

Gastroenteric infections in Italy: cases reported in the area of Parma in the period January 2011-April 2016

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Background: Despite the major efforts in public health to improve the quality of food and water and hygiene measures during the last century, acute gastroenteritis (AGE) still remains a major cause of morbidity and mortality worldwide. Although AGE in industrialized countries is usually characterized by low mortality and most of the cases are self-limiting, the direct and indirect costs can be significant. AGE is a common disease in both outpatients and inpatients that presents diarrhoea, nausea, vomiting, and abdominal pain. The presence or absence of epidemiological (such as travel, hospitalization, antibiotic use) and clinical evidences (such as diarrhoea frequency and duration, severity of abdominal pain and fever, character of stools, presence of chronic illness or immune deficiency) can change the probability to detect each pathogen. However, the burden of AGE in the Italian population is usually underestimated mainly because the notification is poorly accomplished by physicians. The aim of the present study was to investigate the prevalence of pathogens causing gastroenteritis in patients presenting to the University Hospital of Parma in the period January 2011-April 2016.

Methods: From January 2011 to April 2016, a total of 25,610 stool samples (Figure 1) belonging to 19,139 patients (Figure 2), 16,903 Italians and 2,236 foreigners (figure 3), with acute gastroenteritis attending the University Hospital of Parma, Northern Italy, as inpatients (10,996) and outpatients (8,143), were submitted to virological and/or bacteriological investigations based on the request of the physician and on clinical suspicion. For virus detection, the faecal specimens were submitted to conventional cell culture, transmission electron microscopy, latex agglutination (Diarlex, Dasit S.p.A., Italy) or immunocromatography (IC, Immunoquick, Dasit) for rotavirus and adenovirus, and polymerase chain reaction for norovirus (Liferiver Bio-Tech, USA and Fast-track diagnostics, Malta). For bacteria detection, the faecal samples were submitted to conventional culture for *Salmonella sp.*, *Shigella sp.*, *Escherichia coli*, *Yersinia sp.* and/or *Vibrio sp.*, followed by specific IC for Shiga-like toxins producing *E. coli* (Meridian Bioscience, USA) in case of an enteropathogenic isolate, and/or to specific IC for *Campylobacter sp.* (Meridian Bioscience) followed by culture in case of positive result. From January 2016, the faecal specimens belonging to paediatric patients were submitted to the gastrointestinal FilmArray Panel (BioFire Diagnostics, USA; bioMérieux, France) and to polymerase chain reaction for the detection of enterovirus (EliTech, Italy). In this study, the statistical significance of positive patients was calculated on the respective total by chi-square test: a p value <0.05 was considered significant.

Results: Of the overall examined patients, a total of 2,352 (12.28%), 1,914 Italians (11.3% of the Italian patients) and 438 foreigners (19.6% of the foreign patients), were positive ($p < 0.00001$) for at least one agent. In particular, among the patients overall examined for bacteria (18,433), 1,290 (7%) were infected with at least one microorganism, 1,055 were Italians (6.5% of the Italian patients with suspicion of bacterial enteric infection) and 235 foreigners (11.3% of the foreign patients with suspicion of bacterial enteric infection) ($p < 0.00001$), 707 males (406 children and 301 adults) and 583 females (288 children and 295 adults); the most frequently enteric bacteria detected were *Salmonella enterica* sub. *enterica* (318), *Campylobacter* spp. (213), enteropathogenic *E. coli* (65) and *Yersinia enterocolitica* (14) (Figure 4). Among the patients overall examined for viruses (4,318), 1,121 (26%) had a viral enteric infection, 903 were Italians (25.5% of the Italian patients with suspicion of viral enteric infection) and 218 foreigners (28% of the foreign patients with suspicion of viral enteric infection) ($p = 0.0203$), 629 males (575 children and 54 adults) and 492 females (443 children and 49 adults); the most frequently identified viruses were norovirus (454), rotavirus (388), adenovirus (173), and enterovirus (77) (Figure 5). When considering the patients with clinical suspicion of bacterial and viral enteric infection for which both investigations were performed (3,612), in 59 cases a mixed infection (bacteria + virus) was revealed (1.6%); the most frequent associations were Norovirus + *Salmonella enterica* sub. *enterica* (5) and Norovirus + *Campylobacter* spp. (5), followed by Rotavirus + *Salmonella enterica* sub. *enterica* (4) (Figure 6).

Conclusions: This study emphasizes the high number of stools annually analyzed in the last years for AGE. The number of positive cases detected is unexpected in a restricted geographical area, and highlight the diversification in AGE etiology probably due to different factors, such as immigration, increased travelling, market globalization, modern food lifestyle, scientific progress as well as the biological characteristics and high genetic variability of pathogens.

References: 1. Medici MC et al. 2014. *Epidemiology & Infection*. 142:2326-35. 2. Medici MC et al. 2016. *Infection, Genetics and Evolution*. 40:253-61. 3. Medici MC et al. 2012. *Journal of Medical Virology*. 84:643-50. 4. Humphries RM and Linscott AJ. 2015. *Clinical Microbiology Reviews*. 28:3-31.

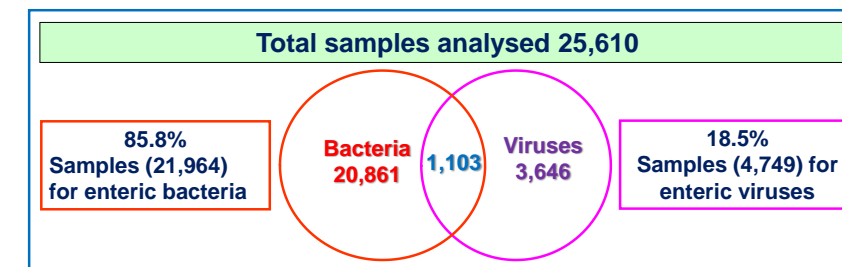


Figure 1. Number of samples examined for enteric bacteria and viruses at the Unit of Microbiology and Unit of Virology of the University Hospital of Parma in the period January 2011-April 2016

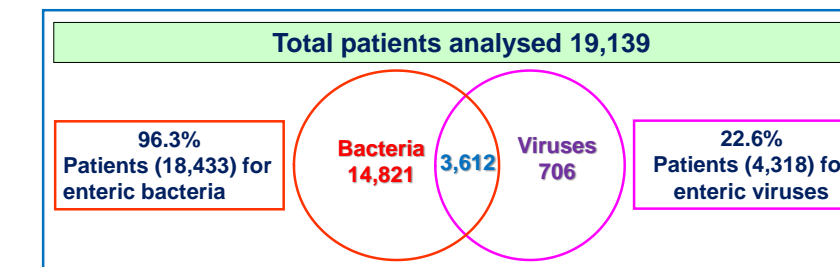


Figure 2. Number of patients examined for enteric bacteria and viruses at the Unit of Microbiology and Unit of Virology of the University Hospital of Parma in the period January 2011-April 2016

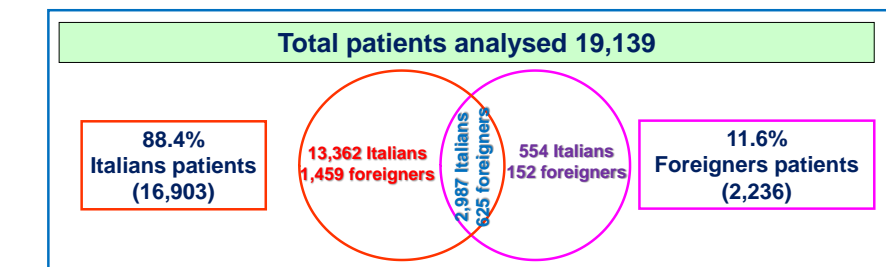
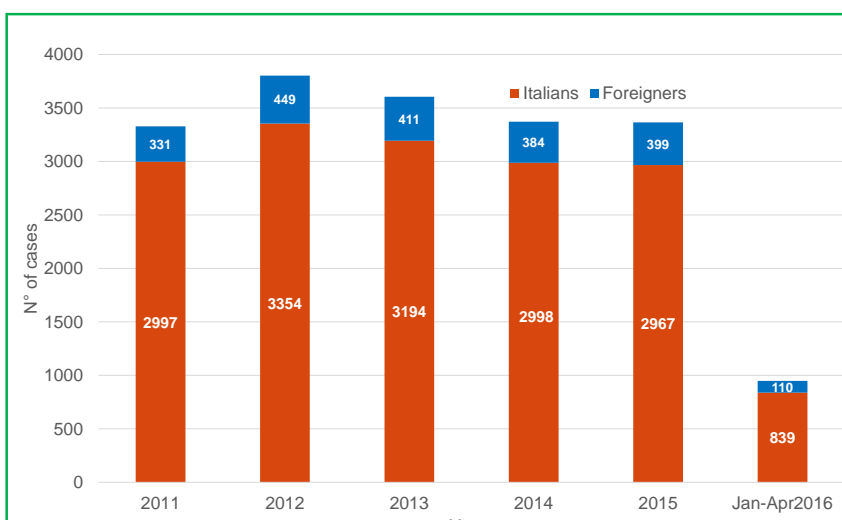
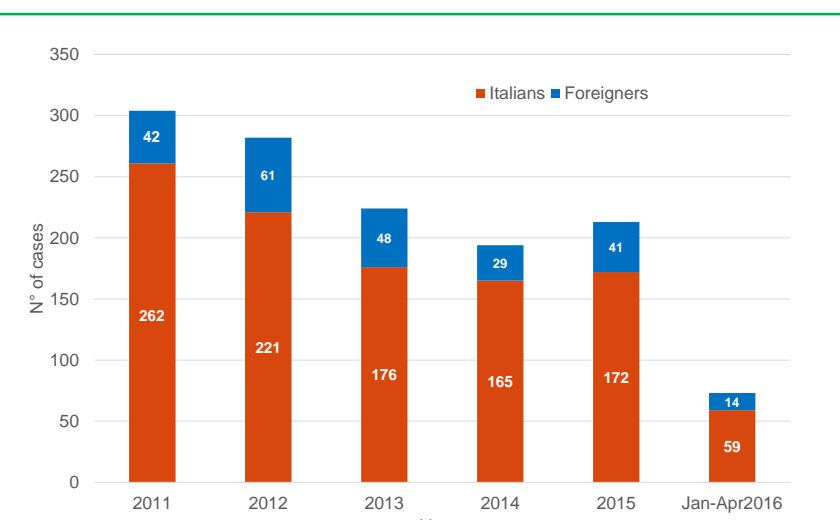


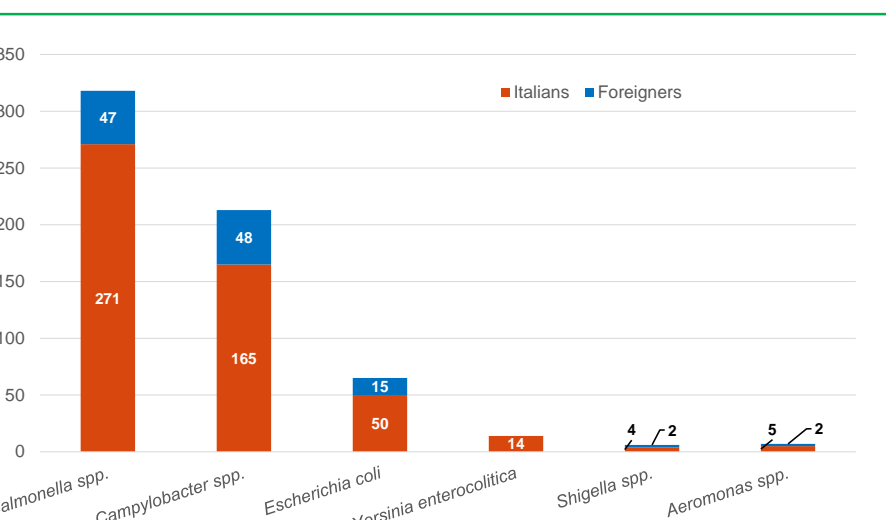
Figure 3. Number of Italians or foreigners patients examined for enteric bacteria (red circle) and viruses (violet circle) at the Unit of Microbiology and Unit of Virology of the University Hospital of Parma in the period January 2011-April 2016



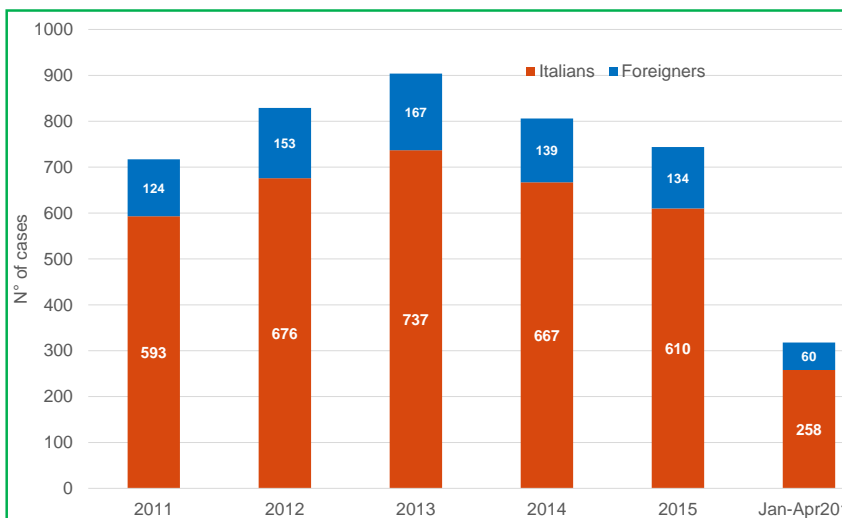
A. Cases (18,433) with clinical suspicion of bacterial enteric infection with samples analysed in the period January 2011- April 2016 at the University Hospital of Parma.



B. Positive cases (1,290) for enteric bacteria in the period January 2011- April 2016 at the University Hospital of Parma.



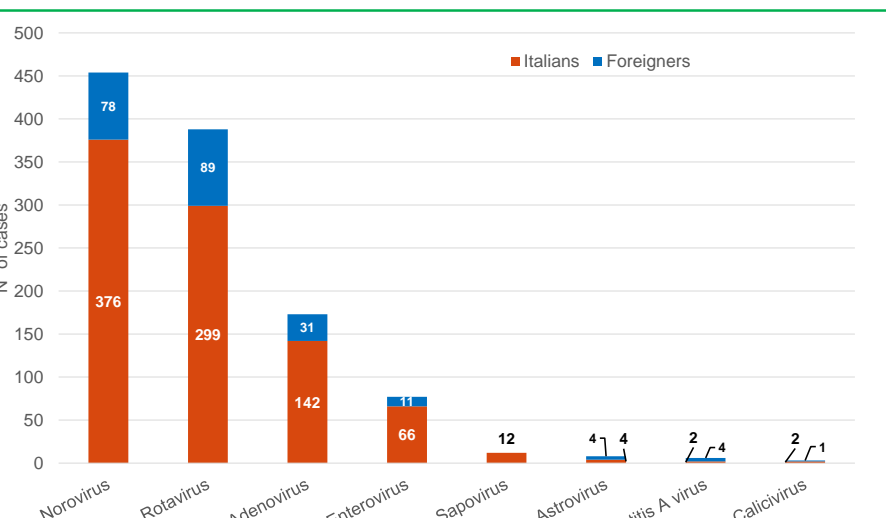
C. Most frequent enteropathogenic bacteria detected in cases with samples analysed in the period January 2011- April 2016 at the University Hospital of Parma.



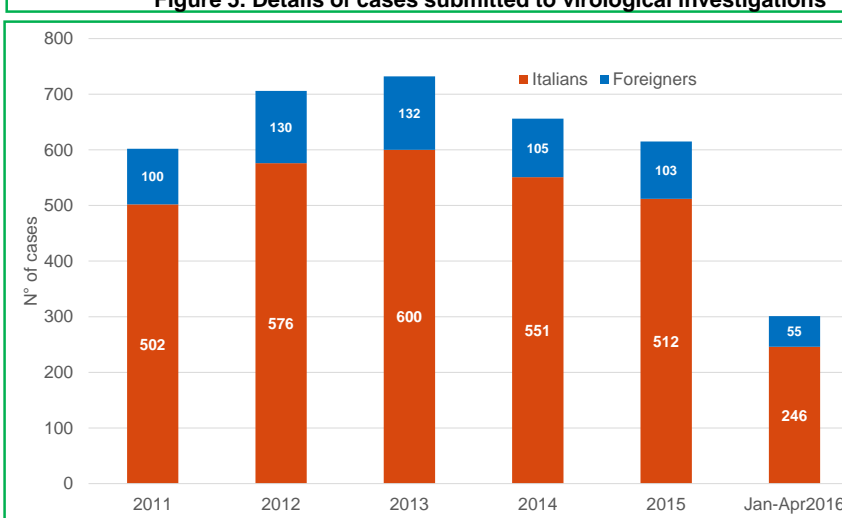
A. Cases (4,318) with clinical suspicion of viral enteric infection with samples analysed in the period January 2011- April 2016 at the University Hospital of Parma.



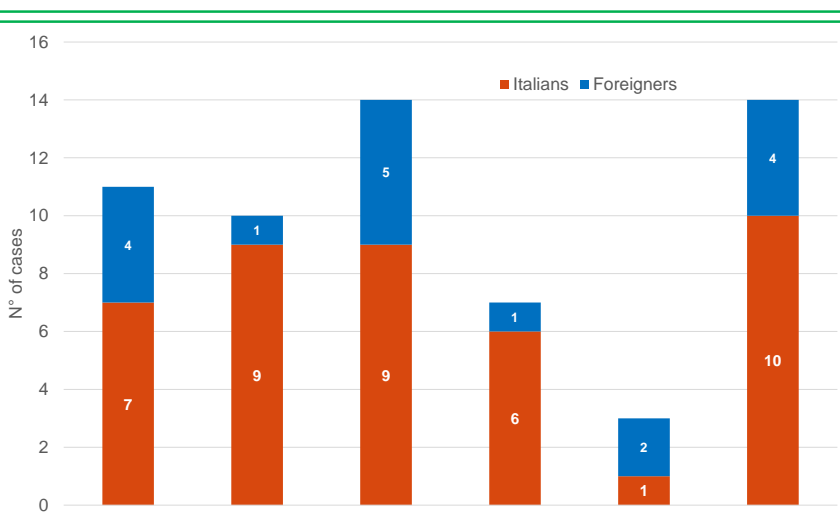
B. Positive cases (1,121) for enteric viruses in the period January 2011- April 2016 at the University Hospital of Parma.



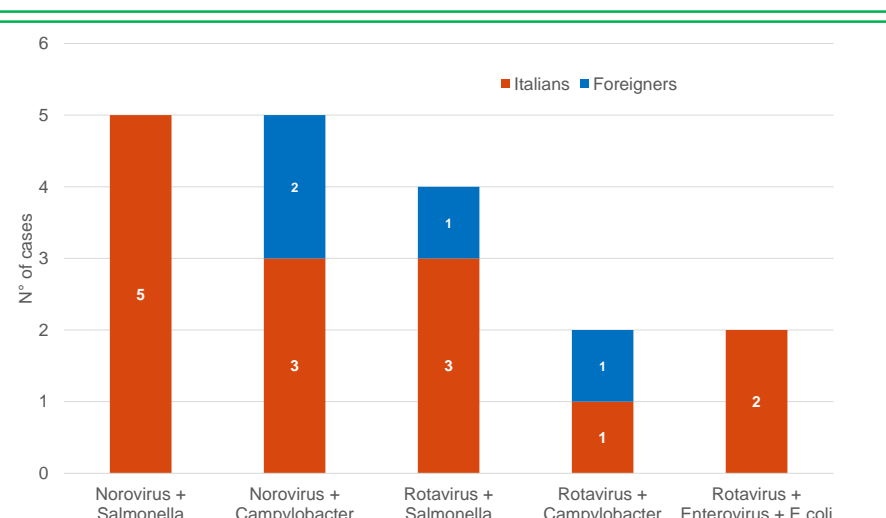
C. Virus detected in cases with samples analysed for viral enteric infection in the period January 2011- April 2016 at the University Hospital of Parma.



A. Cases (3,612) with clinical suspicion of bacterial/viral enteric infection with samples analysed in the period January 2011- April 2016 at the University Hospital of Parma.



B. Positive cases (59) for enteric bacteria/viruses in the period January 2011- April 2016 at the University Hospital of Parma.



C. Most frequent associations of virus and bacteria detected in cases of samples analysed for enteric infection in the period January 2011- April 2016 at the University Hospital of Parma.