

# A NOVEL APPROACH TO STATEWIDE GASTROINTESTINAL PATHOGEN SURVEILLANCE

E. Hanson<sup>1</sup>, E. Reisdorf<sup>1</sup>, M. Wedig<sup>1</sup>, E. Bowles<sup>1</sup>, D. Warschauer<sup>1</sup> and P. Shult<sup>1</sup>.  
<sup>1</sup>Wisconsin State Laboratory of Hygiene, University of Wisconsin-Madison, Madison, WI.

## Objective

To describe the development of a statewide Gastrointestinal Pathogen (GP) surveillance network in Wisconsin, utilizing testing performed at the Wisconsin State Laboratory of Hygiene (WSLH) and other regional testing sites.

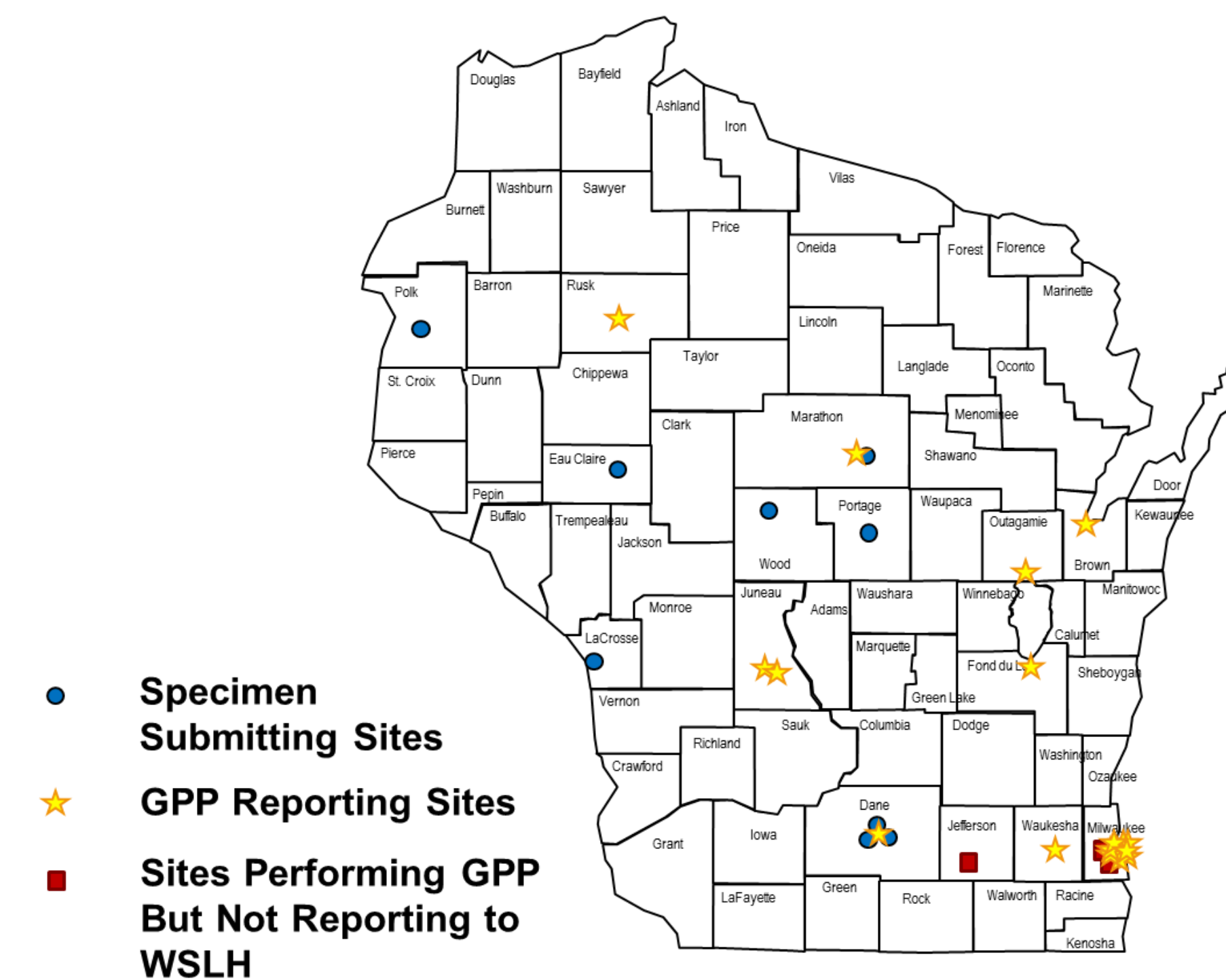
## Background

Acute diarrheal illness is a significant cause of morbidity in the US and the majority of episode causes are unknown. A GP surveillance program was established in Wisconsin to gain awareness of the gastrointestinal pathogens affecting community health in WI. Since most gastrointestinal viral diseases are not reportable, GP surveillance provides situational awareness that otherwise would be largely unknown.

## Methods

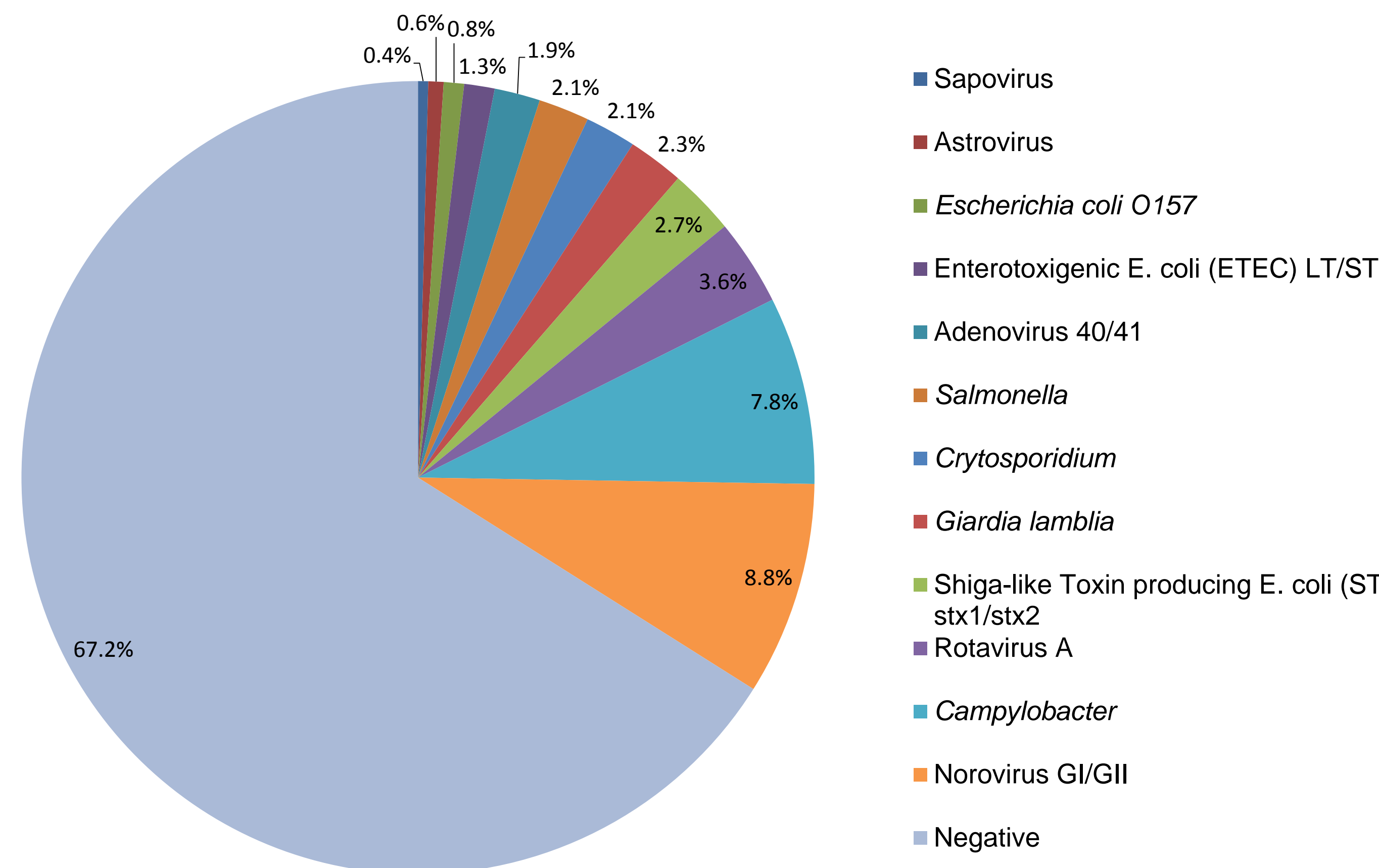
- 9 laboratories within the Wisconsin Clinical Laboratory Network (WCLN) were recruited to send randomized stools specimens to be tested at the WSLH with the Luminex xTAG® Gastrointestinal Pathogen Panel PCR (GPP).
- Specimens testing negative on the GPP at WSLH were also tested for Astrovirus and Sapovirus by RT-PCR.
- Positive surveillance stool specimens submitted to the WSLH could additionally be tested at the WSLH with Pulsed-Field Gel Electrophoresis or sequencing.

**Figure 1. Gastrointestinal Pathogen PCR Reporting and Submitting WCLN Laboratories**



- 18 regional WCLN laboratories utilizing a molecular gastrointestinal panel platform were recruited to submit a weekly summary of their results.
- Laboratories utilized a variety of testing platforms, with the number of targets detected ranging from 5 to 21 (Table 1).
- Submitting sites could report via a web portal, so reporting was efficient and timely.
- A summary of GP Surveillance data is sent out in a biweekly newsletter to public health stakeholders.

**Figure 2. Positivity of Gastrointestinal Pathogens of Surveillance Specimens by PCR at WSLH in 2014-2016<sup>a</sup>**



<sup>a</sup>7.8% of stool specimens tested at WSLH were indeterminate. These specimens were removed from further calculations.

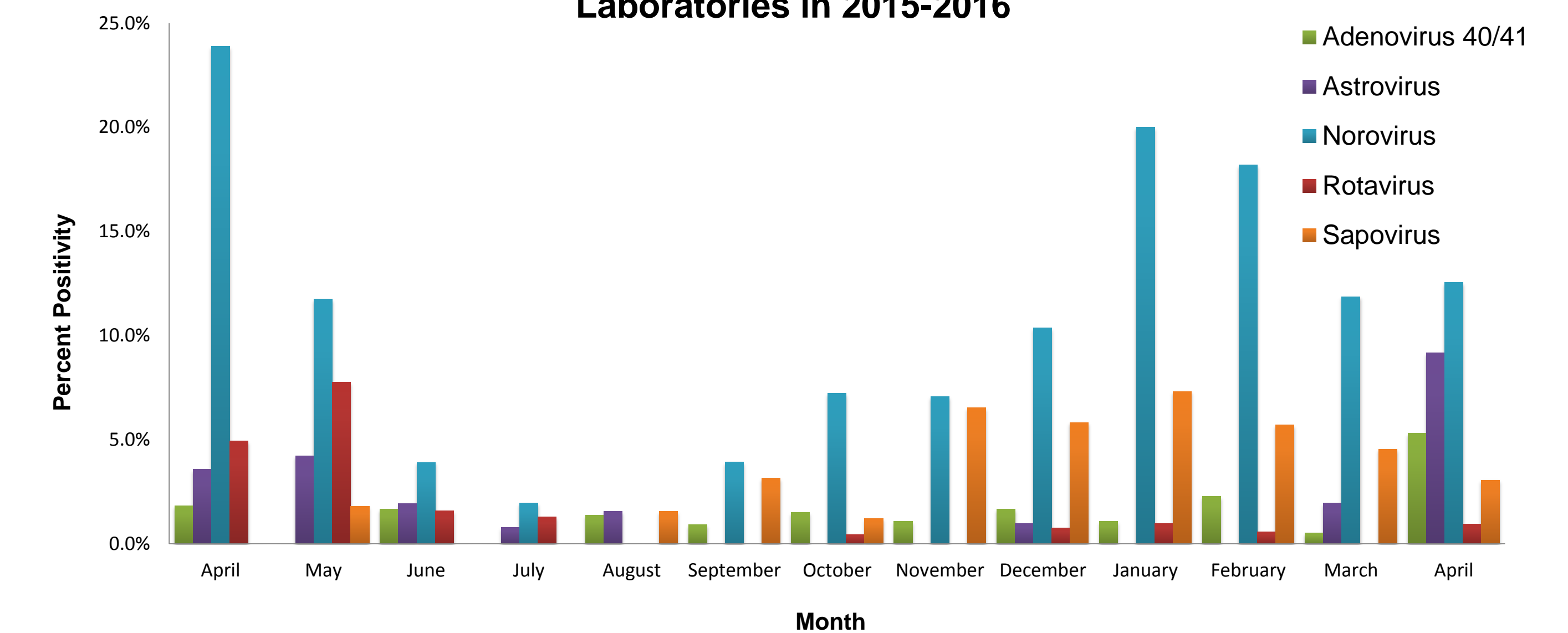
## WSLH GPP Results

- Of the 515 specimens tested with the GPP PCR at the WSLH during 2014, 2015 and early 2016, 32.8% were positive for a pathogen (excluding *C. difficile* toxin A/B).
  - 10.1% of specimens tested positive for *C. difficile* toxin A/B.
    - *Clostridium difficile* is an agent commonly found in GP Panel PCRs. Caution must be taken when interpreting a positive result in a person who does not fit the clinical picture for *C. diff* infection, as carriage of *C. difficile* in healthy individuals can be as high as 14%.
- 15.3% of specimens were positive for viral pathogens, notably Norovirus (8.8%), Rotavirus A (3.6%), and Adenovirus 40/41 (1.9%).
- The most common enteric pathogens were Norovirus (8.8%) and *Campylobacter* (7.8%).
- A higher than expected percent of specimens were positive for *Cryptosporidium* (2.1%) and *Giardia* (2.3%), indicating that these may be underdiagnosed infections in WI.

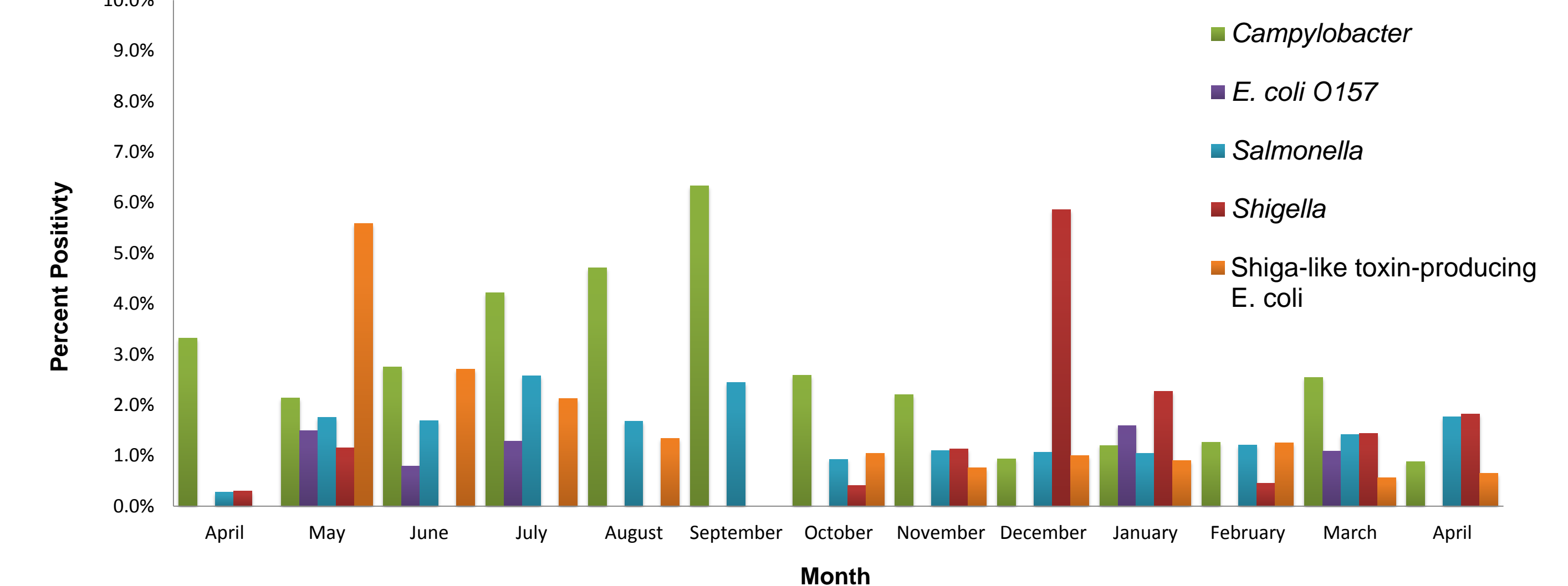
## Statewide GP Results

- Since April of 2015, the majority of positive specimens were positive for viral pathogens including Norovirus (12.3%), Sapovirus (3.4%), Astrovirus (1.8%), Rotavirus (1.7%) and Adenovirus 40/41 (1.4%).
  - Laboratories also detected a high percent of specimens positive for *Campylobacter* (2.5%), *Cryptosporidium* (1.9%) and *Giardia* (1.7%).
  - Number of specimens tested for each enteric pathogen ranged from 1591 (Enteroaggregative *E. coli*) to 7399 (*Salmonella*)
- 7.8% of samples were positive for Enteropathogenic *E. coli* (EPEC) and 2.2% for Enteroaggregative *E. coli* (EAEC).
- Seasonal trends were also observed for bacterial, viral, and parasitic enteric pathogens by PCR at Wisconsin laboratories (Figures 3-5).
  - *Campylobacter* was more prevalent during the summer and fall months.
  - Norovirus and Sapovirus were more prevalent during the winter and spring months.
  - *Cryptosporidium* and *Giardia* were also more prevalent during the summer and fall months
- Caution must be used when interpreting aggregated GPP data. The platforms utilized by WCLN laboratories detected a variety of targets, ranging from 5 to 21 different enteric pathogens. As a result, some enteric pathogens were tested for more often than others.

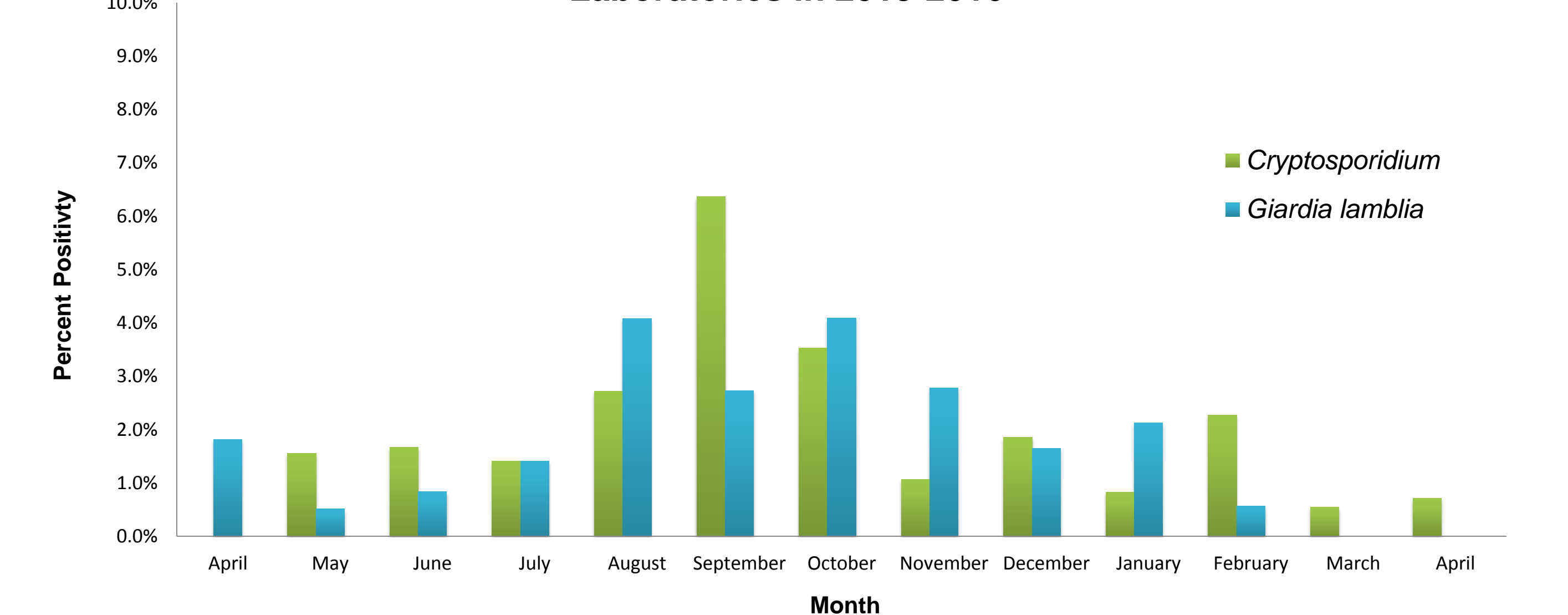
**Figure 3. Positivity of Viral Enteric Pathogens by PCR at Wisconsin Laboratories in 2015-2016**



**Figure 4. Positivity of Bacterial Enteric Pathogens by PCR at Wisconsin Laboratories in 2015-2016**



**Figure 5. Positivity of Parasitic Enteric Pathogens by PCR at Wisconsin Laboratories in 2015-2016**



## Conclusions

- The WSLH recruited sentinel surveillance sites to submit randomized stool specimens for GPP testing and recruited additional labs to submit GPP data for analysis. GP surveillance provides awareness of the gastrointestinal pathogens affecting community health in WI that otherwise would be largely unknown.
- Aggregated GPP data revealed some surprising numbers:
  - Viral enteric pathogens, including Norovirus, Rotavirus, Sapovirus, Adenovirus 40/41 and Astrovirus accounted for the majority of pathogens detected, both for specimens tested at WSLH and in aggregated statewide data.
- The approach described here can be used by other state public health departments to develop an active surveillance model to implement or enhance GP surveillance activities. These data can be used to gauge activity of GPs in the community and by clinicians to enhance evidence-based patient care.

## Acknowledgements

We would like to acknowledge the stake holders of the Wisconsin Clinical Laboratory Network for their efforts in establishing and maintaining this gastrointestinal pathogen surveillance program.

**Table 1. Molecular Gastrointestinal Panel Testing Platforms Utilized by Surveillance Laboratories Across Wisconsin, and Their Respective Targets**

	Biofire (Film Array)	Luminex (xTAG® GPP)	Nanosphere (Verigene)	Hologic (Prodesse ProGastro)	Cepheid (Xpert Norovirus)
Number of participating laboratories utilizing the testing platform <sup>a</sup>	2	2	4	7	2
<i>Campylobacter</i> spp.	x	x	x	x	
<i>E. coli</i> O157	x	x	x	x	
Shiga-like toxin producing <i>E. coli</i> stx1/stx2	x	x	x	x	
<i>Salmonella</i>	x	x	x	x	
<i>Shigella</i> /Enteroinvasive <i>E. coli</i>	x	x	x	x	
<i>Vibrio</i> spp.	x	x	x	x	
<i>Yersinia enterocolitica</i>	x	x	x	x	
Rotavirus	x	x	x	x	
Norovirus	x	x	x		x
Adenovirus 40/41	x	x			
<i>Cryptosporidium</i>	x	x			
<i>Entamoeba histolytica</i>	x	x			
<i>Giardia lamblia</i>	x	x			
<i>Clostridium difficile</i> toxin A/B	x	x			
Enterotoxigenic <i>E. coli</i> (LT/ST)	x	x			
<i>Plesiomonas shigelloides</i>	x				
Enteroaggregative <i>E. coli</i>	x				
Enteropathogenic <i>E. coli</i>	x				
<i>Cyclospora cayentanensis</i>	x				
Astrovirus	x				
Sapovirus	x				

<sup>a</sup>Three reporting laboratories did not specify their testing platform