ISOLATION AND CHARACTERIZATION OF ENTEROINVASIVE ESCHERICHIA COLI (EIEC) FROM CIDT POSITIVE SPECIMENS

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INTRODUCTION

Enteroinvasive Escherichia coli (EIEC) are a class of pathogenic E. *coli* known to cause diarrheal illness similar to bacillary dysentery¹. EIEC is indistinguishable from other *E. colis* biochemically and genetically comparable to Shigella¹.

• Current understanding of EIEC is rather limited.

At the Minnesota Department of Health Public Health Laboratory (MDH-PHL), 51% of *Shigella*/EIEC suspected specimens submitted from clinical laboratories are culture confirmed as Shigella sp.

This retrospective study investigated if EIEC could be isolated from specimens that were positive for *Shigella*/EIEC by culture independent diagnostic testing (CIDT) but Shigella culture negative.

METHODOLOGY

Shigella/EIEC positive stools tested by CIDT were submitted by clinical labs from January 2018 - December 2019. Mixed enteric glycerol specimens (that were Shigella culture negative) were cultured on MacConkey (MAC).

This study used a SYBR Green Real-Time PCR assay on sweeps & isolates to test for *ipaH*.

- *ipaH* is a plasmid gene located on the Invasion plasmid (pINV) in only Shigella and EIEC²
- Molecular CIDTs use *ipaH* as a detection marker

ipaH positive isolates were confirmed as E. coli through biochemical testing and sent to Whole Genome Sequencing (WGS) analyzed by BioNumerics 7.6



RESULTS

279 specimen sweeps that were Shigella culture negative were screened by PCR

Eighty-one (29%) sweeps tested positive for *ipaH*. Twenty nine isolates (36%) were recovered as EIEC

- No additional *Shigella* isolates were found
- Low EIEC isolate recovery rates were observed

• Sweep $C_{(t)}$ values were convincing for *ipaH* but no EIEC isolates were recovered. Experimented with media to retain pINV and *ipaH*



sigA

icsA

Seasonality 2018-2019

EIEC Shigella

EIEC appears to follow the same pattern as *Shigella* in that there is no seasonality associated with infections and mirrors Shigella's peak months

LAB RESULTS





Biochemical			
Reactions 🗾	Shigella 🗾	EIEC 🗾	Total n 💌
TSI	K/A	A/A g	16
Motility	Non-motile	Variable (73%)	22
Lactose	Negative	Positive (93%)	14
Sorbitol	Variable	Positive (91%)	22
Indole	Variable	Variable (73%)	22
Glucose	Negative	Positive (100%)	21
Cellibiose	Negative	Negative (4.8%)	21
Lysine	Neative	Variable (73%)	22
		Mostly Positive	
Acetate	Negative	86%	22

* Shigella sp. tend to be more biochemically inert than EIEC

CONCLUSIONS

Twenty-nine EIEC positive specimens twenty-five cases were recovered during this study suggesting that EIEC is more common than previously recognized.

EIEC appears to be sensitive to sub-culturing and certain media. The low isolation rate observed may be due to plasmid instability and subsequent loss of *ipaH*.

Identification of EIEC isolates is challenging

It is vital to understand EIEC organism characteristics and genetic relatedness during outbreaks

REFERENCES

- BioFire 2020.

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BIOCHEMICAL COMPARISON OF SHIGELLA AND EIEC

Cowley LA, Oresegun DR, Chattaway MA, Dallman TJ, Jenkins C. Phylogenetic comparison of enteroinvasive *Escherichia coli* isolated from cases or diarrhoeal disease in England, 2005-2016. J Med Microbiol. 2018;67:884–8. Pasqua, Martina & Michelacci, Valeria & Di Martino, Maria Letizia & Tozzoli, Rosangela & Grossi, Milena & Colonna, Bianca & Morabito, Stefano & Prosseda, Gianni. (2017). The Intriguing Evolutionary Journey of Enteroinvasive E. coli (EIEC) toward Pathogenicity. Frontiers in Microbiology. 08.

l Culture-Independent Diagnostic Tests (CIDTs), Foodborne Diseases Active Surveillance Network (FoodNet). CDC. National and Zoonotic Infectious Diseases (NCEZID), Division of Foodborne, Waterborne, and Environmental Diseases (DFWED). May 14 /www.cdc.gov/foodnet/reports/cidt-questions-and-answers-2015.html Aarch 11). What's the Significance of Enteroinvasive E. coli (EIEC), Enteropathogenic E. coli (EPEC), and Enteroaggregative E. col (EAEC) in Stool? Retrieved November 1, 2019, from https://www.asm.org/Articles/2019/March/Whats-the-Significance-of-Enteroinvasive-E-coli. Manual of Clinical Microbiology Murray P, Baron, E, Jorgenson J. H, Pfaller M, Yolken R H, 8th edition. ASM Press. 2003 ISBN 1-55581-255-4 Stated sensitivity and specificity is the aggregate performance from the prospective clinical study data presented in the BioFire Gastrointestinal Panel

Luminex. 2019. Time and Motion Study: Molecular Testing with VERIGENE® Enteric Pathogens (EP) Test Accelerates Results for GI Infection Recent Advances in Understanding Enteric Pathogenic *Escherichia coli* Matthew A. Croxen, Robyn J. Law, Roland Scholz, Kristie M. Keeney, Marta Wlodarska, B. Brett Finlay Clinical Microbiology Reviews Oct 2013, 26 (4) 822-880; DOI: 10.1128/CMR.00022-13

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