶ Malaria
- ▶ HIV
- ▶ Influenza



US CDC

▶ Urgent Threats

- ▶ *Clostridioides difficile*
- ▶ Carbapenem-resistant Enterobacteriaceae (CRE)
- ▶ Drug-resistant *Neisseria gonorrhoeae*



US CDC

► Serious Threats

- Multidrug-resistant *Acinetobacter*
- Drug-resistant *Campylobacter*
- Fluconazole-resistant *Candida*
- Extended-spectrum Beta-lactamase producing Enterobacteriaceae
- Vancomycin-resistant *Enterococcus*
- Multidrug-resistant *Pseudomonas aeruginosa*
- Drug-resistant non-typhoidal *Salmonella*
- Drug-resistant *Salmonella* Serotype Typhi
- Drug-resistant *Shigella*
- Methicillin-resistant *Staphylococcus aureus*
- Drug-resistant *Streptococcus pneumoniae*
- Drug-resistant Tuberculosis



US CDC

▶ Concerning Threats

- ▶ Vancomycin-resistant *Staphylococcus aureus*(VRSA)
- ▶ Erythromycin-Resistant Group A *Streptococcus*
- ▶ Clindamycin-resistant Group B *Streptococcus*



Australia's strategy

Goal:

- ▶ minimise the development and spread of AMR
- ▶ ensure the continued availability of effective antimicrobials
- ▶ supports a One Health approach

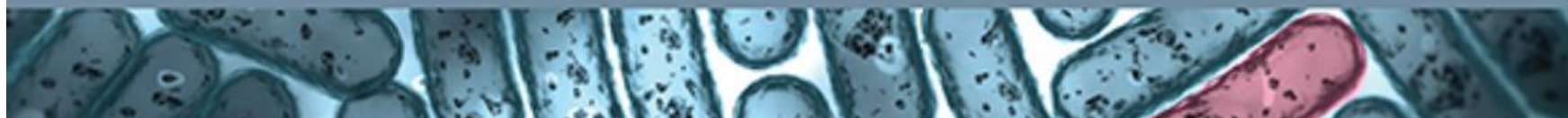




Australian Government
Department of Health
Department of Agriculture



RESPONDING TO THE THREAT OF
antimicrobial resistance



Australia's strategy

Objectives:

- ▶ across human/animal health, agriculture/food sectors:
 - ▶ increase awareness and understanding of AMR
 - ▶ implement effective antimicrobial stewardship
 - ▶ develop integrated national surveillance
 - ▶ improve infection prevention and control practices
 - ▶ develop a national AMR research agenda
 - ▶ strengthen international partnerships
 - ▶ establish clear governance arrangements



Australia

- ▶ Commission
 - ▶ AURA
 - ▶ Coordination Broad guidelines
 - ▶ Sentinel lab surveillance
- ▶ Australian Health Protection PC / Comm Dis Network Aus
 - ▶ Governance – formal jurisdictional processes
 - ▶ Surveillance – specific information to inform control
 - ▶ Sharing of intelligence – among jurisdictions
 - ▶ Common guidelines – alignment of operational policies



Critical antimicrobial resistance Alerts

Species	Critical Resistance
Enterobacteriaceae	Carbapenemase-producing or RM- producing
Enterococcus species	Linezolid non-susceptible
M tuberculosis	Multi-Drug Resistant (MDR)
N gonorrhoeae	Ceftriaxone/azithromycin non-susceptible
Salmonella species	Ceftriaxone non-susceptible strains
Shigella species	MDR strains
Staphylococcus aureus	Vancomycin, linezolid, daptomycin non-susceptible
Streptococcus pyogenes	Penicillin reduced susceptibility



NSW

▶ CEC/LHDs

- ▶ Infection control policy, manual, advice

▶ CEC/Health Protection NSW

▶ Priorities

- ▶ Expert advisory panel
- ▶ MRO surveillance and response protocols for LHDs
 - ▶ Expert working groups – CPE, VRE, C auris
- ▶ Surveillance – notification or monitoring
- ▶ Practice network to share and build knowledge
 - ▶ LHD (technical and governance)



MROs among notifiable diseases

- ▶ Shigella
 - ▶ Increasing, Importations with local spread, MSM
- ▶ Gonococcus
 - ▶ resistance to fluoroquinolone, cephalosporin, azithromycin and ceftriaxone
- ▶ Tuberculosis - MRTB (INH/RIF), XRTB
 - ▶ Mandatory expert panel for each case
- ▶ Salmonella – typhi and non typhoidal
- ▶ Already surveillance and response procedures led by PHUs, need to capture consistent AMR data



The Panel's Top Five ... for now

- ▶ Focus NSW public hospitals
 - ▶ Carbapenemase producing Enterobacteriaceae (CPE)
 - ▶ *Pseudomonas aeruginosa* carbapenem-resistant
 - ▶ Vancomycin resistant *enterococcus* (VRE)
 - ▶ Methicillin resistant *staphylococcus aureus* (MRSA)
 - ▶ Multi-resistant *acineobacter baumannii* (MRAB)
- ▶ Subsequent emergence
 - ▶ *Candida auris*



Carbapenemase producing *Enterobacteriaceae*

- ▶ **What it is** Gut bacteria, eg *Klebsiella*, *E coli* carbapenem-resistant. 5 most important types of carbapenemases found in CPE:
 - ▶ Imipenemase (IMP)
 - ▶ *Klebsiella pneumoniae* carbapenemase (KPC)
 - ▶ New-Delhi metallo- β -lactamase (NDM)
 - ▶ Verona integron-encoded metallo- β -lactamase (VIM)
 - ▶ Oxacillinases (OXA)
- ▶ **Carriage vs illness:** yes, ratio unclear
- ▶ **Infection typically causes:** invasive dx, mortality 30-50%
- ▶ **Increase risk:** Travel, hospital, NH, ventilators, lines, A/B
- ▶ **Transmission:** person to person, environment



Carbapenem-resistant *Pseudomonas aeruginosa*

- ▶ **What it is:** Bacteria commonly found in water and soil
- ▶ **Carriage vs illness:** Yes
- ▶ **Infection typically causes:** bacteraemia, pneumonia, folliculitis (hot tub rash), swimmers ear, conjunctivitis, osteomyelitis
- ▶ **Increase risk:** impaired immunity, burns, cancer, cystic fibrosis, HIV, surgery, ICU, tubes
- ▶ **Transmission:** person to person via hands, contact with contaminated (medical, environmental), coughing or sneezing.



Vancomycin resistant *enterococcus*

- ▶ **What it is:** Bacteria commonly live in the GI tract
- ▶ **Carriage vs illness:** yes
- ▶ **Infection typically causes:** Bacteraemia, from either an existing infection (abscess, UTI) or medical device (urinary or intravenous catheter)
- ▶ **Increase risk:** immune suppression – cancer, dialysis, intensive care, transplants.
- ▶ **Transmission:** person to person (hands of another person), environmental surfaces or medical equipment that have become contaminated; not through the air or by coughing or sneezing



Methicillin resistant *staphylococcus aureus*

- ▶ **What it is:** common bacterium
- ▶ **Carriage vs illness:** colonises nose, throat, skin. Commonly in the nose and on the skin of humans and occasionally in some animals (for example pigs, dogs, horses).
- ▶ **Infection typically causes:** mild skin infections (boils), osteomyelitis, bacteraemia
- ▶ **Increase risk:** hospitalisation, immune suppression, surgery, tubes, lines, chronic wounds
- ▶ **Transmission:** person to person (staff, visitors), environment



Multi-resistant *acineobacter baumannii*

- ▶ **What it is** *Acinetobacter* bacteria common in soil and water. *A. baumannii* 80% of infections.
- ▶ **Carriage vs illness:** especially in tracheostomy sites or open wounds.
- ▶ **Infection typically causes:** pneumonia, septicaemia, wound infections
- ▶ **Increase risk:** Outbreaks in ICU and healthcare settings housing very ill patients. Immune suppression, chronic lung disease, or diabetes, ventilation, prolonged hospital stay, open wounds, invasive devices
- ▶ **Transmission:** person-to-person contact or contact with contaminated surfaces.

Candida auris

- ▶ **What it is** emerging fungus, serious global health threat. Often multidrug-resistant: 1 to 3 drug classes. Hard to identify with standard laboratory methods. Outbreaks in healthcare settings
- ▶ **Carriage vs illness:** Carriage
- ▶ **Infection typically causes:** bloodstream infections, heart, brain, etc; death
- ▶ **Increase risk:** hospitalised and nursing home patients with serious medical problems, lines, tubes, recent surgery, diabetes, broad-spectrum antibiotic and antifungal use.
- ▶ **Transmission:** unlike most *Candida* spreads person to person. last on skin and surfaces a long time



Challenges

- ▶ Varying level of concern
- ▶ Resourcing of infection control response
- ▶ Little visibility of private hospitals or aged care facilities
- ▶ Variable ways of recording infection control alerts in eMR
- ▶ MRO screening variable depending on local experience
- ▶ Reporting of outbreaks
- ▶ Best surveillance methods?
 - ▶ Notification under Public Health Act
 - ▶ Analysis of administrative data sets?
 - ▶ Aggregate reporting?
 - ▶ Outbreak reporting?

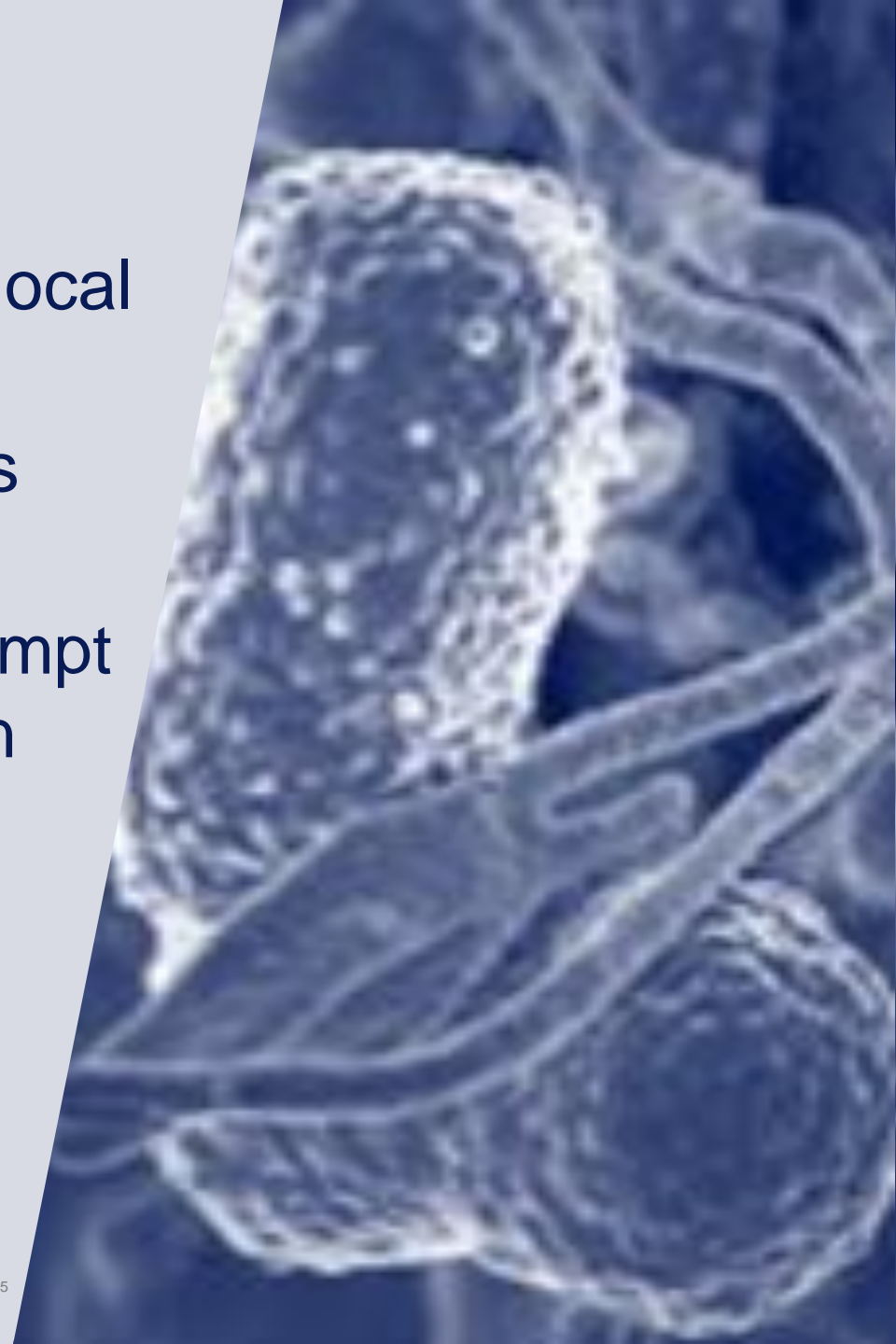




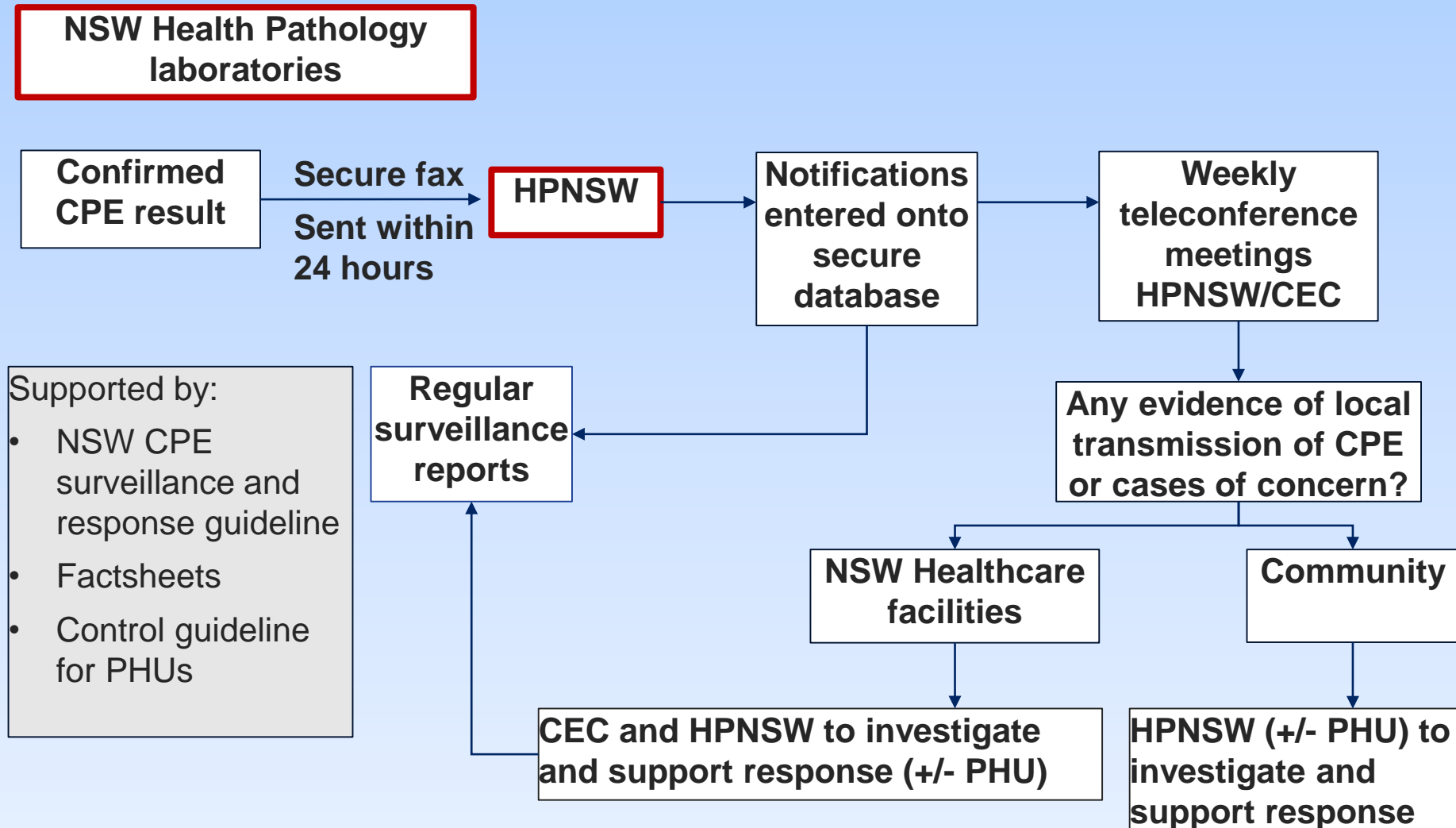
CPE infection and colonisation became a laboratory notifiable condition in NSW on 28 February 2019

Objectives

- ▶ Understand and monitor local epidemiology
- ▶ Early detection of clusters and outbreaks
- ▶ Support facilities with prompt investigation and infection prevention and control implementation



Implementation of NSW CPE Surveillance and Response Program



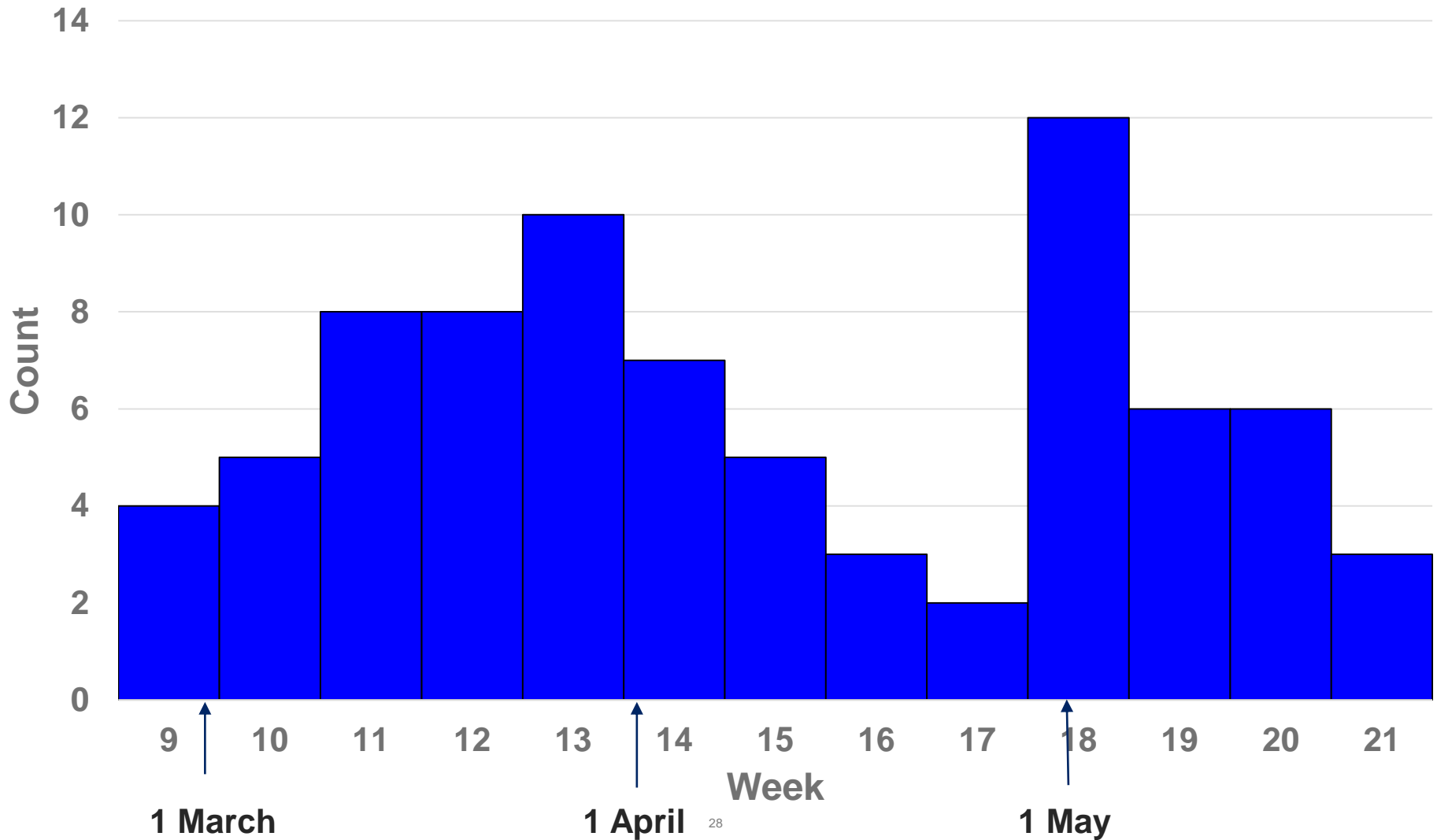
The journey so far...

(28 February – 28 May 2019)

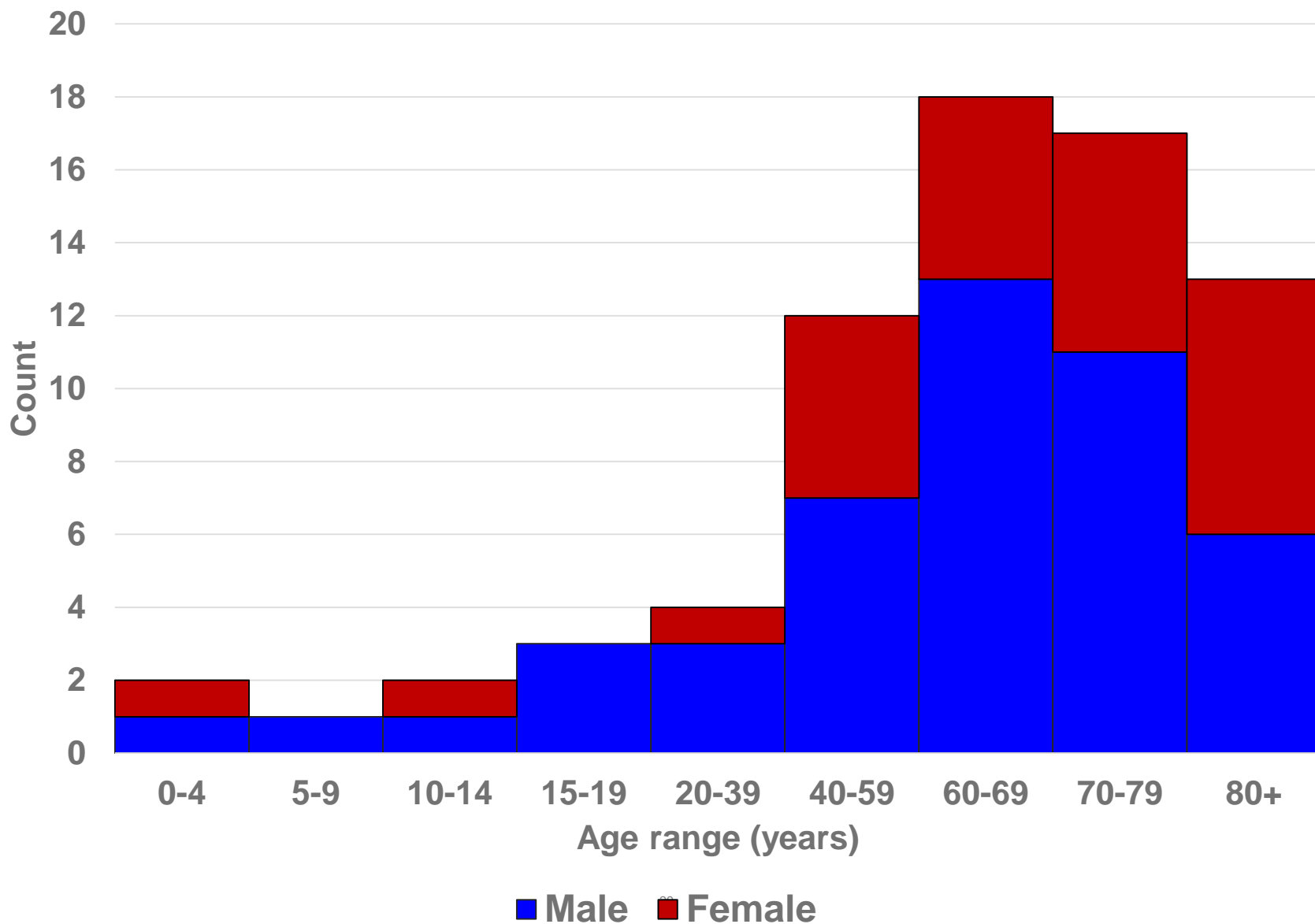


- 80 notifications
- 72 cases
- 1 outbreak

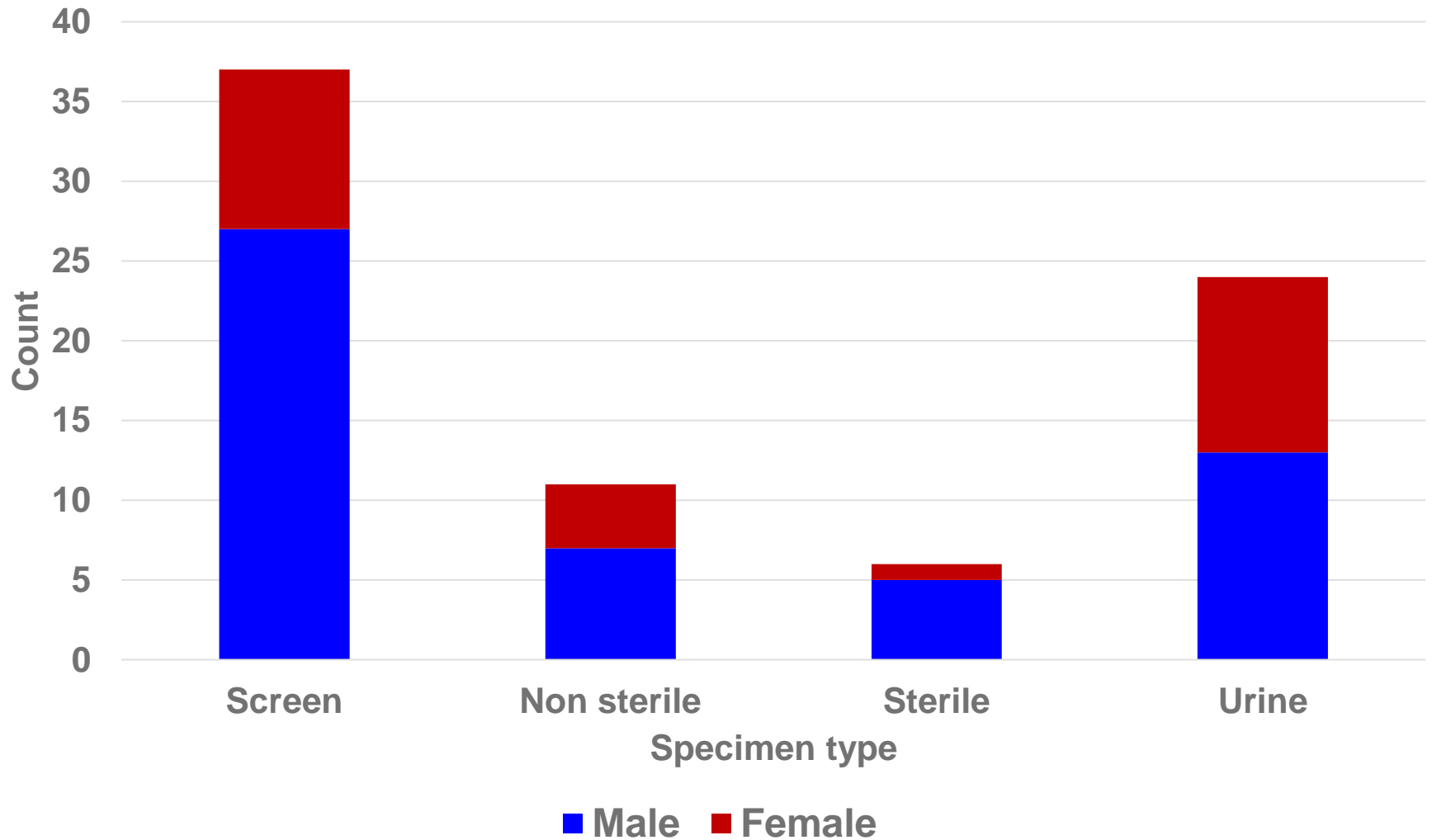
NSW CPE notifications (infection and colonisation): 28 February - 28 May 2019, by date of collection



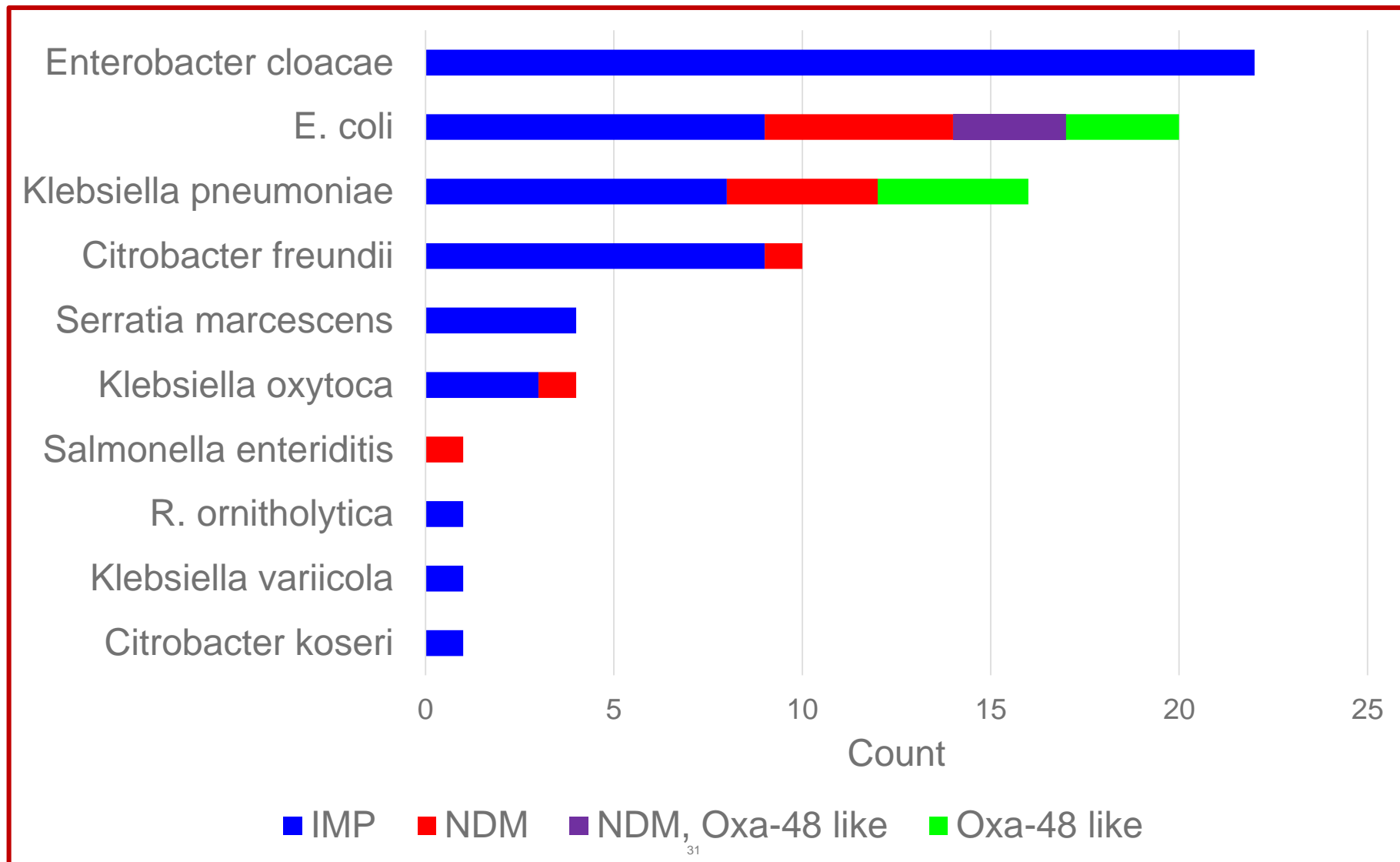
Age and sex distribution of NSW CPE cases notified from 28 Feb - 28 May 2019



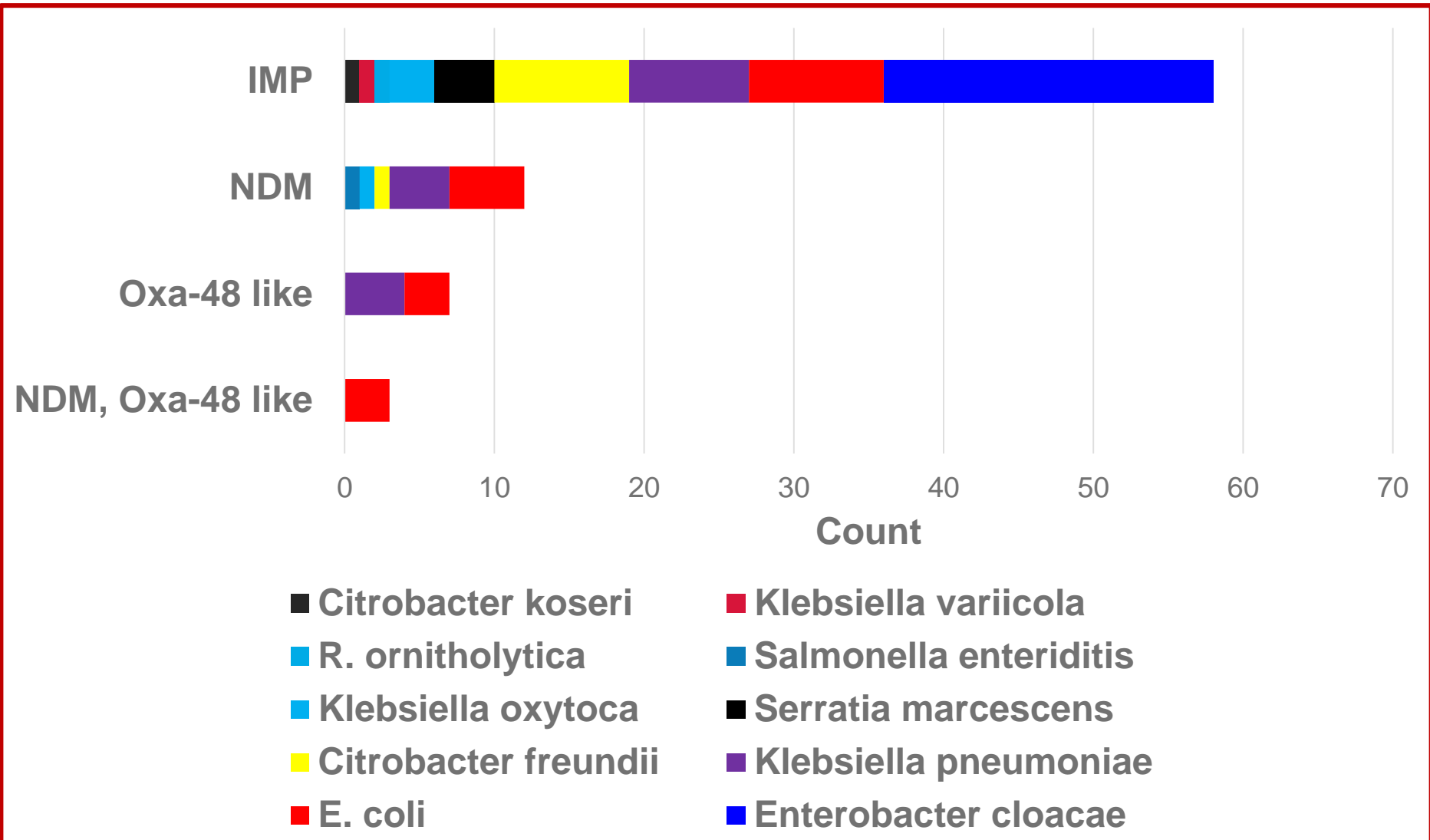
NSW CPE notifications received between 28 February – 28 May 2019, by specimen type



NSW CPE notifications by species: 28 February - 28 May 2019



NSW CPE notifications by carbapenemase type: 28 February - 28 May 2019



What are we missing?

- ▶ Colonisation versus infection
- ▶ Previous history of CPE
- ▶ Travel history
- ▶ Overseas hospitalisation
- ▶ Known CPE contact
- ▶ Medical comorbidities
- ▶ Unknown risk factors
- ▶ Whole genome sequencing

Common threads

- ▶ Increasing, costly
- ▶ Hospital bugs tend to be sticky
- ▶ Colonisation
- ▶ Person to person spread
- ▶ Environment contamination and spread important, variable
- ▶ Risks for acquisition – exposure to the bug (eg, while traveling, in health care)
- ▶ Most colonized people never know it
- ▶ Risks for infection – immune supp, lines, tubes, surgery
- ▶ Many unknowns



Prevention key

- ▶ AMS
- ▶ Infection control
- ▶ Environmental cleaning
- ▶ Case detection
- ▶ Contact management
- ▶ Need to better understand and share knowledge about what works

