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Title: The Epidemiology of Non-Viral Gastroenteritis in New Zealand Children

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#### Introduction:

Gastroenteritis is common in New Zealand (NZ) children and leads to considerable economic cost to both families and the health system. Most cases are self-limiting, however, individuals at the extremes of age are at heightened risk for complications. As such, morbidity and mortality due to gastroenteritis is significant in children and specifically, those less than five years.

Historically, the majority of cases of gastroenteritis in NZ children have been due to viral pathogens and rotavirus in particular. The introduction of the rotavirus vaccine into the national immunisation schedule in 2014 has dramatically reduced the numbers of hospital admissions relating to rotavirus gastroenteritis and consequently other pathogenic organisms, including bacteria and protozoa, are now warranting increased attention.

In NZ, gastroenteritis due to *Campylobacter*, *Shigella*, Non-typhoidal *Salmonella*, *Salmonella typhi*, *Yersinia*, *Escherichia coli* (*E. coli*), *Giardia* and *Cryptosporidium* is notifiable. Two datasets are available to elucidate epidemiological trends. The first, National Minimum Dataset (NMDS), is a national collection of public and private hospital discharge information. The second dataset is from The Institute of Environmental Science and Research Limited (ESR). ESR receives information pertaining to all notifiable diseases in NZ.

To date, data relating to the impact of the above pathogens in paediatric gastroenteritis in NZ has not been analysed or reported. In view of the morbidity associated with gastroenteritis, analysis of the pathogens implicated, as well as time and geographical trends, may provide valuable public health information.

#### Aim:

To describe the epidemiological trends in hospital admissions and disease from non-viral gastroenteritis in NZ children.

#### Impact:

Children generally have the highest burden of disease from acute, non-viral gastroenteritis. However, the occurrence of these infections in NZ children hasn't been studied in detail before. This project provides the first specific information on the burden of these diseases in children and how these have changed over time.

#### Method:

This population-based descriptive study considered children aged 0-to-14 and data from 1997 to 2015. Two data sets were analysed; The National Minimum Dataset and The Centre for Environmental Science notifiable diseases database from EpiSurv.

Data was analysed in the statistics package 'R' with guidance from a Biostatistician and included analysis of descriptive data and annual age-specific and age-standardised rates.

#### Results:

For the time period considered, there were 76,560 notifications and 3,192 hospital admissions due to the pathogens considered by this study.

Overall, Campylobacter was the most commonly notified pathogen (n=40,094, 52.4%), followed by Giardia (10,682, 14.0%), Non-typhoidal Salmonella (10,421, 13.6%), Cryptosporidium (9692, 12.7%), Yersinia (3,477, 4.5%), E. coli (1,375, 1.8%), Shigella (650, 0.8%) and Salmonella typhi (169, 0.2%). Annual age-standardised notification rates highlighted notifications were highest in the 1-4 year age category for Campylobacter, Cryptosporidium and Giardia and the <1 year age category for Non-typhoidal Salmonella and Yersinia. Disease notifications were lowest in the 5-9 and 10-14 year age categories.

With respect to hospital admission, Campylobacter was the commonest pathogen implicated (n=1,385, 43.3%), followed by Non-typhoidal Salmonella (778, 24.4%), Cryptosporidium (286, 9.0%), E. coli (175, 5.5%), Shigella (161, 5.0%), Giardia (146, 4.6%), Salmonella typhi (144, 4.5%) and Yersinia (117, 3.7%). An overall reduction in hospitalisations due to Campylobacter and Non-typhoidal Salmonella was observed from 1997-2015 (from 3.4 to 3.0 per 100,000 and 2.4 to 2.0 per 100,000, respectively). Annual age-standardised admission rates were highest in the <1 year age category when compared to the 1-4, 5-9 and 10-14 year age groups for Campylobacter, Giardia, Non-typhoidal Salmonella and Yersinia.

Specifically, for Campylobacter, the pathogen identified as the commonest cause for both disease notifications and hospital admissions, the notification rate decreased from 240 per 100,000 in 1997 to 140 per 100,000 in 2015 (42% reduction). Notification rates peaked in 2003-2004 at 330 per 100,000 and were lowest in 2007-2008 at 2.2 per 100,000. Hospitalisation rates also decreased from 1997-to-2015. Whilst it was the 1-4 year age category who had the most disease notifications, those aged <1 were most likely to be admitted to hospital.

#### Conclusion:

For all pathogens, and most notably Campylobacter, the majority of the burden of disease lies in the community, with only a fraction of hospital admissions compared to notifications. Children <1 year are at greatest risk for hospitalisation. There has been a reduction in notification rates due to Campylobacter and Non-typhoidal Salmonella, however the burden of disease due to these pathogens remains high, warranting further consideration from a public-health perspective. The results presented provide valuable insight into the non-viral causes for gastroenteritis in NZ children. Further analysis will look at rates of disease related to ethnicity and region in NZ to further describe the burden of disease.