



FAIRFAX COUNTY HEALTH DEPARTMENT

Surprised by Science:

The Role of Whole Genome Sequencing in
Multi-Drug Resistant Organism Outbreak Management

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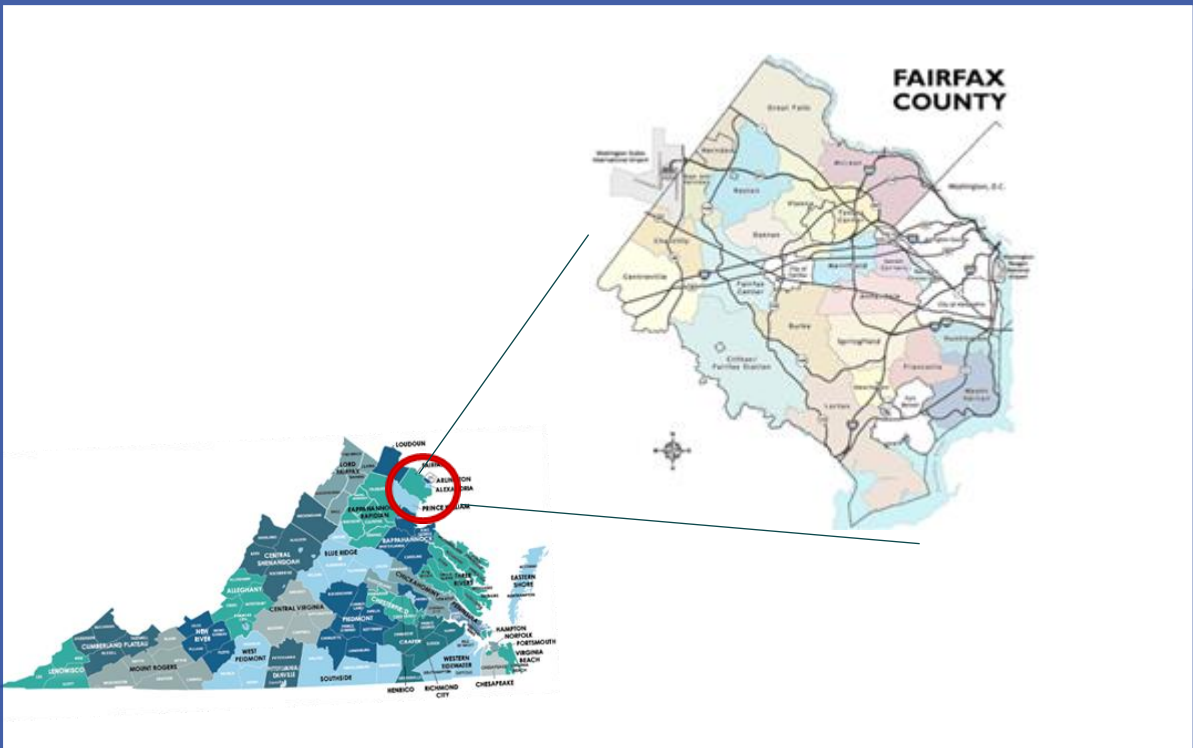


Objectives

- Review the local health department's response to multiple cases of multi-drug resistant organisms (MDROs) in high-risk facilities;
- Highlight the value of ongoing collaboration with facility leadership and the infection prevention and control team;
- Discuss the role of whole genome sequencing in MDRO investigations.

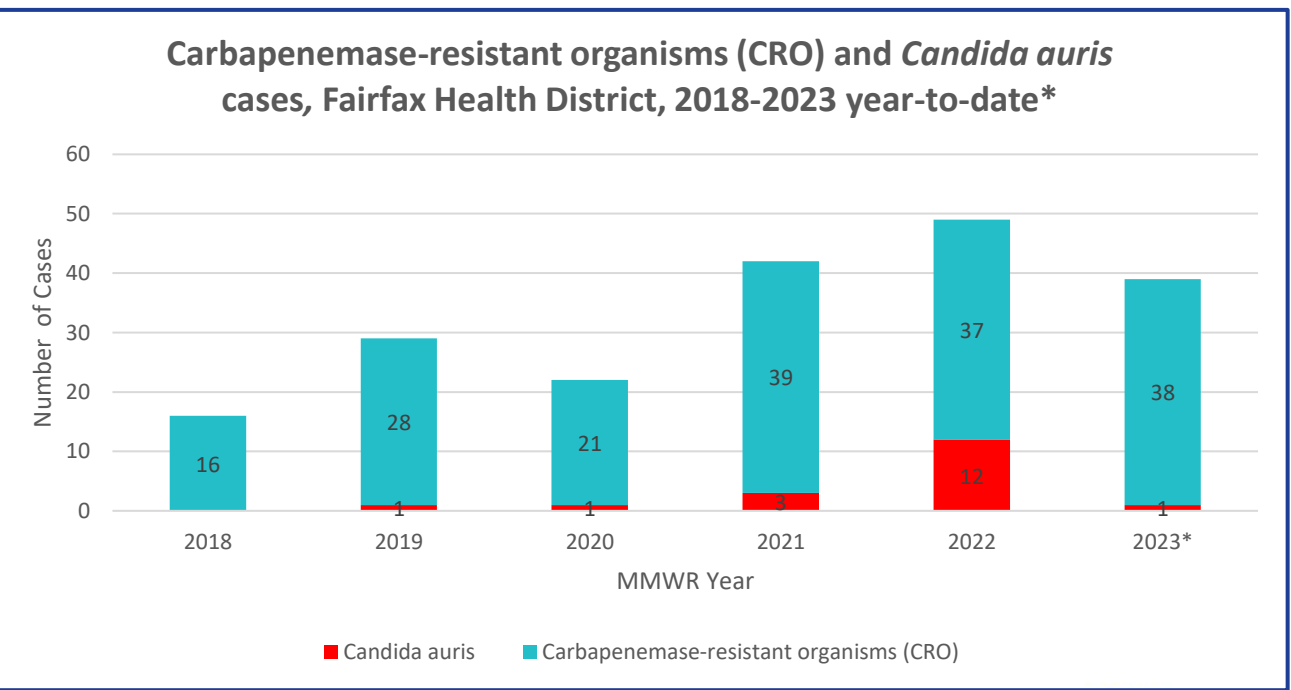


Fairfax Health District and MDROs



Population	1.2 million
Acute Care Hospitals (ACH)	5
Long-term Acute Care Hospital (LTACH)	1
Skilled Nursing Facilities (SNFs)	15

Fairfax County Health Department (FCHD) has documented over a 50% increase in multi-drug resistant organisms (MDROs) since 2018 when these pathogens first became reportable in Virginia

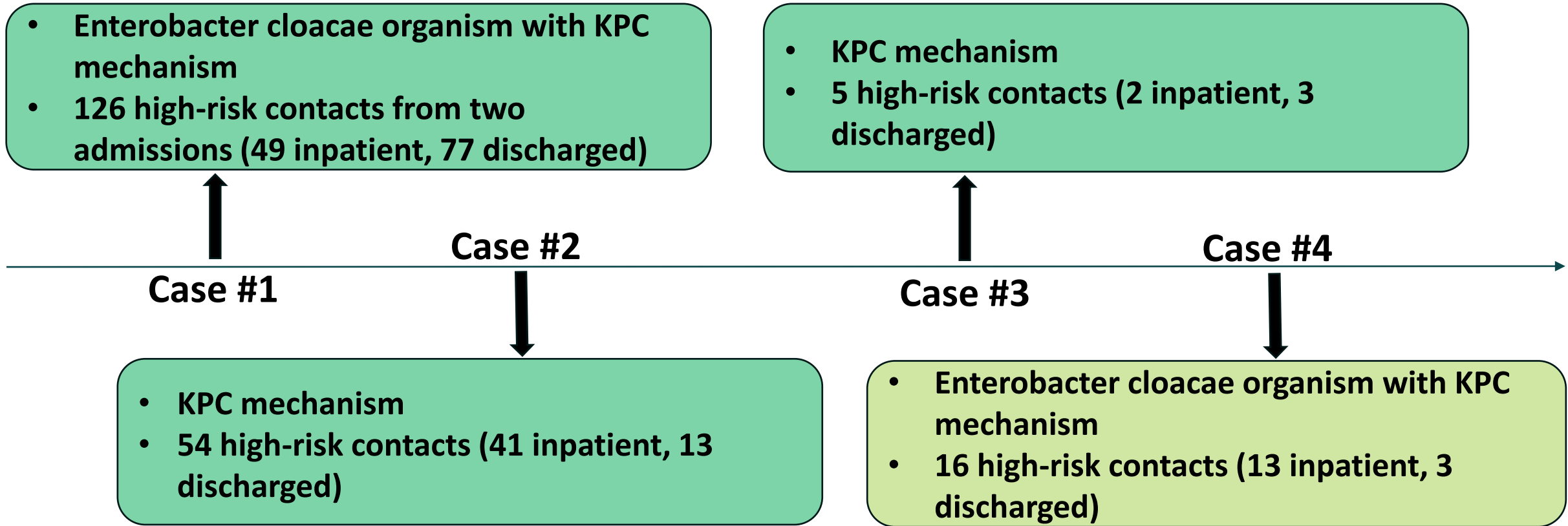


*2023 data as of October 3, 2023

Data Source: Virginia Electronic Disease Surveillance System (VEDSS)



Outbreak A: Acute Care Hospital



Case Medical Record Review

High acuity patients

Lengthy hospital admissions

Multiple healthcare visits in months prior

Multiple invasive procedures

Multiple indwelling medical devices



Investigation facilitated through close collaboration

- **Acute Care Hospital Infection Prevention Team**
 - Timely notification and quick action by IP staff
 - Sharing of contact list
 - Discussions with hospital IP staff
 - Recommendations provided and actions taken
- **Fairfax Health District Skilled Nursing Facilities**
 - Colonization screening of residents
- **State HAI AR Program**
 - Consultation and guidance on next steps
 - Notification of contacts transferred outside of Fairfax Health District
- **Neighboring Local Health Districts**
 - Notification and coordination with high-risk facilities
- **Public Health Laboratory Partners**
 - Coordinating forwarding of specimens and consultation on results



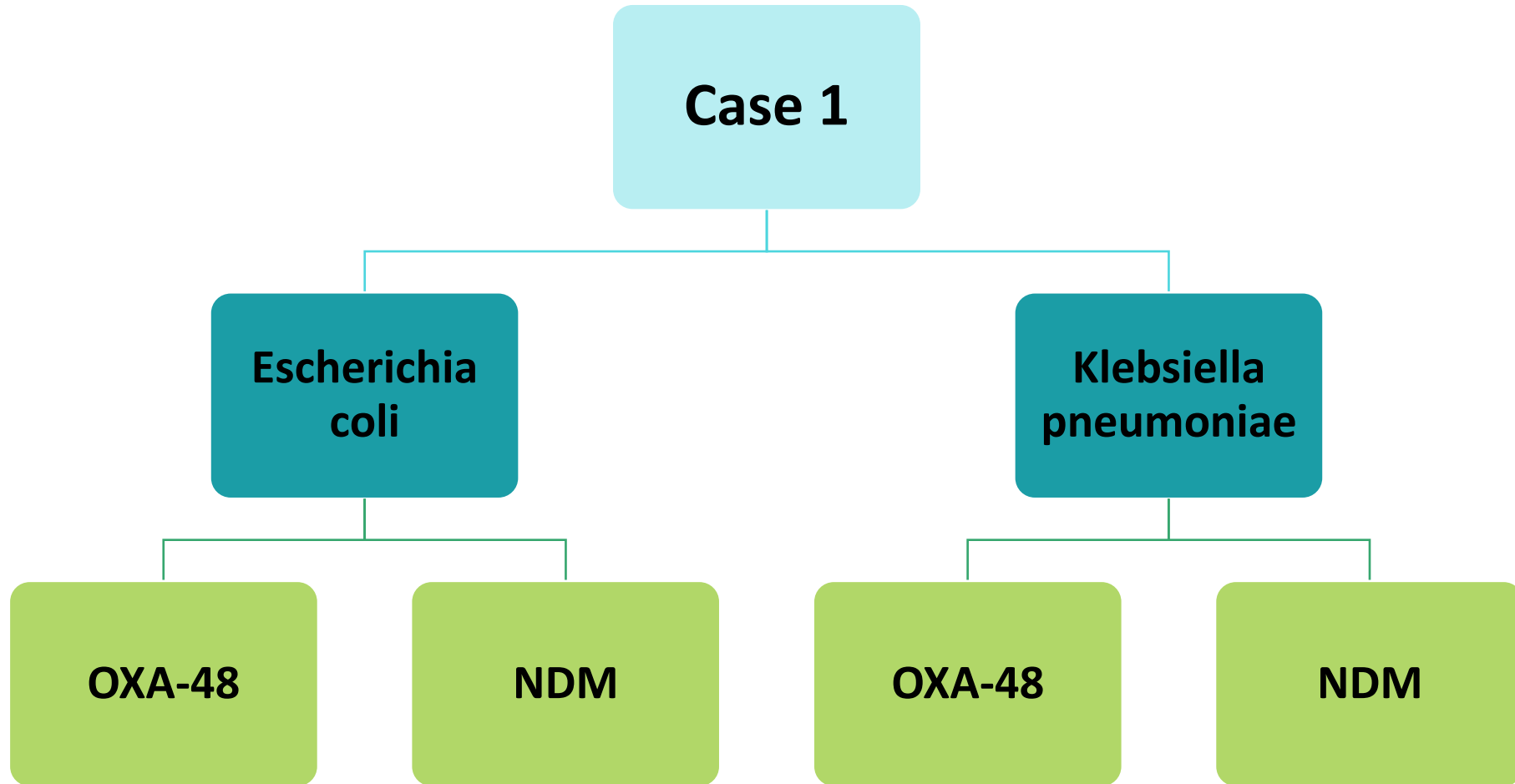
Whole Genome Sequencing Results

Dryad SNP	CASE 1	CASE 4
CASE 1		22
CASE 4	22	

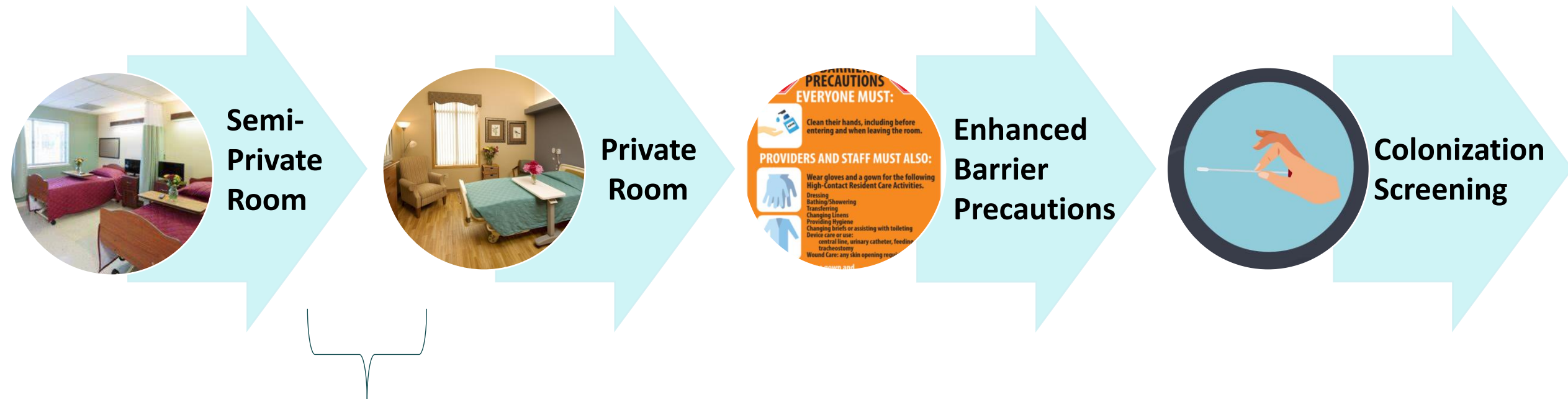
- DCLS whole genome sequencing was completed on two samples.
 - Case 2 and 3 did not have isolates available for sequencing.
- DCLS Dryad testing results found the isolates to be 22 SNPs apart. Typically, ≤ 10 SNP differences suggest genetic relatedness.
- However, SNP differences greater than 10 can still be significant if isolates are further apart in time or there is an epidemiological link.



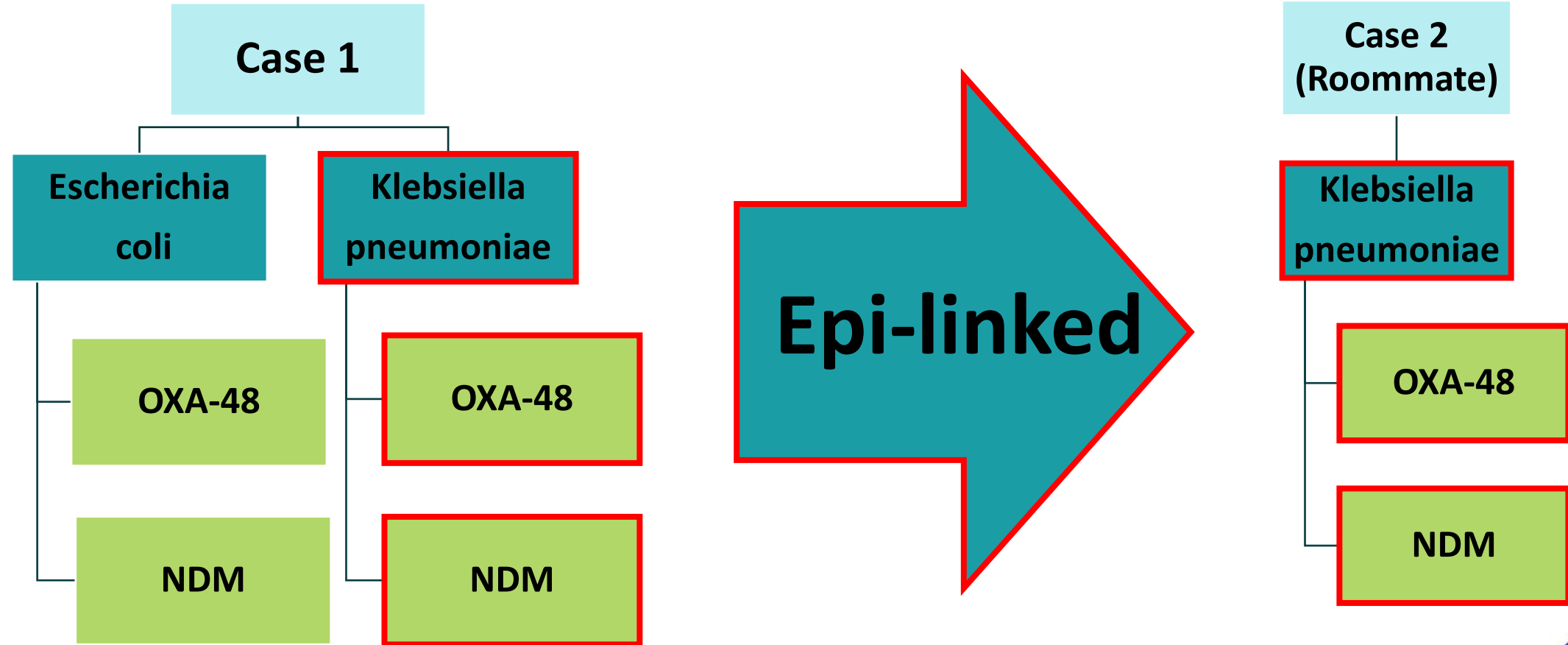
Outbreak B: Skilled Nursing Facility



Skilled Nursing Facility Action Steps



Roommate's Test Results



SNF Reactive ICAR Recommendations

PPS

- Point Prevalence Survey of unit: 17 residents consented to colonization screening and 6 residents declined screening
- 3rd resident was identified with NDM mechanism

Nursing Staff

- Nursing staff education on hand hygiene and proper PPE donning & doffing
- Staff training on Enhanced Barrier Precautions vs. Contact Precautions

EVS Staff

- VDH Regional IP performed ATP testing of high touch surface areas
- Daily and terminal cleaning and disinfection procedures to EVS staff



Whole Genome Sequencing Results

Dryad SNP	CASE 1	CASE 2	CASE 3
CASE 1		2	25738
CASE 2	2		25900
CASE 3	25738	25900	

- DCLS performed Single Nucleotide Polymorphism (SNP) comparison analysis
- Typically, ≤ 10 SNP differences suggest genetic relatedness



Antimicrobial Resistance Gene Summary

Case	Specimen Source	Species ID	Resistance Genes
Index Case	Peritoneal Fluid	Klebsiella pneumoniae	OXA-181 (OXA-48-like), NDM-5
Roommate	Urine	Klebsiella pneumoniae	OXA-181 (OXA-48-like), NDM-5
Resident in Same Unit	Colonization Rectal Swab	Klebsiella pneumoniae	NDM-7

Resistance gene testing showed differences in NDM alleles between the two roommates and the colonized resident on the same unit.



Conclusion

- Infection Prevention and Control guidance was promptly provided based on information known at the time.
- Whole Genome Sequencing results were available after the outbreak investigations concluded and shed new light on both outbreaks.
 - The Acute Care Hospital results were too variable to confirm relatedness.
 - The Skilled Nursing Facility results decreased the outbreak from 3 to 2 cases.
- Are these results surprising?



Acknowledgements

- Acute Care Hospital (A) Infection Prevention Team
- Division of Consolidated Laboratory Services (DCLS)
- Fairfax County Health Department
 - Division of Epidemiology and Population Health
 - Public Health Laboratory
- Maryland Antibiotic Resistance Laboratory Network (MD ARLN)
- Skilled Nursing Facility (B) Administration, Director of Nursing, Infection Preventionist, Unit Charge Nurses, Regional Infection Prevention Team
- Virginia Department of Health
 - Healthcare Associated Infections and Antibiotic Resistance (HAI AR) Program
 - Northern Virginia Regional Team





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Questions?

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