

**Physician Perspectives on Vaccination and Diagnostic Testing in Children with
Gastroenteritis: A Primary Care Physician Survey**

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40 **Ethical Considerations**

41 Approval to conduct this survey was provided by The Conjoint Health Research Ethics Board

42 (CHREB) at the University of Calgary (#13-1005).

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Introduction

Acute gastroenteritis remains a common cause of childhood mortality worldwide, claiming approximately 578000 lives annually(1). Although mortality is very low in Canada, morbidity is significant with an estimated 240000 children seeking emergency department (ED) care annually on account of gastroenteritis(2). Societal costs are enormous as each ED visit costs ~\$800 and hospitalized child ~\$2700(3).

Implementation of rotavirus vaccination programs has successfully resulted in a reduction in the incidence of rotavirus-related ED visits, hospitalizations, and healthcare costs(4-7). However, a universal rotavirus vaccination program had not been included in Alberta's publicly-funded health-care system at the time of this study, despite endorsement by Canada's National Advisory Committee on Immunization in 2010(8) (note: a vaccination program was implemented June 1, 2015). The delayed implementation of a program in Alberta could have been due to a lack of knowledge of the local pathogen-specific gastroenteritis epidemiology and disease burden(9).

Identifying the pathogens responsible for gastroenteritis symptoms has traditionally been challenging. The majority of affected patients do not seek medical care, stool samples are not always requested from those who seek care, and compliance with specimen collection is suboptimal(10). Diagnostic capabilities of routine laboratory testing and physician understanding of these test results, is limited. These issues contribute to underreporting and a misrepresentation of disease burden.

67 Our objective was to ascertain physician understanding of the diagnostic tests used to identify
68 various enteric pathogens and the ease of sample collection methods. Such knowledge is needed
69 to drive changes in the diagnostic approach to gastroenteritis. Additionally, we sought to
70 measure physician support for the implementation of an enteric pathogen vaccination program.
71

Methods

Survey development

Physicians and researchers with clinical and academic expertise from the areas of pediatrics (SF, BL), family medicine (JD), emergency medicine (SF), and microbiology/virology/infectious disease (ML, LC, XP, BL), collaborated to develop survey content. The survey was designed to capture clinician knowledge and awareness of existing diagnostic tests used in Alberta and also knowledge of "optimal" testing options available. Additionally, the survey aimed to obtain perspectives on the integration of an enteric vaccine into the existing local vaccine schedule. The final version of the survey was restricted to 30 questions and was designed for completion in 5 to 7 minutes. Before distribution, the survey was tested among 10 Alberta Provincial Pediatric EnTeric Infection TEam (APPETITE) members for face validity, content, relevance, and time required for completion. Based on the feedback provided, the survey was revised accordingly.

Survey setting and population

The province of Alberta has a population of 3.8 million and is divided into five healthcare zones with two-thirds of the population residing in two urban zones (Calgary and Edmonton). The survey was administered to physicians across all five healthcare zones (<http://www.albertahealthservices.ca/ahs-map-ahs-zones.pdf>) who were members of Alberta's Primary Care Networks (PCN), The Alberta Recording and ReseArch NeTwork (TARRANT), and The Society of General Pediatricians of Greater Edmonton. These groups were selected as they represent discrete target end-user physician groups who directly treat children with gastroenteritis. They were also felt to potentially have higher response rates than from unselected

populations. Eligible participants had an email address and were members of one of the
aforementioned networks.

Forty-six PCNs were listed on the Primary Care Initiative website when it was accessed in
October 2013. Seven of the PCNs were listed as “under development” or did not provide contact
information online and were excluded from this study. Therefore, 39 PCNs representing 2492
physicians were invited to participate. Of these 39 PCNs, 18 PCNs representing 1106 physicians
agreed to participate and confirmed sending out the survey to their physicians. Twenty-one PCNs
declined participation or did not confirm sending out the surveys. Four of the PCNs that declined
participation suggested that we contact their encompassing medical clinics directly, which
resulted in 35 physicians from 9 clinics being sent the survey link. Thus 1141 physicians, or
45.8% of the eligible PCN physician members, were contacted by these methods.

TARRANT is a province-wide influenza illness surveillance program and is composed of
approximately 50 voluntary participating primary care physicians. The Society of General
Pediatricians of Greater Edmonton is comprised of approximately 60 pediatricians.

Survey distribution

A study team member called each PCN and explained the purpose of the survey to administrative
personnel. PCNs that agreed to participate distributed the survey to their physicians with an
initial email containing the survey link, followed by three reminder emails spaced ~1 week apart.
PCN administrative staff was subsequently contacted to ensure that survey links were
distributed. Two participating PCNs distributed the link within their newsletter. In keeping with

the administrative infrastructure required by these PCNs, survey distribution was performed by an administrator within each network, thereby prohibiting our group's ability to track emails and reminders sent.

The head of the TARRANT network (JD) is a member of our research group and agreed to distribute the survey link and three reminder emails to all members. The chair of The Society of General Pediatricians of Greater Edmonton is affiliated with a member of our research group (BL), and agreed to distribute the survey link and three reminder emails to all members. Again, survey distribution was performed by an administrator within each network, thereby prohibiting our group's ability to track emails and reminders sent.

The final 30-question survey was administered between October 2013 and January 2014 using REDCapTM (Research Electronic Data Capture).

Data Analysis

Qualitative analysis of the data was performed. The results presented include respondent demographics and perspectives on three domains: knowledge needs surrounding diagnostic tests to detect pathogens, stool sample collection methods, and implementation of enteric virus vaccination programs. Responses are summarized as frequencies. Likert scale responses (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) were offered to collect respondents' perspectives. While the raw data is presented in tabular format, manuscript text grouped together "strongly agree" with "agree," and "strongly disagree" with "disagree" to facilitate and clarify the interpretation of the responses received.

Results**Demographics**

Of the 1251 physicians who were provided the survey link, 92 (7.4%) completed the survey, including 78 family physicians, 9 pediatricians, 3 physicians who indicated their field of training as “other,” and 2 physicians who abstained from answering this question. Surveys were collected from 18 physicians (19.6%) from the North zone, nine (9.8%) from the Edmonton zone, five (5.4%) from the Central zone, 52 (56.5%) from the Calgary zone, and eight (8.7%) from the South zone. Fifty-eight percent (53/91) of respondents described their practice as “all urban” or “mostly urban”.

Knowledge needs

To identify self-perceived gaps related to diagnostic testing modalities, respondents evaluated their comfort with ordering tests to identify bacteria, viruses, and parasites in stool (Table 1). Ninety-one percent (81/89) of respondents claimed they are aware of the tests available to identify bacterial and parasitic pathogens. Fifty-one percent (44/87) reported they possess sufficient knowledge to order tests to identify viruses. Seventy-six percent (68/90) of respondents believe that enhancing their knowledge of viral pathogens would enable them to provide better care and guidance.

Respondent physicians were asked to identify diagnostic tests that a) are currently used and b) are optimal, to identify stool pathogens (Table 2). Although EM and EIA were used to evaluate viruses in stool samples in Alberta during the study period (11), only 20% and 48% of respondents identified EM and EIA respectively as tests they could request for these purposes.

Culture was correctly identified by 99% of respondents as the available test to identify bacterial stool pathogens, however, culture was also incorrectly chosen as a modality to diagnose viruses (74%), parasites (47%), and *C. difficile* (67%) in stool. Additionally, PCR is the diagnostic modality with the greatest ability to identify all discussed stool pathogens, but was only selected as the best modality to identify bacteria, viruses, parasites, and *C. difficile* by 22%, 40%, 8%, and 29% of respondents respectively.

Stool sample collection

Though 77% (69/90) of respondents agreed that children with diarrhea and vomiting can be seen on the same day in their practice, 62% (55/89) believe that current methods of stool sample collection for diagnostic testing are inconvenient, and 82% (72/88) indicated that specimen submission rates would improve if rectal swab samples could be submitted for testing. Furthermore, 40% (36/90) of physicians agreed that current stool sample testing methods lack sensitivity and do not provide results in a timely manner (Table 3).

Vaccination perceptions (Table 4)

Seventy-three percent (66/90) of physician support an enteric vaccine program however, 82% (71/87) stated that a requirement for the addition of such a vaccine into the provincial vaccination schedule should include evidence of cost-effectiveness.

Discussion

The survey indicated there is room for improvement in the understanding of available and optimal diagnostic test options to detect enteric pathogens. Although the vast majority of respondents claim that they possess adequate knowledge of the tests available to identify bacterial and parasitic pathogens, only half claim they are aware of tests to identify viruses. This disparity uncovers a need for increased knowledge of viral pathogens and the methods by which they can be diagnosed. Limited testing and identification of fecal viral pathogens in Alberta may be connected to knowledge gaps we identified regarding diagnostic tests.

Diagnostic testing based on stool collection impedes pathogen identification in community practice. Our survey identified that physicians believe that rectal swab use would increase convenience and sample collection rates. Such an approach has been used to identify enteric pathogens and it may be as sensitive as stool(12). Rectal swab use could therefore improve our understanding of the pathogen-specific burden of disease.

Another target for improvement relates to microbiology requisitions which often require physicians to select tests from a list. Such a process does not directly ask what organism physicians are seeking or what the clinical context is – such approaches could better link clinical needs and microbiologic tests. Given that most clinicians have limited knowledge of likely pathogens and recent advances in microbiologic testing procedures, a gap is created between clinical needs and the tests requested. This challenge has been identified(13) and an alternative to changing the approach to test ordering may be the use of assays that test for a broad range of the most common disease causing pathogens. One such example is the

The Luminex Gastrointestinal Pathogen Panel (xTAG(®) GPP) that detects in one assay adenovirus 40/41, norovirus genogroup I/II, rotavirus A, *Clostridium difficile* toxin A/B, *Campylobacter* sp., *Escherichia coli* O157, Enterotoxigenic *E. coli* heat-labile enterotoxin/heat-stable enterotoxin, *Salmonella* sp., Shiga-toxin producing *E. coli*, Shiga-like toxin (Stx)1/2, *Shigella* sp., *Vibrio cholerae*, *Yersinia enterocolitica*, *Cryptosporidium* sp., *Entamoeba histolytica* and *Giardia* sp. However, such approaches also present challenges for clinicians with respect to interpretation.

We found that 73% of respondent physicians support the addition of a gastroenteritis vaccine into Alberta's vaccination schedule. Our survey adds to the existing literature which reported that only 53% of Canadian pediatricians recommend the administration of a rotavirus vaccine and 59% endorse the implementation of a publically funded vaccination program(14). A recent study reported that Canadian physician endorsement of rotavirus vaccination is the lowest of the seven vaccines evaluated(15). Our findings demonstrate that physician endorsement of a gastroenteritis vaccine is far from universal. This knowledge is important since physician opinion plays a major role in vaccine uptake(16). One possible explanation for the low endorsement rate may relate to the limited ability to identify a pathogen and hence a lack of direct connection between episodes of rotavirus and severe gastroenteritis symptoms. Additionally in Canada, rotavirus infections are associated with very low mortality rates compared to elsewhere in the world.

Limitations of this study include a very low response rate, which may have resulted in respondent bias. Although physicians across all of Alberta's five healthcare zones participated, selection bias must always be considered as physicians with strong opinions might have been

230 more likely to participate. Family physicians and pediatricians were invited to participate in the
231 survey in an attempt to promote the generalizability however this approach also introduced
232 heterogeneity. In Alberta these two groups of physicians along with emergency room physicians
233 directly treat children with gastroenteritis, and therefore combining the groups is appropriate.
234 Lastly, sub-analyses by group were planned, but due to the low response rate they were not
235 practical.

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238 Conclusions

239 Challenges with stool collection and test ordering could minimize the perception of the
240 pathogen-specific burden of disease and may contribute to limited vaccine support. Our data
241 support the notion that simplified stool testing and collection procedures may improve our
242 knowledge and understanding of the value of immunization, while enhancing the ability to
243 identify enteric infections in children.

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