Implementation of a Molecular Diagnostic Test for Pediatric Acute Gastroenteritis: The FilmArray GI Panel IMPACT Study

Chris Stockmann,1,2 Daniel Cohen,3 Amy Leber,3 Judy A. Daly,2 Jami T. Jackson,4 Rangaraj Selvarangan,4 Neena Kanwar,4 Jeffrey M. Bender,5 Jennifer Dien Bard,5 Ara Festekjian,5 Susan Duffy,6 Chari Larsen,1,2 Tanya Baca,1 Kristen Holmberg,7 Kevin Bourzac,7 Kimberle C. Chapin,6 and Andrew T. Pavia,1,2

1University of Utah School of Medicine, Salt Lake City, UT, USA 2Primary Children's Hospital, Salt Lake City, UT, USA 3Nationwide Children's Hospital, Columbus, OH, USA 4Children's Mercy Hospital, Kansas City, MO, USA 5Children's Hospital of Los Angeles; Los Angeles, CA, USA 6Hasbro Children's Hospital, Providence, RI, USA 7BioFire Diagnostics, LLC, Salt Lake City, UT, USA

Background
• Diagnosis of the etiology of acute gastroenteritis (GE) with conventional tests is complex, slow and has low yield
• New multiplex molecular tests can identify potential etiology in 50-70% of patients within a few hours
• However, many cases of GE are self-limited and newer tests are expensive
• Goal of the GI IMPACT study: Measure the impact of diagnosis of the etiology of acute gastroenteritis (GE) on patient outcomes

Methods
• Design: Prospective, multicenter, modified step-wedge quasi-experimental study
• Site initiation based on feasibility, not randomization
• Setting: 5 Academic Pediatric Emergency Departments
• Patients: Children <18 years with acute GE presenting to ED
• Duration of symptoms >24 hr but <14 days
• Able to provide stool specimen within 48 hr
• Procedures:
  • Structured questionnaire at baseline
  • Chart abstraction
  • Follow up questionnaire at 7-10 days

Pre-intervention:
• After enrollment, physician-directed testing. Stool tested retrospectively by multiplex PCR (FilmArray® GI Panel, BioFire Diagnostics, Salt Lake City)
• Post-intervention:
  • Providers educated on test platform and pathogens
  • Multiplex PCR on all patients, either in ED or within 2 days
  • Clinical use of multiplex PCR on stool of all children admitted to hospital

Outcomes
• Primary: Additional health care encounters
• Secondary: Treatable infections, appropriate therapy, time to diagnosis, time to therapy, absence from childcare or work, secondary illness in family

Clinical Findings

Results
Pathogens detected by ED physicians using standard of care tests, compared to retrospective diagnosis by mPCR in pre-intervention and real time during intervention

Figure: Proportion returning and return visits by season

Conclusions
• Clinical use of multiplex PCR on stool of all children presenting to ED with acute GE markedly increased detection of treatable pathogens and pathogens (STEC, Salmonella) for which antimicrobials should be withheld
• It did not reduce overall return visits to Health care providers
• However, multiplex PCR decreased return visits during winter

Limitations
• Periods imbalanced with regard to:
  • Season
  • Viral etiologies
• Children’s hospitals with Pediatric ED practitioners, limiting generalizability to other practices
• Not all treatment may have been captured

Next steps
• Mixed effects models, cost analysis, identification of subgroups where multiplex PCR testing is most useful

Acknowledgments: This study is funded by NIH/NIAID grant R01AI104593 to BioFire Diagnostics with additional funding from BioFire Diagnostics

Contact: andy.pavia@hsc.utah.edu

In memory of Chris Stockmann PhD 1988-2016

Demographics

Table: Pathogens detected among all subjects with AGE that were ordered tests

Figure: Pathogens identified during pre-intervention compared to post-intervention

P < 0.01 Multiplex PCR prevalence during pre-intervention compared to post-intervention