Carbapenemase Producing Organisms: How BC Fares Amidst Its Global Emergence

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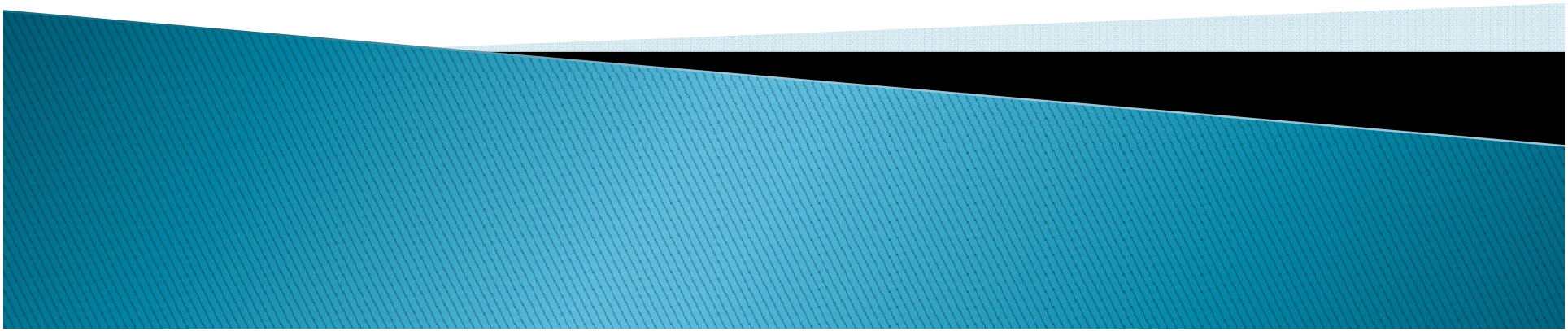
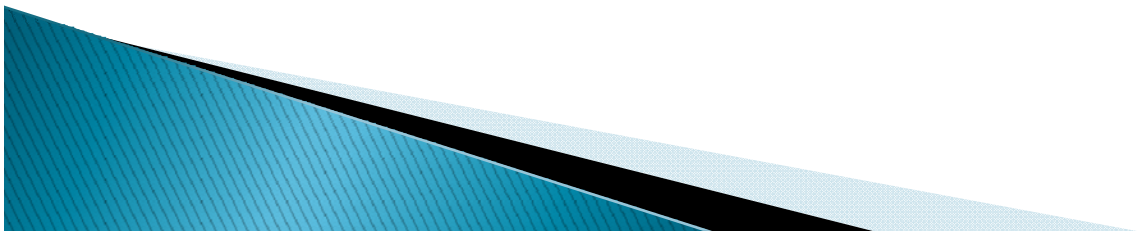
My thanks to Dr. Linda Hoang



Outline

- Background
- CPO in Canada
- Provincial Picture
- Infection Prevention and Control Measures



What are Carbapenemase Producing Organisms (CPO)?

- Carbapenemases are a class of enzymes that inactivate carbapenem antibiotics by hydrolysing them.
- Carbapenem antibiotics, often referred to as "last resort antibiotics":
  - Imipenem
  - Meropenem
  - Ertapenem
- Carbapenemases most commonly in *E. coli* and *Klebsiella spp.*, (Enterobacterieaceae) but have also been found in other Gram-negative species.

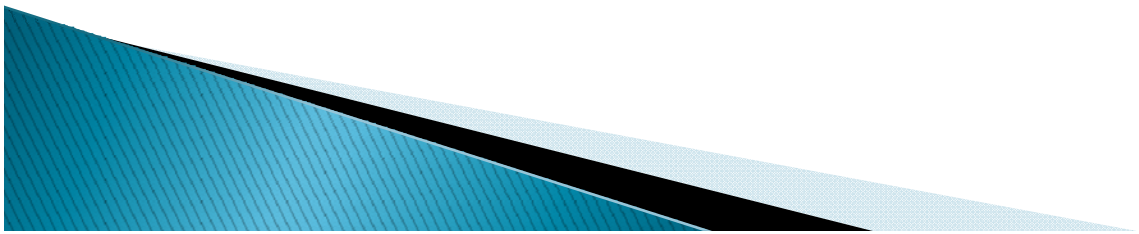
Beta-lactamase Family

Molecular Class	Types
A	TEM, SHV, CTX-M KPC, GES, SMC, IMI, PER, NMC-A, SFO, SFC, BIC, IBC
B	NDM-1, IMP, VIM, GIM, SPM, SIM, DIM, AIM, KHM
C	CMY, ACT, FOX, MOX
D	OXA, PSE OXA-48

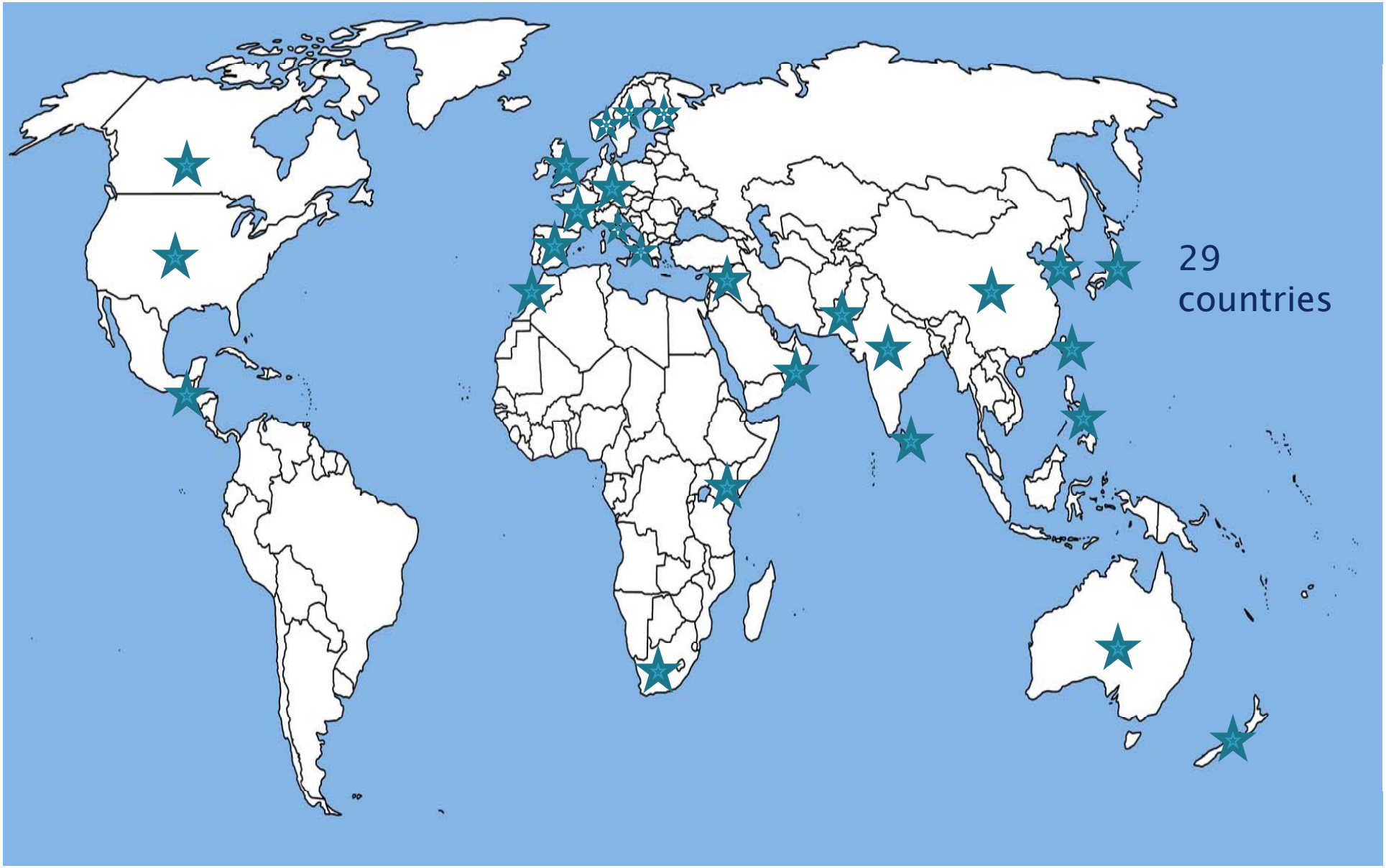
New Delhi Metallo-beta-lactamase (NDM-1)

- Reports in 2008 of Swedish and UK travelers to Indian subcontinent
- Since then, reports of high endemicity in Indian, Pakistan and Bangladesh hospitals
- NDM-1 genes in sewage and water reservoirs in some Indian cities
  - 51/171 (30%) waste water seepage
  - 2/50 (4%) communal drinking water samples

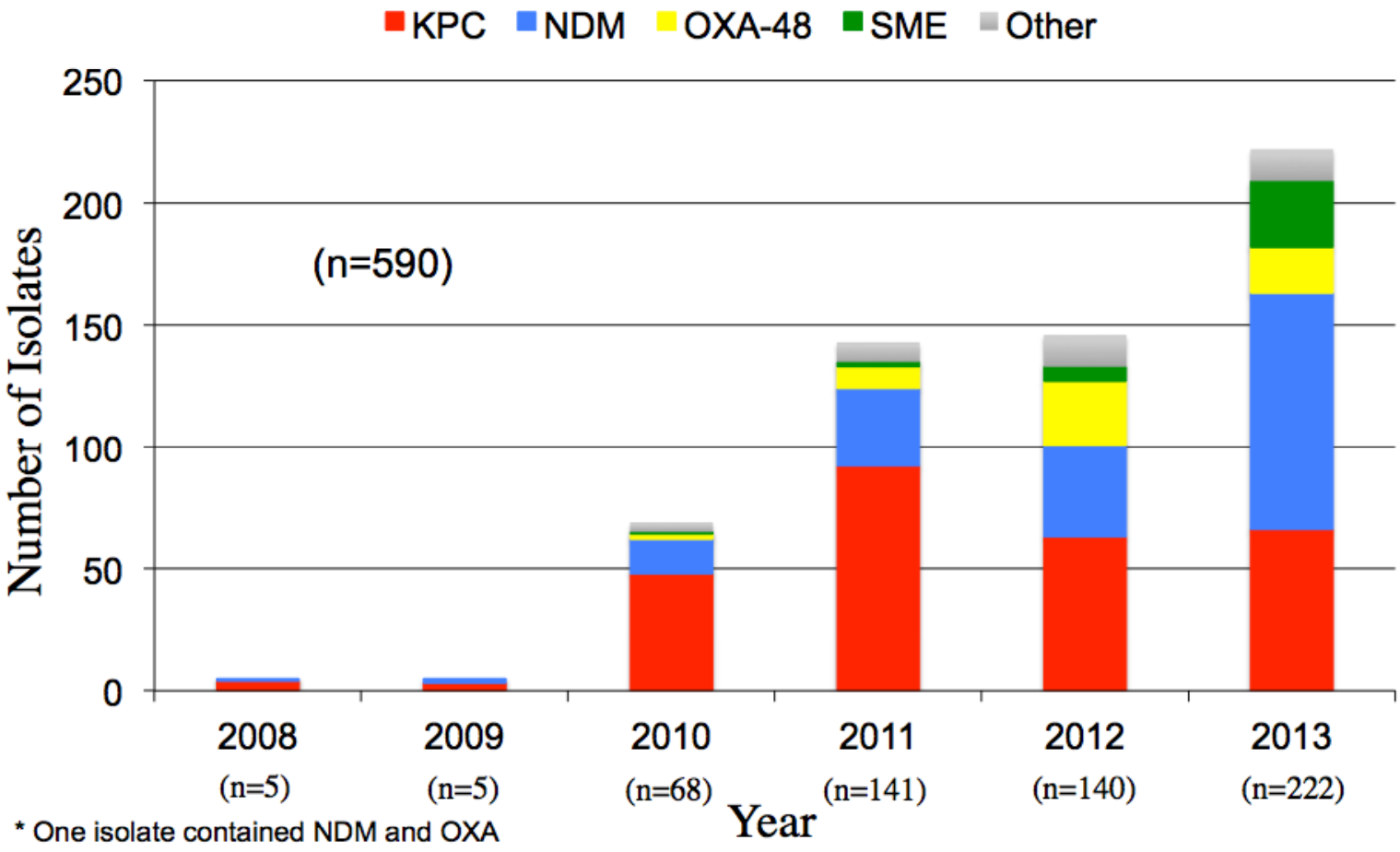
Walsh et al. The Lancet Infectious Diseases, 2011, 11: 355-62



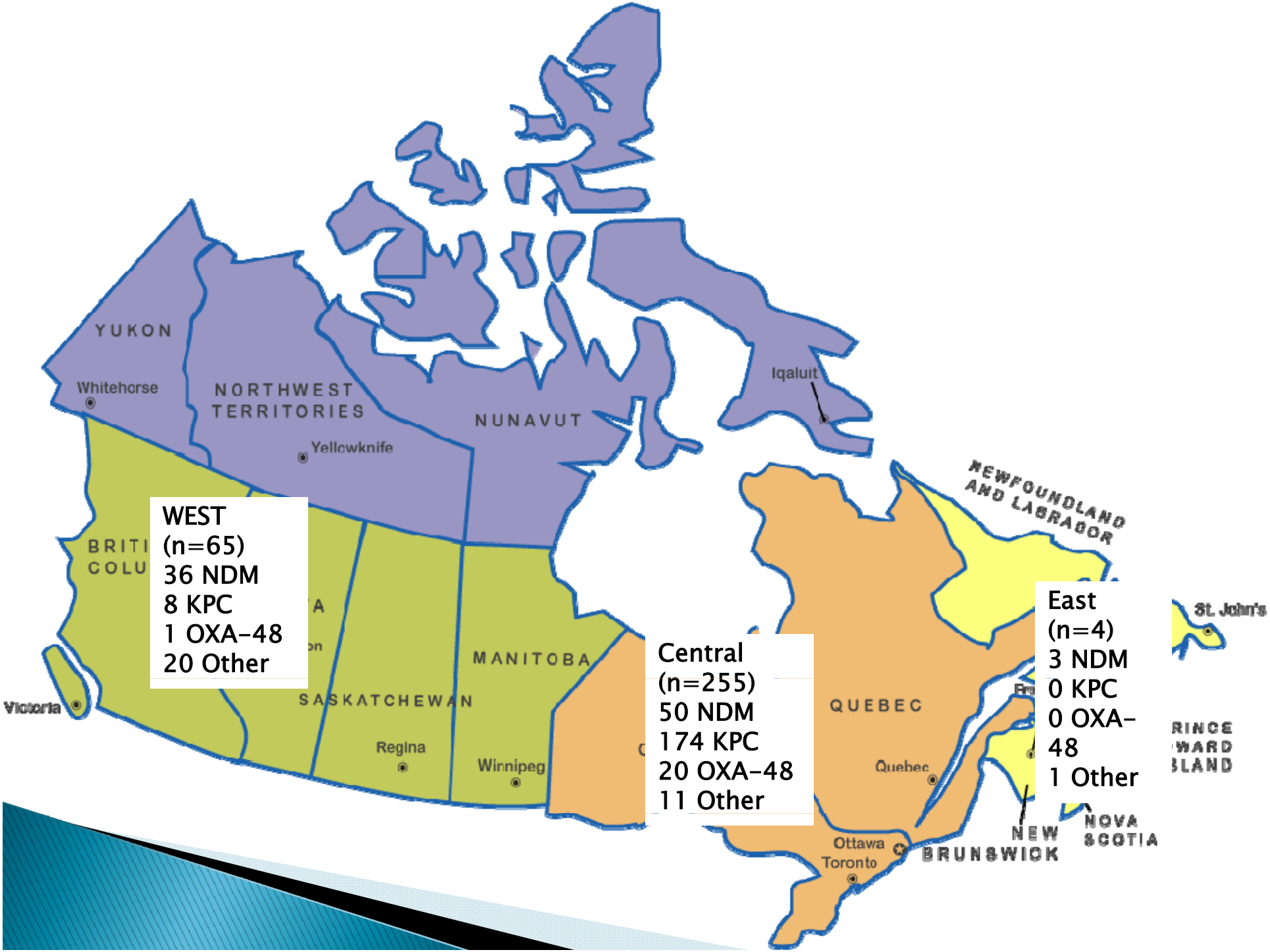
Global Distribution NDM-1



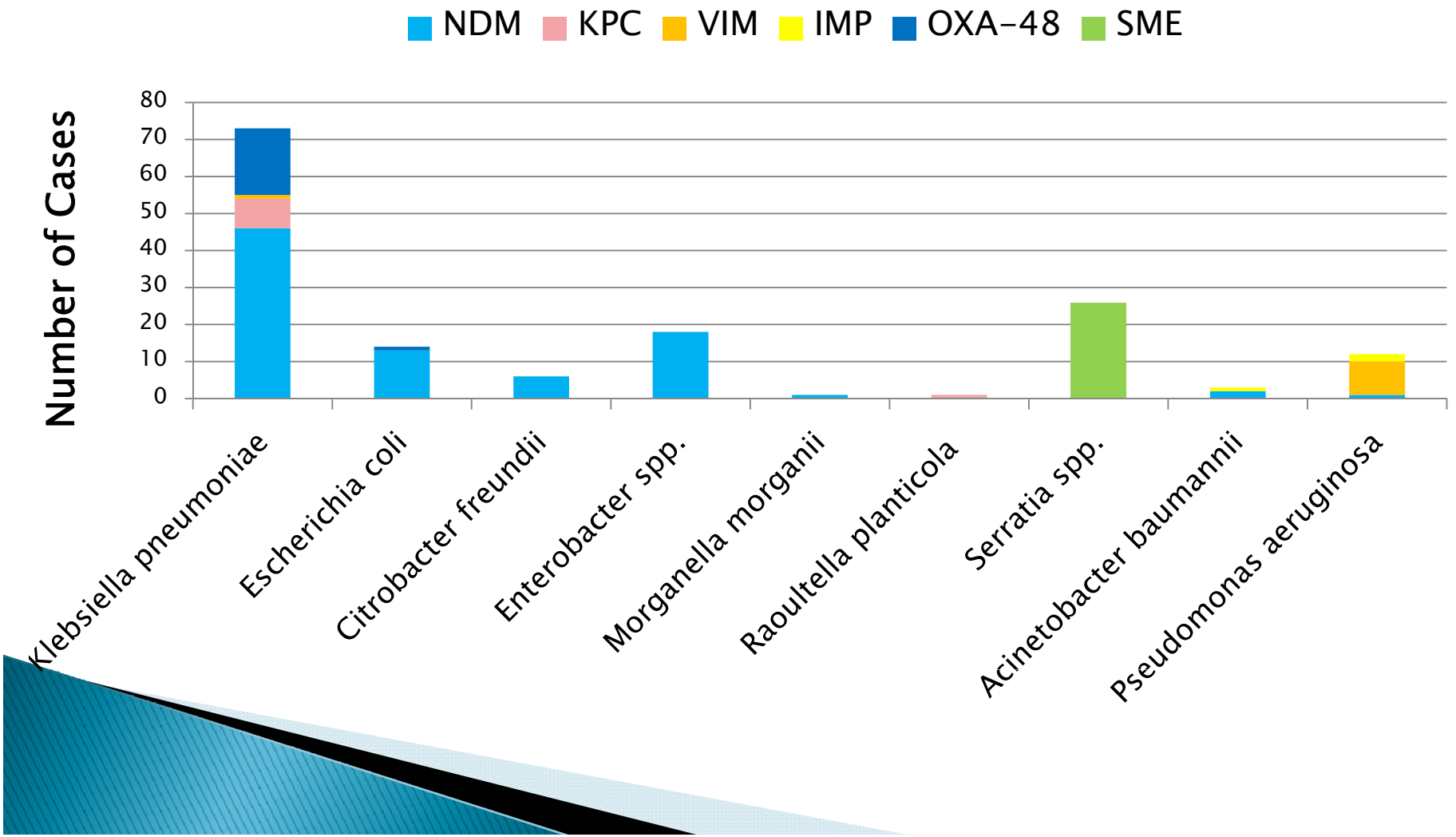
Carbapenem Producing Organisms in Canada



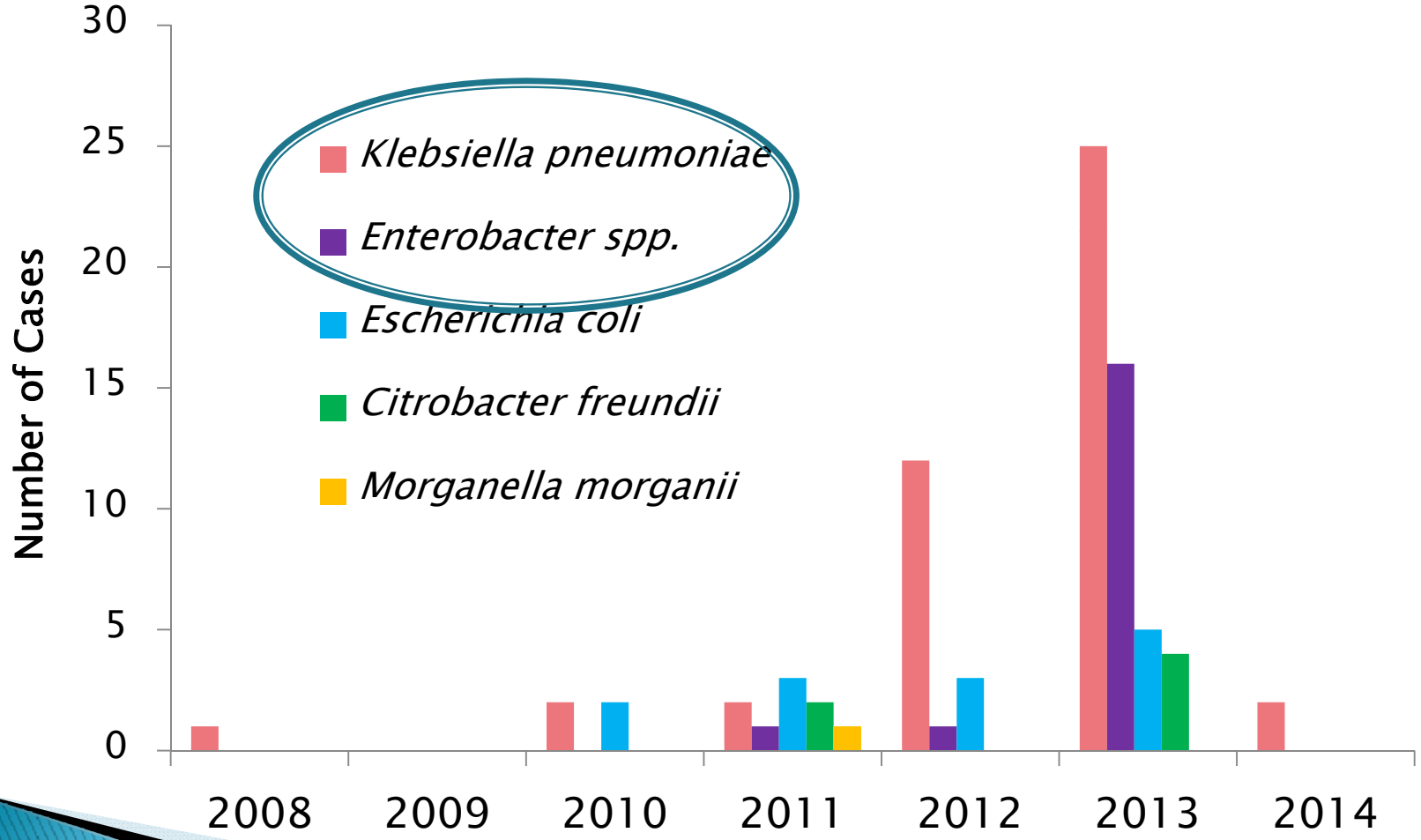
* One isolate contained NDM and OXA


YUKON
Whitehorse
NORTHWEST TERRITORIES
Yellowknife
NUNAVUT
Iqaluit
NEWFOUNDLAND AND LABRADOR
St. John's
BRITI COLU
MANITOBA
SASKATCHEWAN
Regina
Winnipeg
Victoria
QUEBEC
Quebec
Ottawa
Toronto
NEW BRUNSWICK
NOVA SCOTIA
RINCE WARD SLAND
WEST
(n=65)
36 NDM
8 KPC
1 OXA-48
20 Other
Central
(n=255)
50 NDM
174 KPC
20 OXA-48
11 Other
East
(n=4)
3 NDM
0 KPC
0 OXA-48
1 Other

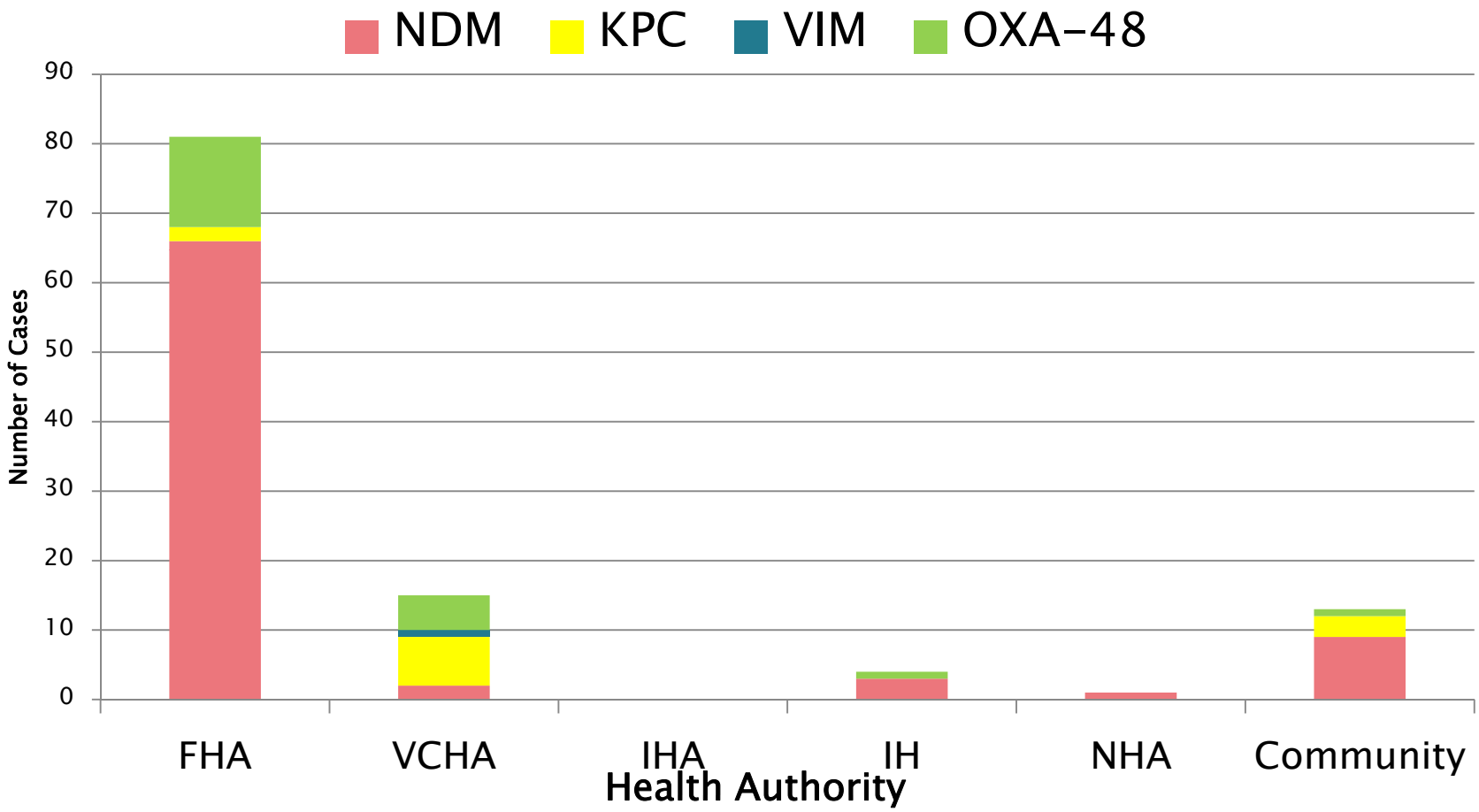
Carbapenemase Producing Organisms by Species, 2008-Current*



Enterobacteriaceae with NDM

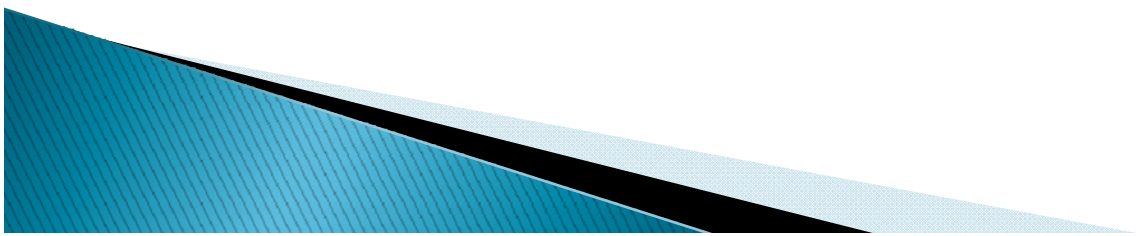


CPE by Health Authority (BC)



How are these organisms transmitted?

1. Patient-to-patient
2. Shared Health Care equipment
3. Environmental Contact (environmental reservoirs)
4. Health care workers (Primarily hands)



Risk factors for Colonization and Infection with CPE

- *Risk factors for acquisition of CPE*
  - prolonged hospitalization
  - Poor functional status
  - ICU stay
  - invasive devices
  - Immunosuppresion
  - multiple antibiotic agents
- Risk factors for infection once colonized with CPE
  - Previous invasive procedure
  - Diabetes mellitus
  - Solid organ tumor
  - Tracheostomy
  - Urinary catheter
  - Prior exposure to antipseudomonal penicillin

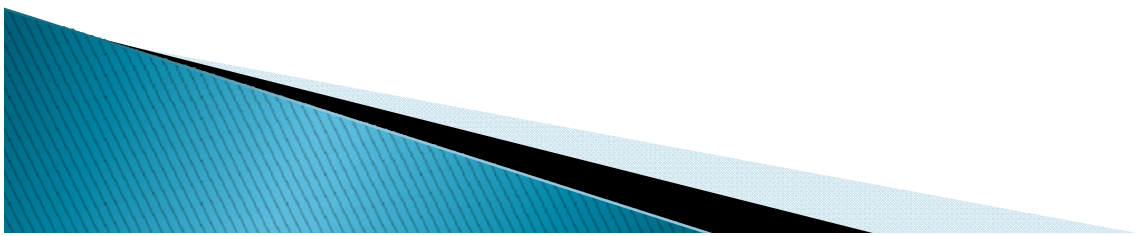
If colonized with CPE, 9-47% of patients may develop infection

CPE Measures Implemented

- Screening/Active surveillance
  - On admission to Unit
  - Weekly point prevalence
  - All contacts of suspect or confirmed cases, at 0, 7 and 21 days
- Precautions
  - Private room and staff cohorting and dedicated equipment
- Cohorting of patients and staff
  - “CPE” nursing assignments & dedicated ward
  - Hand hygiene & PPE (goal: 100%)
  - Weekly audits
- Antimicrobial stewardship

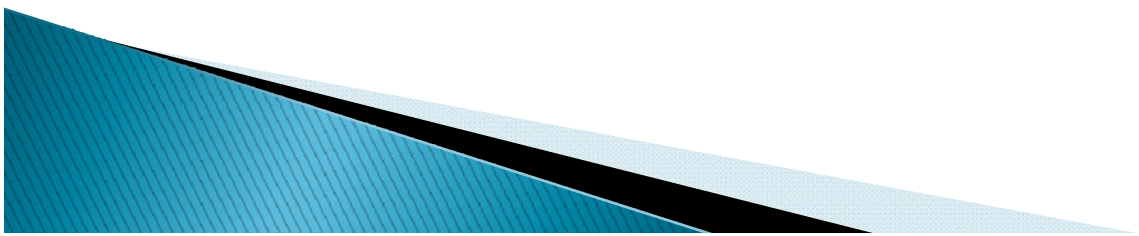
CPE Measures Implemented

- Avoid discarding any bodily fluids in sinks
- Cleaning
  - Enhanced cleaning including daily 2nd clean of high touch surfaces in affected rooms/units
  - Use hydrogen peroxide
  - Terminal clean on discharge of colonized patients:
    - Discard all supplies, terminal clean, audit of clean
- Daily CHG baths for all colonized patients.



Infection Control Processes

- Screening for all admitted patients
  - Question: “Have you been hospitalized or had renal dialysis outside of Canada anytime in the previous 6 months?”
  - If yes: patient will have rectal screen for CPE



Next Steps and Challenges

- Better and faster testing
  - Develop Real-time PCR method for screening specimens directly
- Maintain aggressive infection control state & CPE alerts between facilities
- Continued Provincial level surveillance with infection control data
  - Collaboration with PICNet
- Further explore genomic characteristics of BC strains and transmission behaviour
  - Whole Genome Sequencing

Summary

- CPE are an emerging pathogen with global spread, now in Canada
- CPE can spread within institutions
- The most vulnerable patients are the most at risk to become colonized and infected
- Treatment of infections is complex
- Control of spread requires full compliance with precautions and antibiotic stewardship