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# Infectious gastroenteritis and the need for strict contact precaution procedures in adults presenting to the emergency department

## a Danish Register-based Study

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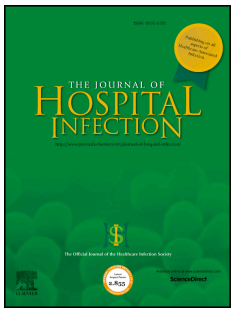


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# Infectious Gastroenteritis and the Need for Strict Contact Precaution Procedures in Adults Presenting in the Emergency Department – a Danish Register-based Study

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**Running title**: Gastroenteritis contact precaution

**Key words**: Infectious Gastroenteritis, Contact Precautions, Norovirus, Clostridium difficile

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## Summary

**Background:** Acute infectious gastroenteritis requires contact precautions to prevent spreading. On acute admission the cause of diarrhoea is unknown, so the decision of whom to isolate has to be made on clinical information with a risk of inexpedient use of contact precautions.

**Aim**: The aims of the study were to investigate how often gastroenteritis occurs, and thus the isolation indication has to be assessed, in Danish emergency departments, and how often patients have to remain on contact precaution according to the results of the faecal samples.

**Methods:** This Danish register based retrospective cohort study on adults in Danish emergency departments linked three data sources: discharge diagnoses from the Danish National Patient Register; microbiologically results from faecal samples delivered in the emergency department; and the causes of hospital admission based on the chief complaint.

**Findings:** Among 66,885 acute admissions 4.3% patients had at least one feature of gastroenteritis: admission with a chief complaint of diarrhoea (1.6%); faecal sample microbiology examination (2.8%); discharged with a gastroenteritis diagnosis (1.7%). 19% of those who had a faecal sample tested were norovirus or *Clostridium difficile* cases, who should remain on strict contact precautions.

**Conclusion:** The initiation of contact precaution has to be assessed for 4.3% of all emergency department patients; 19% of the patients who had a sample tested had highly contagious gastroenteritis and required strict contact precautions. Further studies for developing tools to determine whom to isolate are needed.


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## Background

Acute infectious gastroenteritis (GE) is a common disease and normally perceived as a mild and self-limiting illness (1). However, especially in vulnerable individuals such as smaller children, immunocompromised persons and the elderly, GE may lead to health care contacts and even hospitalization due to complications like sepsis or dehydration. In Denmark the incidence rate of acute gastrointestinal illness (AGI) has been estimated to be 1.4 episodes per person-year (2), which is similar to other developed countries (3). In Denmark 1.6 % of all acute hospital admissions are discharged with a diagnosis of gastroenteritis with a known or suspected infectious aetiology (4). The majority of these patients are admitted to an emergency department (ED) with a high patient flow and short duration of stay. Contact precautions (CP) for potentially contagious diseases, including GE, are important in such an environment to decrease the risk of spreading of disease. Strict isolation (strict CP) in a separate room with private toilet, and health staff wearing gowns, gloves and masks (5) are recommended for patients with confirmed or suspected Norovirus or toxigenic *Clostridium difficile* infections. Patients infected with other pathogens can in most cases be nursed in barrier isolation (standard CP), which includes gowns and gloves when the staff is in direct contact with the patient, but not necessarily nursed in a separate room or with access to a private toilet.

However, on admission the cause of diarrhoea is unknown in most cases' thus the decision on whether or not to initiate isolation procedures has to be based on clinical information, with the risk of isolating too many or too few patients. Strict CP require resources, are time consuming for healthcare staff and lead to less documented care, including fewer physician visits (6). Isolated patients are twice as likely to experience adverse events during hospitalization (7) as non-isolated patients. The results of stool sample examinations will in most cases be a correct indicator for the identification of patients in need for strict CP, but this information is not available at the time of admission (8).

There are several studies which have investigated the aetiology of acute gastroenteritis in EDs worldwide, all based on the results of the microbiological examination of faecal samples. A German study from 2008 (9) also included risk factors for the length of admission, and an Australian study from 2007-2010 (10) described demographic details, clinical data and risk factor data for the different pathogens. A US study from 2011 (11) included data on clinical features, treatment and outcome depending on the different microorganisms, and a UK study from 2011 (12) compared aetiologic changes over a 15 year period. None of these studies considered the aetiology with special focus on the need of the isolation indication.

Evidence-based guidelines helping clinicians to make the right decision concerning isolation are scarce. The so called "Kaplan criteria" (13) using vomiting, negative stools for bacterial pathogens and duration of the illness of 12-60 hours are suitable to define a Norovirus out-break. The "Vesikari Score" (14) uses duration of vomiting and diarrhoea, maximal number of diarrheal stools and vomiting per 24-hours, duration of fever, and dehydration severity to rank the severity of GE. A Swedish research team has recently developed

an algorithm with very high sensitivity to detect viral gastroenteritis by using anamnestic criteria (15), but the study included only viral gastroenteritis.

There is thus a need to optimize our criteria for isolation of GE in the ED. To make rational decisions concerning isolation procedures, it is essential first to have a basal knowledge of the patient population, specifically its demographic and clinical characteristics, as well as of the distribution of causative agents.

In this study we aimed to describe the incidence and aetiology of acute infectious gastroenteritis in EDs in Denmark with special focus on contagious infectious gastroenteritis caused by norovirus or *C. difficile* that require use of strict CP. We attempted to investigate how many acutely admitted patients had symptoms suggestive of GE, how many patients has a faecal sample tested and what the results were, and how many patients should have been isolated on strict CP according to the results of the faecal samples.

## Methods

### Study population

We conducted a Danish register based historic cohort study that included all patients over 18 years residing in the Region of Southern Denmark and who were acutely admitted to an ED in 2013. The Region of Southern Denmark has a total population of around 1.2 million inhabitants and provides five hospitals with an ED and four of these hospitals provide a microbiological department.
The study linked three data sources: the discharge diagnoses from the Danish National Patient Register (DNPR), microbiology results from faecal samples delivered from the EDs, and the causes for acute referral to the hospital based on the chief complaint.

### Definitions

The definition of GE is based on an unknown causing microorganism. The classification “acute infectious gastroenteritis” requires that the causative microorganism is known. In Denmark contagious infectious gastroenteritis comprises patients with Norovirus or *C. difficile* infections.

The DNPR records all patient contacts with the Danish health care system and registers the discharge diagnoses (16). The discharge diagnoses were classified according to the International Classification of Diseases, version 10 (ICD-10). All gastroenteritis diagnoses were aggregated as shown in the Appendix. Patients were also included if they fulfilled this definition even if they had other diagnosis which could cause diarrhoea due to cancer of the bowel, irritable bowel syndrome, Crohn’s disease, ulcerative colitis, cystic fibrosis, coeliac disease, or another chronic illness but not if the diarrhoea was assumed to be due to drugs, alcohol, or pregnancy (17).

We validated the DNPR gastroenteritis diagnosis by reviewing 15% randomly chosen patient files among those patients who did not have a presenting complaint of gastroenteritis. We scrutinized each file for clinical evidence of gastroenteritis. The files were categorised into definite, probable or no GE according to the following criteria: 1) Definite GE: A) fulfilling 3 criteria: 1) acute onset state with 2) three or more loose stool or any vomiting 3) in 24 hours. B) Fulfilling at least 1 criteria with a stool examination revealing

enteropathogens 2) Probable GE: at least 2 of the 3 criteria + other evidence for the GE diagnosis (isolation, stool samples for GE) 3) No GE: not fulfilling Definite or Probable GE.
For the validation we registered date of admission, age, gender, department, specialty, examination of stools and results, discharge diagnosis, and any mentioned reasons for why the GE was not a presenting complaint. We calculated the positive predictive value (PPV) of the DNPR diagnosis as the proportion of all definite GE/all GE diagnosis and all definite + probable GE/all GE diagnosis and provided a 95% CI for the estimate.

Microbiologically data were results from faecal samples examined for norovirus, *C. difficile* and enteropathogenic bacteria in the microbiological departments. The samples were analyzed with a Polymerase Chain Reaction (PCR) method for norovirus and *C. difficile,* and conventional culture was done for pathogenic gut bacteria according to the four individual microbiological departments' standards.
The interactive patient registration system was used by all included hospitals, and this system recorded clinical data on the admission, patient ID, and the reason for the referral based on 55 chief complaints.

**Data analysis**
All data were handled according to the Danish Data Protection Agency's requirement. To link all data resources the unique person registration number, provided by the Danish Civil Registration System (18) and the date of admission was used. Data were analyzed with simple descriptive statistics and Chi Square test using Stata statistical software, version 14.2 (StataCorp, College Station, Texas, USA) in cooperation with a statistician and a data manager. The cohort was defined partial by the DNPR and partial by the microbiological data or being referred due to chief complaint diarrhoea. All results of the faecal samples send from one patient within the first 72 hours after admission were related to this ED stay. The analytic unit was the number of acute admissions implicating that an individual person can be included more than once in the database. The Charlsons-comorbidity index was calculated by extracting all discharge diagnoses from 2002 – 2012 and using 19 comorbid conditions from the ICD-10 operationalization system to rank comorbidity (19). We divided in Charlsons-comorbidity = 0 for healthy and ≥1 for existing co-morbidities.

**Ethics**
The study was approved by the Danish Data Protection Agency (project ID number. 2008-58-0035/ 1608) and the Danish Health and Medicines Authority (project number 3-3013-799/1/Reference SMFS).

## Results
The five EDs recorded a total of 66,885 acute admissions (on 48,949 individual persons) in 2013. Figure 1 shows the patient flow through the ED.

Of all acute admissions 1.6% were referred and admitted due to the chief complaint "diarrhoea". A total of 2.8 % delivered faecal samples, and 1.7% were discharged with a gastroenteritis diagnosis. All three factors (admitted due to chief complaint diarrhoea, delivering a faecal sample and being discharged with a

gastroenteritis diagnosis) were met by 0.4% and any combination of two factors was met by 0.3 – 0.6% (figure 2).

In total, 4.3% of the patients had some characteristics of AGI since they were either admitted due to the chief complaint diarrhoea, had a faecal sample examination or were discharged with a gastroenteritis diagnosis.

The study population consisted of 48% males and 52% female participants with a mean age of 62.5 years. The age and co-morbidity distribution showed that younger age groups ($p < 0.001$) and patients with no co-morbidities ($p < 0.001$) were more likely to be discharged with a GE diagnosis (table 1).

Overall, 1901 patients have delivered at least one faecal sample, 66 % of the patients suspected for GE. Of those 836 were tested for norovirus (11.5 % positive), 1,754 for *C. difficile* (14.9% positive) and 1,825 were cultured for pathogenic gut bacteria (11% positive) (Table 2).

Norovirus was equally distributed for males and females; the age distribution does not show any pattern. *C. difficile* infection increased with increasing age, ($p< 0.001$) and increasing co-morbidity ($p< 0.001$).

As patients infected with Norovirus or *C. difficile* have to be nursed on strict CP, 358 patients (18.8% of all who delivered a faecal sample) should have been isolated with strict CP according to the results of the faecal samples.

Estimating the confirmed norovirus related ED visits results in 14/10,000 ED visits. For confirmed *C. difficile* cases we estimated 39/10,000 ED visits.

For validation of the DNPR diagnosis 15% of the files from the 762 patients without GE as presenting complaints were scrutinized. Among the 114 randomly selected patients 109 files were accessible for reviews. Among the patients 63% had a stool sample for examination and in these samples 16% were positive for *C. difficile*, 25% for norovirus infection and 9% for other intestinal pathogens. The PPV was 82% (95% CI: 73-88 %) for definitive GE and 92% (95% CI: 85-96 %) for definitive+ probable GE. The reasons for achieving a DNPR GE diagnosis without GE as presenting complaints was that 38 % of the patients were referred primarily with abdominal pain for surgical assessment and during the assessment the history of accompanying GE was revealed. Another 15% had the onset of GE during the ED stay, but were primarily referred for other reasons.

## Discussion

This is the first study assessing the proportion of patients in the ED for whom isolation procedures due to possible contagious GE should be considered. Merging the three criteria chief complaint diarrhoea (met by

1.6% of all acute admissions), having an examination of a faecal sample obtained during the ED visit (met by 2.8%) and being discharged with a gastroenteritis diagnosis (met by 1.7%) revealed that in total for 4.3% of all acutely admitted patients contact precaution procedures had to be considered. Of these patients 66 % provided a faecal sample for analysis, with 11.5% having norovirus infection, 14.9% *C. difficile* infection and 11% other gastrointestinal pathogens. These observations indicate that 18.8 % of the patients who had a faeces sample tested require isolation with strict CP measures.

Our findings are in accordance with our previous smaller study from 2014 (19) where we found that 3.3% of all acute admissions were referred to the ED with a chief complaint of diarrhoea, 3.2% provided a faecal sample and 1.6% were discharged with a gastroenteritis diagnosis. However, the numbers of patients requiring each type of isolation procedure were not estimated in our previous study. Our finding of 11.5% positive samples having norovirus is in concordance with findings from the US (16%) (11) and Australia (10.7%) (10), but is lower than in Germany (23%) (9). Our finding of 14.9% positive stool analysis for *C. difficile* is higher than in the US (5.3%) (11)and Germany (4%) (9), but lower than in Australia (19.2%) (10). The previous mentioned studies from Australia (10), the UK (12) and Germany (9) were all based solely on the results from obtained faecal samples, and did not take patients who did not deliver a faecal sample for analyses into account. The studies therefore give a minimum estimate of the number of admitted patients where assessment of the need for strict CP is needed.

In contrast, the previously mentioned US study (11) reported that 91% of the patients provided a stool specimen. However, just 40% of the patients delivered a whole stool sample and the remaining patients only a rectal swab specimen. Even though this study included all patients who could not deliver a faecal sample, by collecting a rectal swab, it does not account for all patients not meeting the inclusion criteria, but having diarrhoea.

Our study estimated that 14/10,000 ED visits were related to confirmed norovirus infections and 39/10,000 ED visits were related to confirmed *C. difficile* infections. Other studies from the US in 2010 estimated the number of *C. difficile* related ED visits was 4.2/10,000 ED visit (20) and that 14/10,000 ED visits were related to norovirus (21). In both studies the unconfirmed cases of infectious diarrhoea, that probably were isolated until the negative result of the stool examination was available, were excluded. We found an equal distribution for Norovirus in all age groups, an increase of *C. difficile* cases with increasing age and *Campylobacter* and *Salmonella* cases decreased with increasing age, which is similar to findings from Australia (10).

Our study is strengthened by the large number of included patients and completeness of data from different data sources. However, clearing and linking register data implies several limitations: since in the DNPR hospital admission and discharge are recorded separately for every department, the complete hospital stay with the final discharge diagnosis has to be generated. In cases of double reported admissions, the first discharge time was selected, not taking into account if the following discharge diagnoses could be a GE diagnosis. Our validation of the DNPR diagnosis also revealed a PPV of 82-92% for a correct diagnosis. This means that the number of patients who were not referred due to GE but had a GE diagnosis at discharge might be 8-18% lower than our results suggest. As the faecal examinations were undertaken by

four microbiological departments, with small differences in methodology and number of pathogens included in the analysis, the results differ slightly from department to department.

Knowing the aetiology of GE allows choosing the right isolation regime. However, not all patients produce a faecal sample during their stay in the ED. Thus our study estimates that 4.3% of all acutely admitted patients in the participating Danish EDs have symptoms suggestive of gastroenteritis, and the indication for initiating CP has to be assessed in all of these. A faecal sample can only be obtained from 65% of all patients with gastroenteritis symptoms, so the decision of de-isolation must for a large number of patients be based on the clinical courses of the disease and not the result of the faecal sample. Further studies for developing tools to determine the isolation regime are needed. This could include identifying risk factors or a risk score as well as rapid test methods for the examination of faecal samples.

## Conclusion

Merging the three data sources (chief complaint diarrhoea, having an examination of a faecal sample obtained during the ED visit and being discharged with a gastroenteritis diagnosis) we found that contact precaution procedures including isolation due to GE had to be considered in 4.3% of all patients in the ED. Of these patients 66 % delivered a faecal sample for analysis, with 11.5 % having norovirus infection, 14.9% *C. difficile* infection and 11% had infections with other pathogenic gut bacteria. This means that 18.8 % of the patients who delivered a faeces sample should be isolated with strict CP measures. Further studies for developing tools to determine the isolation regime are needed. This could include identifying risk factors or a risk score as well as rapid test methods for the examination of faecal samples.

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## Conflicts of Interests

There are no conflicts of interest to declare.

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# Table I

**Table I: Distribution of chief complaint diarrhoea, delivered faecal samples and GE discharge diagnosis**

| | ED (total) | chief complaint diarrhoea | | delivered faecal sample | | GE diagnosis | | total: at least one factor | | all three factors | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| **total** | 66.885 | 1.065 | 1,6 | 1.901 | 2,8 | 1.141 | 1,7 | 2.874 | 4,3 | 260 | 0,4 |
| **Sex** | | | | | | | | | | | |
| male | 32.306 | 435 | 1,3 | 803 | 2,5 | 455 | 1,4 | 1.192 | 3,7 | 115 | 0,4 |
| female | 34.579 | 630 | 1,8 | 1.098 | 3,2 | 686 | 2,0 | 1.682 | 4,9 | 145 | 0,4 |
| **Age (years)** | | | | | | | | | | | |
| mean | 62,5 | 63.5 | | 63.8 | | 59.4 | | | | 57.6 | |
| 18 - 45 | 14.109 | 246 | 1,7 | 384 | 2,7 | 341 | 2,4 | 636 | 4,5 | 17 | 0,1 |
| 46 - 65 | 17.590 | 219 | 1,2 | 442 | 2,5 | 246 | 1,4 | 641 | 3,6 | 45 | 0,3 |
| 66 - 75 | 13.200 | 189 | 1,4 | 389 | 2,9 | 209 | 1,6 | 566 | 4,3 | 65 | 0,5 |
| 76 - 110 | 21.986 | 420 | 1,9 | 686 | 3,1 | 345 | 1,6 | 1.031 | 4,7 | 75 | 0,3 |
| **Charlsons co-morbidity index** | | | | | | | | | | | |
| healthy | 20.282 | 286 | 1,4 | 616 | 3,0 | 482 | 2,4 | 946 | 4,7 | 97 | 0,5 |
| co-morbid | 30.841 | 423 | 1,4 | 886 | 2,9 | 449 | 1,5 | 1.276 | 4,1 | 84 | 0,3 |

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# Table II

**Table II: Results of the microbiological examination of the faecal samples**

| | Norovirus | | | C. difficile | | | Enteropatogenic bacteria | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Salmonella species | | Campylo bacter species | | Shigella | | Yersinia | | Aeromonas | | Others (1) | |
| | number of samples | positive samples | | number of samples | positive samples | | number of samples | positive samples | | | | | | | | | | |
| | n | n | % | n | n | % | n | n | % | n | % | n | % | n | % | n | % | n | % |
| **total** | 836 | 96 | 11,5 | 1.754 | 262 | 14,9 | 1.825 | 39 | 2,1 | 119 | 6,5 | 2 | 0 | 5 | 0,3 | 14 | 0,8 | 31 | 1,7 |
| **sex** | | | | | | | | | | | | | | | | | | | |
| male | 348 | 35 | 10,1 | 743 | 111 | 14,9 | 771 | 19 | 2,5 | 52 | 6,7 | 0 | 0 | 0 | 0,0 | 6 | 0,8 | 14 | 1,8 |
| female | 488 | 61 | 12,5 | 1011 | 151 | 14,9 | 1054 | 18 | 1,7 | 61 | 5,8 | 1 | 0 | 5 | 0,5 | 8 | 0,8 | 17 | 1,6 |
| **age (years)** | | | | | | | | | | | | | | | | | | | |
| 18 - 45 | 168 | 25 | 14,9 | 357 | 17 | 4,8 | 375 | 14 | 3,7 | 51 | 13,6 | 0 | 0 | 0 | 0 | 3 | 0,8 | 9 | 2,4 |
| 46 -65 | 170 | 12 | 7,1 | 401 | 42 | 10,5 | 429 | 13 | 3,0 | 38 | 8,9 | 1 | 0,2 | 5 | 1,2 | 3 | 0,7 | 12 | 2,8 |
| 66 - 75 | 166 | 18 | 10,8 | 355 | 61 | 17,2 | 366 | 6 | 1,6 | 17 | 4,6 | 0 | 0 | 0 | 0 | 0 | 0,0 | 5 | 1,4 |
| 76 - 110 | 332 | 41 | 12,3 | 641 | 142 | 22,2 | 655 | 4 | 0,6 | 7 | 1,1 | 0 | 0 | 0 | 0 | 8 | 1,2 | 5 | 0,8 |
| **Charlsons Co-morbidity index** | | | | | | | | | | | | | | | | | | | |
| no comorbidity | 282 | 25 | 8,9 | 550 | 47 | 8,5 | 598 | 16 | 2,7 | 57 | 9,5 | 1 | 0,2 | 3 | 0,5 | 8 | 1,3 | 15 | 2,5 |
| existing co-morbidity | 440 | 45 | 10,2 | 817 | 165 | 20,2 | 842 | 9 | 1,1 | 26 | 3,1 | 0 | 0,0 | 2 | 0,2 | 6 | 0,7 | 15 | 1,8 |
| **Chief complaint** | | | | | | | | | | | | | | | | | | | |
| Diarrhoea | 212 | 37 | 17,5 | 432 | 73 | 16,9 | 437 | 13 | 3,0 | 39 | 8,9 | 0 | 0,0 | 1 | 0,2 | 3 | 0,7 | 8 | 1,8 |
| Others | | | | | | | | | | | | | | | | | | | |
| **Discharge diagnosis** | | | | | | | | | | | | | | | | | | | |
| GE diagnosis | 320 | 42 | 13,1 | 1142 | 161 | 14,1 | 639 | 26 | 4,1 | 87 | 13,6 | 1 | 0,2 | 0 | 0,0 | 3 | 0,5 | 14 | 2,2 |
| Others | 516 | 54 | 10,5 | 612 | 101 | 16,5 | 1.186 | 11 | 0,9 | 26 | 2,2 | 0 | 0 | 5 | 0,4 | 11 | 0,9 | 17 | 1,4 |

(1) others: Enteropathogenic E. coli species, Plesiomonas and Vibro Cholerae

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# Figures

Figure 1

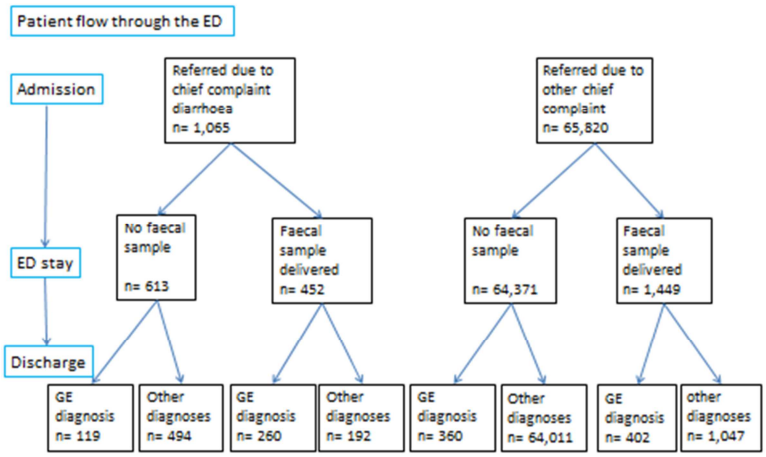
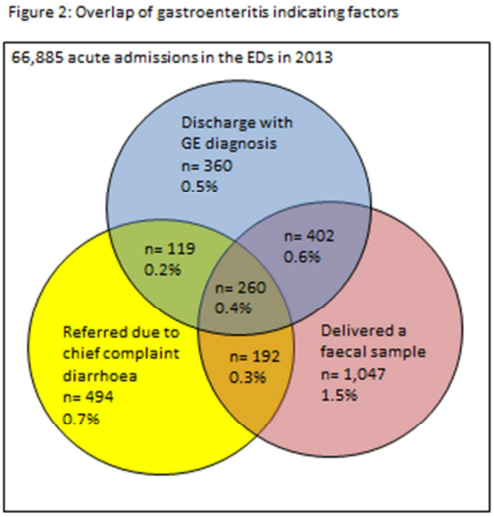



Figure 2



## Table and Figure legends:

**Table I**

Heading: Distribution of chief complaint diarrhoea, delivered faecal samples and gastroenteritis discharge diagnosis

**Table II**

Heading: Results of the microbiological examination of the faecal samples

**Figure 1**

Heading: Figure 1: Patient flow through the emergency department

Legend: ED = Emergency Department

**Figure 2:**

Heading: Figure 2: Overlap of gastroenteritis indicating factors

Legend: ED = Emergency Department, GE = gastroenteritis

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## Appendix

All ICD diagnosis code aggregated to GE diagnosis:

| | |
|---|---|
| DA01 | Typhoid and paratyphoid fever |
| DA010 | Typhoid fever |
| DA011 | Paratyphoid A |
| DA012 | Paratyphoid B |
| DA013 | Paratyphoid C |
| DA014 | Paratyphoid unknown serovar |
| DA02 | Salmonella infection, other |
| DA020 | Salmonella enteritis |
| DA021 | Salmonella sepsis |
| DA028 | Other salmonella infection |
| DA029 | Salmonella infection, unknown serovar |
| DA030 | Bacillary dysentery, caused by Shigella dysenteriae |
| DA031 | Bacillary dysentery, caused by Shigella Flexneri |
| DA032 | Bacillary dysentery, caused by Shigella Boydi |
| DA033 | Bacillary dysentery, caused by Shigella Sonnei |
| DA038 | Bacillary dysentery, other |
| DA039 | Bacillary dysentery unknown cause |
| DA04 | Other bacterial infection |
| DA040 | Enteropathogenic *Escherichia coli* infection |
| DA041 | Enterotoxigenic E coli infection |
| DA042 | Enteroinvasive E coli infection |
| DA043 | Enterohaemorrhagic E coli infektion |
| DA044 | Escherichia coli, other infections |
| DA045 | Campylobacter enteritis |
| DA046 | Yersinia enterocolitica enterocolitis |
| DA047 | Clostridium difficile infection |
| DA048 | Other bacterial enteritis |
| DA049 | Enteritis cause by unknown bacteria |
| DA05 | Bacterial intoxication |
| DA060 | Amoebic dysentery |
| DA07 | Other protozoan infection |
| DA070 | Balantidiasis |
| DA071 | Giardiasis |
| DA071A | Lambliasis |
| DA072 | Cryptosporidiosis |
| DA073 | Isosporiasis |
| DA073A | Coccidiosis intestinalis |
| DA078 | Other specific protozoan infection |

| | |
|---|---|
| DA080 | Rotavirus |
| DA081 | Gastroenteritis caused by Norwalk agents |
| DA082 | Adenoviral enteritis |
| DA083 | Enteritis, other viral |
| DA083A | Gastroenteritis caused by parvovirus |
| DA084 | Presumed viral gastroenteritis (unconfirmed) |
| DA09 | Diarrhoea and gastroenteritis, likely of infectious origin |
| DA090 | Non-specific infectious diarrhoea or gastoenteritis |
| DA099 | Diarrhoea and gastroenteritis of infectious origin |
| DK529 | Other non-infectious gastroenteritis or colitis |
| DK528 | Other forms of infectious gastroenteritis or colitis |

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**Table II: Results of the microbiological examination of the faecal samples**

| | Norovirus | | | C. difficile | | | Enteropatogenic bacteria | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Salmonella species | | | Campylobacter species | | Shigella | | Yersinia | | Aeromonas | | Others (1) | |
| | number of samples | positive samples | | number of samples | positive samples | | number of samples | positive samples | | | | | | | | | | | |
| | n | n | % | n | n | % | n | n | % | n | % | n | % | n | % | n | % | n | % |
| **total** | 836 | 96 | 11.5 | 1,754 | 262 | 14.9 | 1,825 | 39 | 2.1 | 119 | 6.5 | 2 | 0 | 5 | 0.3 | 14 | 0.8 | 31 | 1.7 |
| **sex** | | | | | | | | | | | | | | | | | | | |
| male | 348 | 35 | 10.1 | 743 | 111 | 14.9 | 771 | 19 | 2.5 | 52 | 6.7 | 0 | 0 | 0 | 0.0 | 6 | 0.8 | 14 | 1.8 |
| female | 488 | 61 | 12.5 | 1011 | 151 | 14.9 | 1054 | 18 | 1.7 | 61 | 5.8 | 1 | 0 | 5 | 0.5 | 8 | 0.8 | 17 | 1.6 |
| **age (years)** | | | | | | | | | | | | | | | | | | | |
| 18 - 45 | 168 | 25 | 14.9 | 357 | 17 | 4.8 | 375 | 14 | 3.7 | 51 | 13.6 | 0 | 0 | 0 | 0 | 3 | 0.8 | 9 | 2.4 |
| 46 -65 | 170 | 12 | 7.1 | 401 | 42 | 10.5 | 429 | 13 | 3.0 | 38 | 8.9 | 1 | 0.2 | 5 | 1.2 | 3 | 0.7 | 12 | 2.8 |
| 66 - 75 | 166 | 18 | 10.8 | 355 | 61 | 17.2 | 366 | 6 | 1.6 | 17 | 4.6 | 0 | 0 | 0 | 0 | 0 | 0.0 | 5 | 1.4 |
| 76 - 110 | 332 | 41 | 12.3 | 641 | 142 | 22.2 | 655 | 4 | 0.6 | 7 | 1.1 | 0 | 0 | 0 | 0 | 8 | 1.2 | 5 | 0.8 |
| **Charlsons Co-morbidity index** | | | | | | | | | | | | | | | | | | | |
| no comorbidity | 282 | 25 | 8.9 | 550 | 47 | 8.5 | 598 | 16 | 2.7 | 57 | 9.5 | 1 | 0.2 | 3 | 0.5 | 8 | 1.3 | 15 | 2.5 |
| existing co-morbidity | 440 | 45 | 10.2 | 817 | 165 | 20.2 | 842 | 9 | 1.1 | 26 | 3.1 | 0 | 0.0 | 2 | 0.2 | 6 | 0.7 | 15 | 1.8 |
| **Chief complaint** | | | | | | | | | | | | | | | | | | | |
| Diarrhoea | 212 | 37 | 17.5 | 432 | 73 | 16.9 | 437 | 13 | 3.0 | 39 | 8.9 | 0 | 0.0 | 1 | 0.2 | 3 | 0.7 | 8 | 1.8 |
| Others | | | | | | | | | | | | | | | | | | | |
| **Discharge diagnosis** | | | | | | | | | | | | | | | | | | | |
| GE diagnosis | 320 | 42 | 13.1 | 1142 | 161 | 14.1 | 639 | 26 | 4.1 | 87 | 13.6 | 1 | 0.2 | 0 | 0.0 | 3 | 0.5 | 14 | 2.2 |
| Others | 516 | 54 | 10.5 | 612 | 101 | 16.5 | 1,186 | 11 | 0.9 | 26 | 2.2 | 0 | 0 | 5 | 0.4 | 11 | 0.9 | 17 | 1.4 |

(1) others: Enteropathogenic E. coli species, Plesiomonas and Vibro Cholerae

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**Table I: Distribution of chief complaint diarrhoea, delivered faecal samples and GE discharge diagnosis**

| | ED (total) | chief complaint diarrhoea | | delivered faecal sample | | GE diagnosis | | total: at least one factor | | all three factors | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| **total** | 66,885 | 1,065 | 1.6 | 1,901 | 2.8 | 1,141 | 1.7 | 2,874 | 4.3 | 260 | 0.4 |
| **Sex** | | | | | | | | | | | |
| male | 32,306 | 435 | 1.3 | 803 | 2.5 | 455 | 1.4 | 1,192 | 3.7 | 115 | 0.4 |
| female | 34,579 | 630 | 1.8 | 1,098 | 3.2 | 686 | 2.0 | 1,682 | 4.9 | 145 | 0.4 |
| **Age (years)** | | | | | | | | | | | |
| mean | 62.5 | 63.5 | | 63.8 | | 59.4 | | | | 57.6 | |
| 18 - 45 | 14,109 | 246 | 1.7 | 384 | 2.7 | 341 | 2.4 | 636 | 4.5 | 17 | 0.1 |
| 46 - 65 | 17,590 | 219 | 1.2 | 442 | 2.5 | 246 | 1.4 | 641 | 3.6 | 45 | 0.3 |
| 66 - 75 | 13,200 | 189 | 1.4 | 389 | 2.9 | 209 | 1.6 | 566 | 4.3 | 65 | 0.5 |
| 76 - 110 | 21,986 | 420 | 1.9 | 686 | 3.1 | 345 | 1.6 | 1,031 | 4.7 | 75 | 0.3 |
| **Charlsons co-morbidity index** | | | | | | | | | | | |
| healthy | 20,282 | 286 | 1.4 | 616 | 3.0 | 482 | 2.4 | 946 | 4.7 | 97 | 0.5 |
| co-morbid | 30,841 | 423 | 1.4 | 886 | 2.9 | 449 | 1.5 | 1,276 | 4.1 | 84 | 0.3 |