Epidemiology of Carbapenemase-Producing Enterobacterales (CPE) in Long-Term Care Homes in South-Central Ontario

Population-Based Surveillance in Toronto and Peel Region, 2007–2023

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Background & Rationale

- In endemic settings, long-term care homes (LTCHs) and long-term acute care hospitals can function as reservoirs of CPE
- LTC patients may introduce CPE into acute care hospitals, contribute to transmission, and re-introduce it to LTCHs
- Experience across jurisdictions is inconsistent – some show aggressive control reduces prevalence; others report low LTC transmission
- In Canada, including Ontario, the epidemiology of CPE in long-term care had not been systematically examined

Aim: To examine CPE acquisition, transmission, and burden in LTC homes using detailed epidemiologic data combined with whole genome sequencing.

Study Setting

Toronto Invasive Bacterial Diseases Network (TIBDN) Population-Based Surveillance, Toronto & Peel Region

4.7M
Residents

28
Acute Care Hospitals

120
Long-Term Care Homes

19,000+
LTC Beds

Surveillance Period: October 2007 – June 2023

Captured CPE from all hospital microbiology labs and major community labs + epidemiological data (e.g., patient movements between acute care, long-term care)

Overall Results

1,576

Total CPE Cases

October 2007 – June 2023

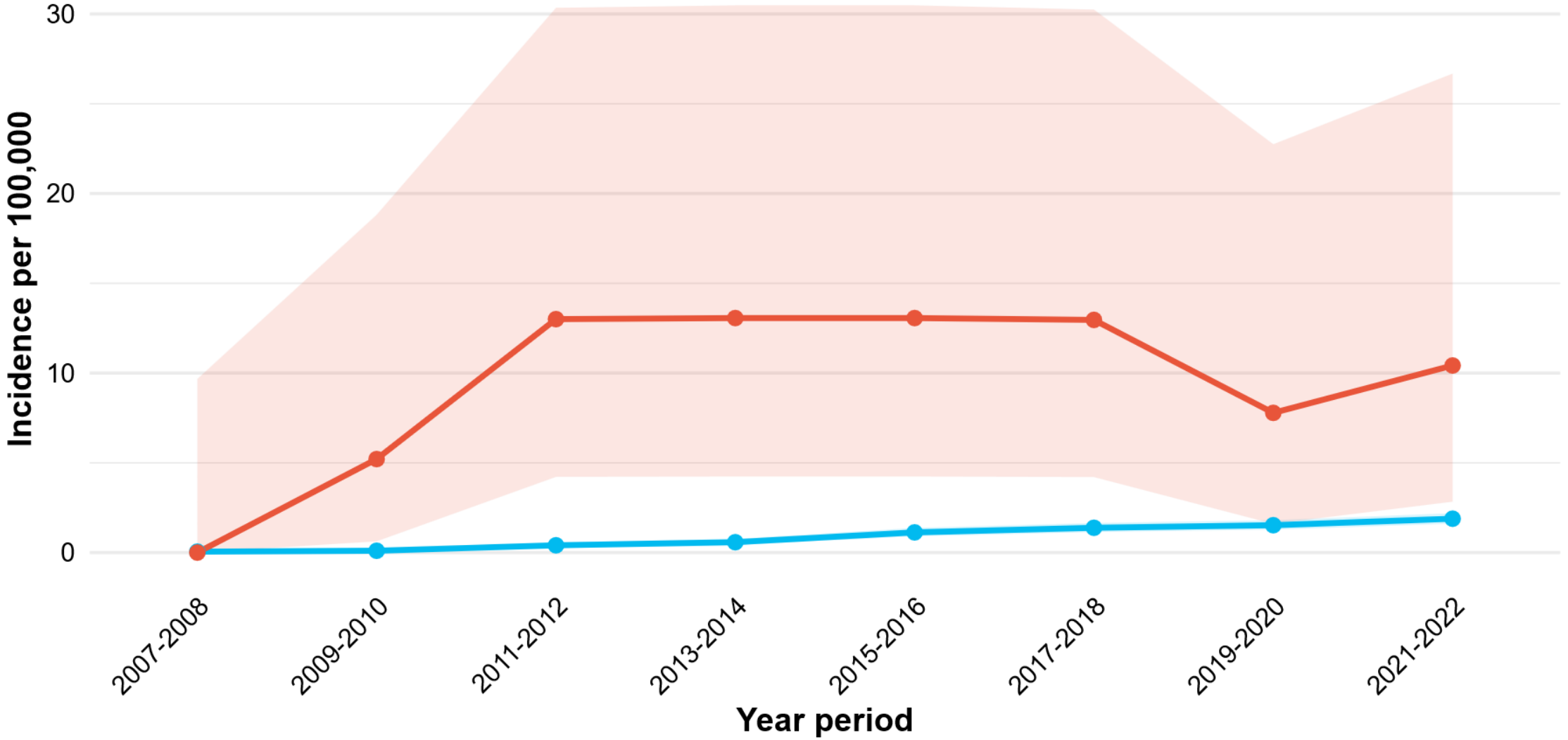
55

LTC-Associated Cases

3.5% of total

Key Finding: Incidence among LTC residents increased from 0 to **10 per 100,000 beds/year** and remained substantially higher than in community-dwelling individuals, even when restricted to older adults.

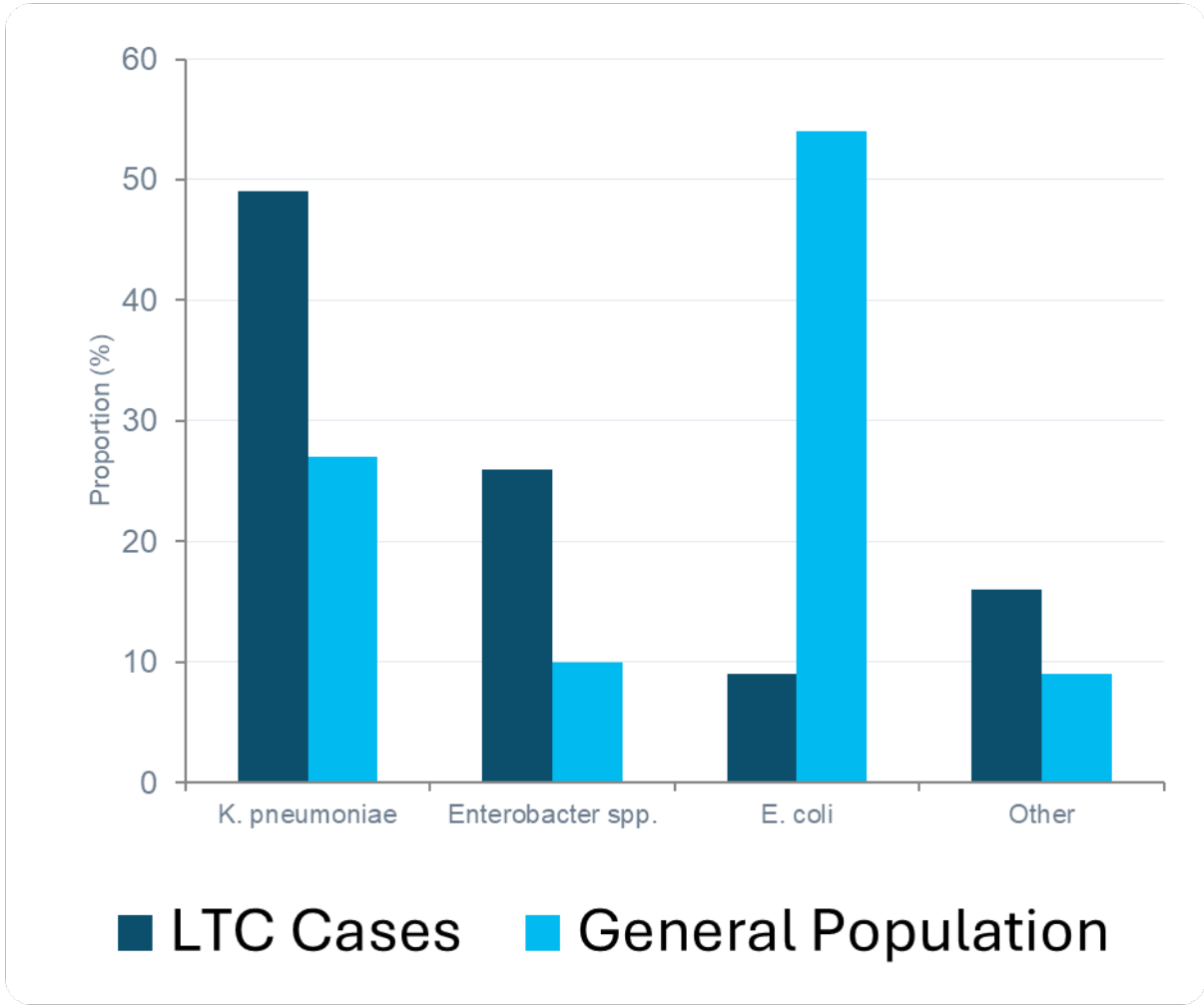
Incidence Trends Over Time



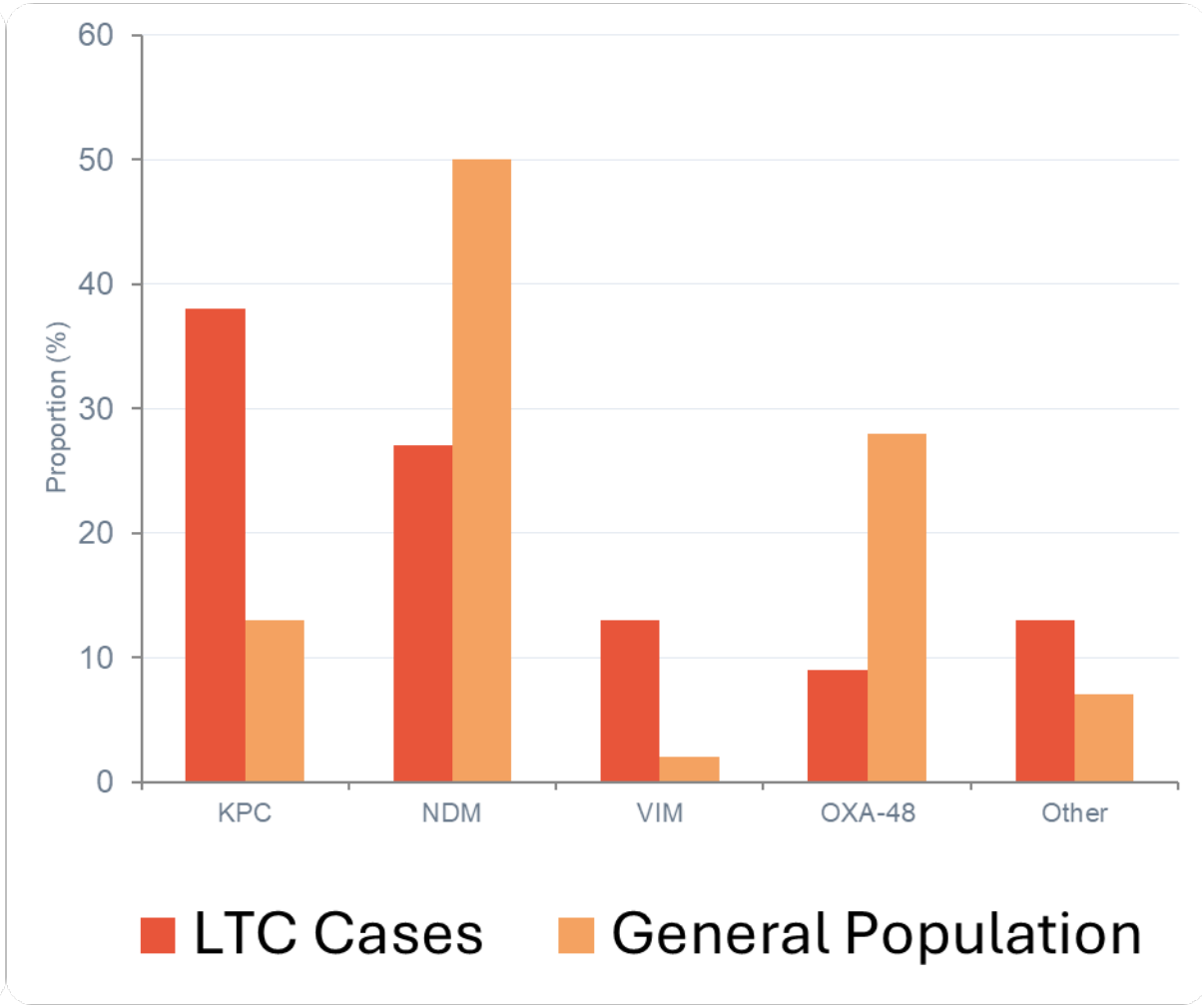
Community cases: ~20% mean annual increase | **LTC cases:** Smaller increase, not statistically sig.

Microbiologic Profiles: LTC vs. General Population

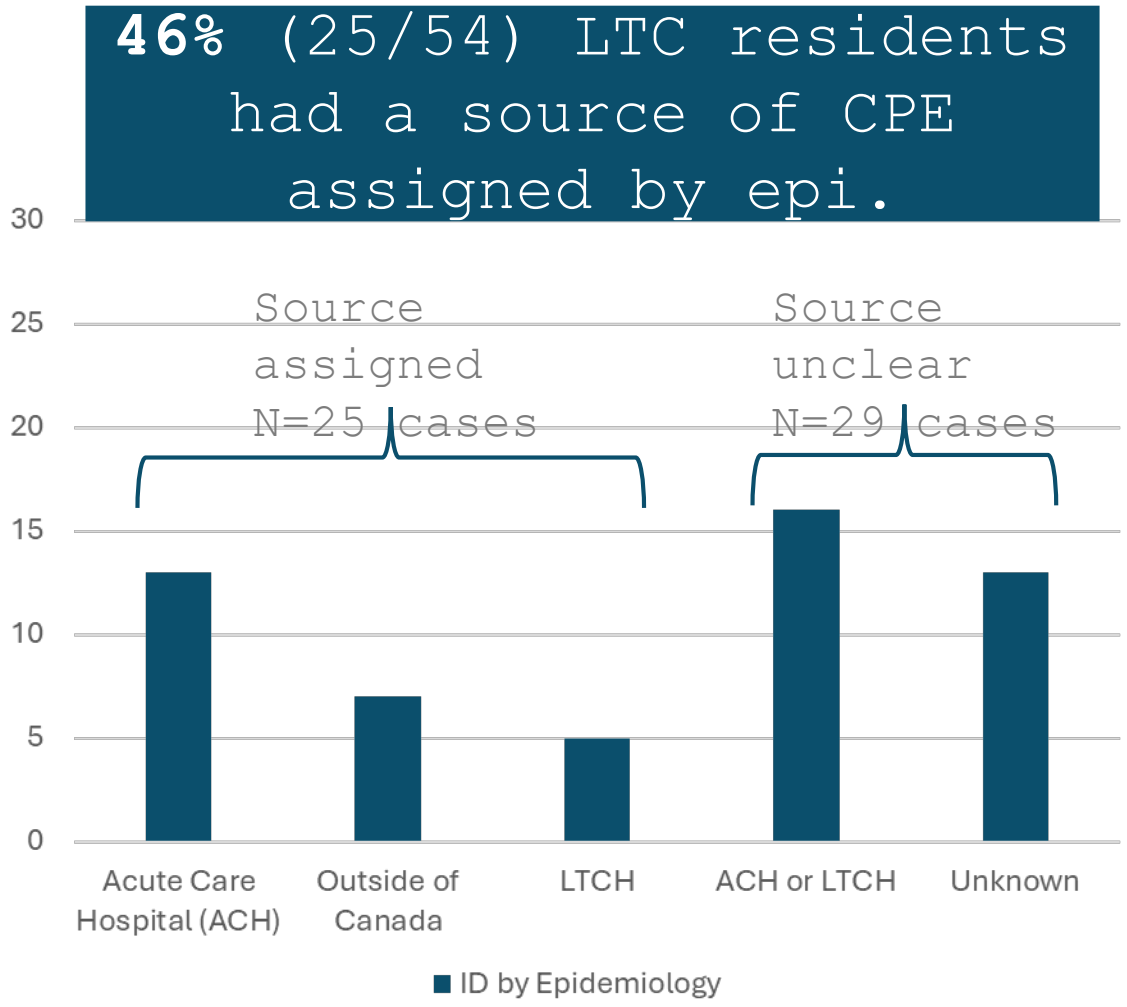
Organism Distribution



Carbapenemase Distribution



Where are LTC Residents Acquiring CPE?



Most identifiable acquisitions traced to Canadian acute care hospitals

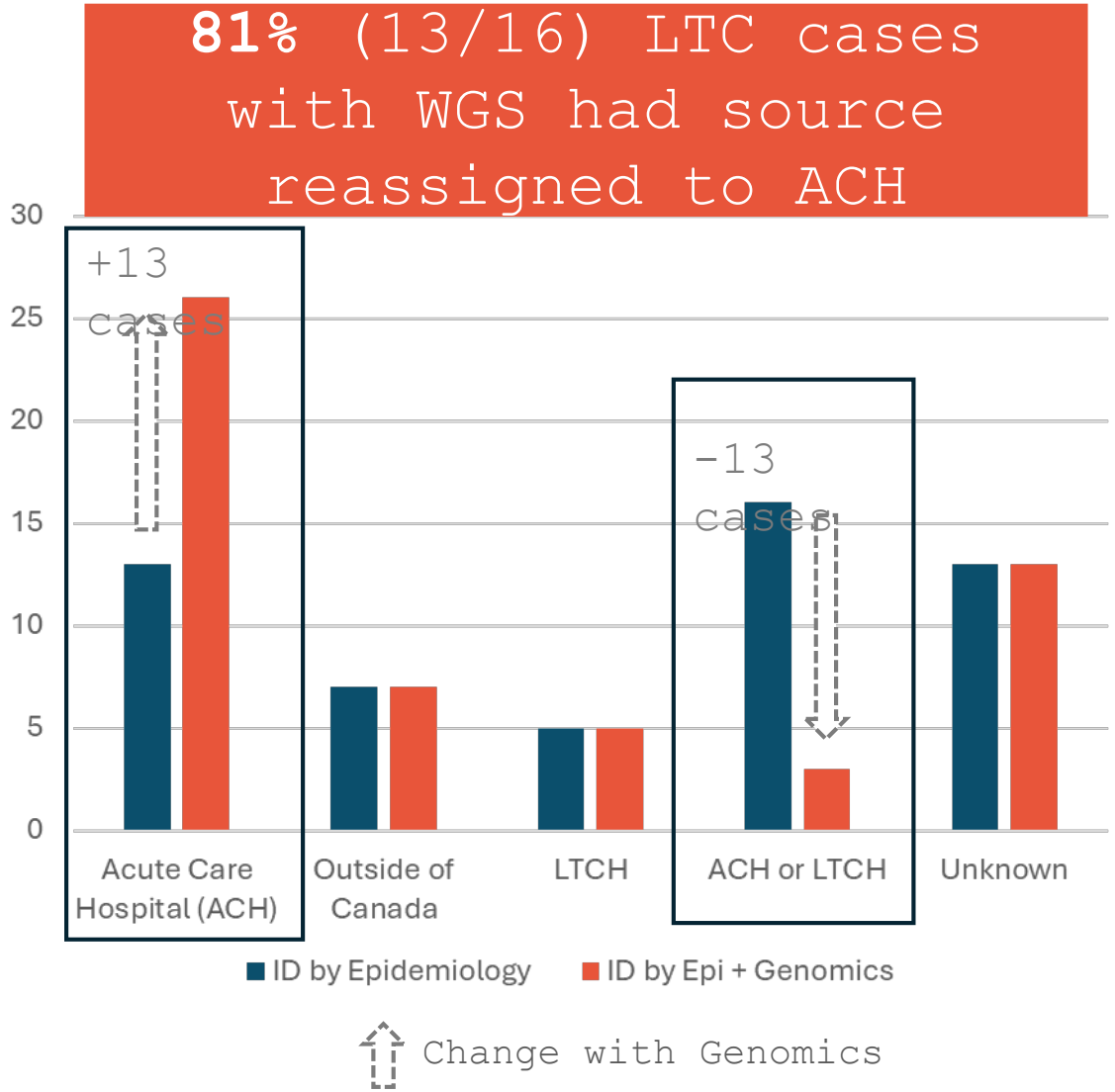
Source of CPE determined by looking at:

- Timing of CPE: e.g., *before* vs. *after* entering LTC
- Exposures: e.g., hospitalization outside Canada

Only 2 instances of resident-to-resident transmission over 16 years

- IMP-producing *P. mirabilis*
- KPC-producing *K. pneumoniae*

Addition of Whole-Genome Sequencing



WGS of **16 LTC cases** in "ACH or LTCH" category + **related acute care cases**

Related acute care cases defined as:

- Same carbapenemase
- Same hospital
- Within 1 year prior to LTC case

Whole-genome sequencing (WGS) examined **clonal relatedness** and **plasmid transmission**

Addition of Whole-Genome Sequencing

Resolving 16 LTC Cases with **LTCH or ACH** Acquisition Sources

56% (9/16) **Clonally related** to acute care cases in hospitals where LTC resident was admitted

25% (4/16) Linked through **highly related plasmids** to acute care cases

63% (10/16) LTC residents linked to acute care cases via shared time in room or unit

WGS strengthened the conclusion:

Canadian acute care hospitals are the dominant acquisition site for CPE in LTC residents

LTC Homes as Sites of Exposure

~90%

of LTC residents

exposed their LTC home

while colonized or infected

Reservoirs, Not Transmitters

LTC homes become exposed because residents arrive already colonized after acute care hospitalization, not because of within-facility transmission.

Screening Gap

Many residents discharged to LTC weeks after last positive culture, often without repeat screening.

Policy Implication

Routine screening of LTC residents at hospital admission or discharge has not been standard practice in Ontario.

Discussion & Implications

Burden in LTC

- LTC residents represent a small fraction of CPE cases, but **incidence is consistently higher than in the general population**, confirming LTC residence as a risk factor.

Acquisition Site

- Most acquisition occurs in **acute care hospitals**, not in LTC homes.
- Effective interventions to reduce CPE burden in LTC will likely occur upstream in acute care.

Control Strategy

- Admission screening of high-risk populations is critical.
- Economic analyses suggest screening becomes **cost-effective** at prevalence thresholds likely already crossed in Ontario.

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WGS + population-based surveillance = robust framework for understanding transmission in complex healthcare networks

Conclusions

- As CPE emerged in South Central Ontario, both acute care hospitals and long-term care homes were affected
- Acute care hospitals were the primary site of CPE acquisition for LTC residents
- Long-term care homes were predominantly sites of exposure, not sustained transmission
- Resident-to-resident transmission within LTC was rare (2 instances in 16 years)
- Targeted genomic analysis integrated with population-based surveillance provides a robust framework for understanding AMR spread in complex healthcare networks

Thank You

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