

Acute Gastroenteritis in Ireland, North and South
A Telephone Survey

This research was commissioned and funded by



Communicable Disease
Surveillance Centre
– Northern Ireland



Department of Public
Health Medicine and
Epidemiology,
University College Dublin



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Surveillance Centre

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Foreword

I am very pleased to present this report on acute gastroenteritis. This report is the result of the collaboration of surveillance, public health, food safety and academic public health organisations in Ireland, North and South.

Acute gastroenteritis is a common but frequently preventable illness. Current measures of the burden of disease caused by acute gastroenteritis are incomplete. What this report adds to the current knowledge is, for the first time, an estimate of the frequency and characteristics of acute gastroenteritis in the community in Ireland, North and South. The size of the problem is much larger than that suggested by statutory notifications or laboratory reports of illness.

Acute gastroenteritis is a common and important public health problem, with significant economic cost. Fluid replacement is the mainstay of treatment, but there is an opportunity to make a bigger impact by preventing the illness occurring. Simple measures such as washing hands and following rules of safe food preparation will prevent its spread.

I would like to thank all the members of the Steering Committee, who provided expert guidance for this study, and to mention in particular Dr Margaret Fitzgerald, the Project Director and Ms Elaine Scallan, the Project Co-ordinator, whose tireless efforts ensured that this study was carried out efficiently and smoothly.

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- Respondents for taking part in the survey.

Executive Summary

Acute gastroenteritis is a common but frequently preventable illness. Its symptoms include a combination of diarrhoea and vomiting, and occasionally abdominal pain, cramps, and fever. The majority of cases are caused by infectious agents including viruses, bacteria, and protozoa. Infectious acute gastroenteritis can be acquired and spread in a number of ways: through close contact with other infected persons, through direct and indirect contact with infected farm animals or pets, or through consuming contaminated food or water. A small proportion of acute gastroenteritis cases are not infectious and can be caused by, for example, pregnancy, bowel disorders, and medication. The focus of this study is on infectious acute gastroenteritis and non-infectious causes have been excluded.

In Ireland, North and South, there are three main sources of information on acute gastroenteritis: routine notifications made by medical practitioners, laboratory reporting, and outbreak surveillance. While these provide useful information, they do not provide a complete picture of the burden of this condition. In addition, many people with acute gastroenteritis do not make contact with their doctor. It is important to know about these people in order to understand the full magnitude of the problem and establish the need for prevention initiatives. In addition, there may be significant economic and social costs associated with this illness. One way to identify the true extent of acute gastroenteritis is to measure illness in the community and not just at the point where the individual has made contact with the health services.

This study was undertaken to estimate the frequency and characteristics of acute gastroenteritis in the community in Ireland, North and South. It also looked at the health-seeking behaviour of those affected and the impact on work and school attendance. The findings of this survey will lead to better interpretation of current information, and will be used to inform policy on public health leading to better planning for the prevention, surveillance, and control of acute gastroenteritis.

A random selection of households, North and South, were contacted by telephone and one member of each household was selected to complete the interview. Almost 10,000 people were interviewed over the 12-month period from December 2000 to November 2001. Of the households contacted, 84.1% participated in the study.

Of the 9,903 respondents surveyed, 394 people reported suffering from acute gastroenteritis in the 4 weeks prior to interview. This corresponds to 4.5% of the population of Ireland, North and South, or a frequency of 0.60 episodes per person per year. If extrapolated to the entire population on the island, this means there are approximately 3.2 million episodes of acute gastroenteritis each year, or 8,800 new episodes each day. The average duration of illness was estimated to be four days. This suggests that there are 35,000 people ill each day in Ireland, North and South. The groups most at risk were children and younger adults. There was also more illness in households with at least one member under 18 years of age.

Twenty-nine percent (29.2%) of those with acute gastroenteritis sought medical care, and 98.8% of these made contact with their GP. If translated into numbers in the population, this corresponds to 3,100 GP consultations each day. Only a small percentage of people attended a hospital casualty department (1.3%) or were admitted to hospital (1.8%). Nine percent (9.1%) of those consulting a GP were asked to submit a stool sample for testing, and 75.0% of these did so. This figure is the equivalent of 180 stool samples being submitted for laboratory testing each day from those with acute gastroenteritis or 64,000 samples annually.

These findings suggest that in Ireland, North and South, for every 100 persons in the community with acute gastroenteritis, 29 persons consult their GP, and 2 stool samples are submitted from the community for laboratory testing.

Forty-seven percent of those with acute gastroenteritis reported taking medication for their symptoms; 17.6% reported taking anti-diarrhoeal agents, while 7.4% were taking antibiotics. The majority (56.5%) of those taking medication purchased it over the counter at a pharmacy, 37.4% were prescribed medication, while 9.3% obtained medication from another source (e.g. already in the home).

It was estimated that for 17.4% of those with acute gastroenteritis, they or a member of their family had to take time off work due to their illness; 19.0% had taken time off school or college. For those who took time off work, the average number of days taken was estimated at 2.7. This amounts to approximately 1.5 million working days lost each year in Ireland, North and South, with €173.5 million or £114.0 million in lost earnings alone.

This study did not examine in detail the causes of acute gastroenteritis. When asked what they thought caused their illness, over half did not know, while 23.3% suspected their illness was due to consuming contaminated food or water, and 17.1% said they had been in contact with an infected person.

Conclusions

- Acute gastroenteritis is an important public health problem in Ireland, North and South
- The magnitude of the problem is much higher than that suggested by statutory notifications or laboratory reporting
- Further research should look at the burden of acute gastroenteritis in general practice. GPs are the primary point of contact for those seeking medical care, however, little is known about GPs management of patients with acute gastroenteritis or what is considered by GPs to be best practice
- Consideration should be given to raising public and professional awareness of the importance of fluid replacement
- There is a need for increased awareness among both professionals and the public regarding the appropriate use of antibiotics

- Further research should examine the risk factors for acute gastroenteritis so that appropriate prevention measures can be implemented
- The economic cost of acute gastroenteritis is substantial. The costs involved in implementing interventions would be offset by the savings achieved through a reduction in the rate of illness
- Measures to prevent acute gastroenteritis are simple. Hand-washing, for example, remains one of the most effective ways to prevent the spread of illness. Following the simple rules of safe food preparation would also control the spread of illness. The challenge is to find new and innovative ways of getting these simple messages across and changing people's behaviour.

Summary of key findings

	Measure (precision*)
Frequency of acute gastroenteritis in any four-week period	4.5% (4.1—4.9)
Episodes of acute gastroenteritis per person per year	0.60 (0.55—0.66)
Percentage with acute gastroenteritis:	
• consulted a GP	29.2% (25.2—33.6)
• attended A&E	1.3% (0.6—2.9)
• were admitted to hospital	1.8% (0.9—3.5)
• submitted a stool sample	2.0% (1.1—3.8)
• reported taking medication	47.0% (42.4—51.6)
• reported taking antibiotics	7.4% (5.3—10.1)
• reported taking anti-diarrhoeals	17.6% (14.4—21.4)
• took time off work	17.4% (14.2—21.2)
• took time off school/college	19.0% (15.6—22.9)
Average duration of illness for those with acute gastroenteritis	4.0 days (3.5—4.5)

Estimates extrapolated to the population of Ireland, North and South

	Number (precision*)
Episodes of acute gastroenteritis:	
• new episodes per day	8,800 (8,000—9,500)
• new episodes per year	3.2 million (2.9—3.5)
Days of illness due to acute gastroenteritis per year	12.6 million (10.8—14.5)
Acute gastroenteritis-related GP consultations	
• consultations per day	3,100 (2,600—3,500)
• consultations per year	1.1 million (0.9—1.3)
Acute gastroenteritis-related stool samples submitted:	
• submitted per day (from the community)	180 (60—290)
• submitted per year (from the community)	64,000 (21,500—106,500)
Working days lost due to acute gastroenteritis per year	1.5 million (1.1—2.0)
Loss of earnings due to acute gastroenteritis per year	€173.5 million (124.4—222.7)
	£114.0 million (81.7—146.3)
School/college days lost due to acute gastroenteritis per year	1.3 million (1.0—1.7)

* This is a 95% confidence interval for each of the estimates.

1. Background

Acute gastroenteritis is a common but frequently preventable illness. Its symptoms include a combination of diarrhoea and vomiting, and occasionally abdominal pain, cramps, and fever. The majority of cases are caused by infectious agents including viruses, bacteria, and protozoa. Viral infections are the most common cause of illness, with Norovirus – so-called winter vomiting bug – and rotavirus being the most common laboratory-confirmed viral agents. Bacterial gastroenteritis is usually caused by infection with *Campylobacter* or *Salmonella*. In a small number of cases *Escherichia coli* O157 or other *E.coli* can cause bacterial gastroenteritis. The main protozoa that cause acute gastroenteritis are *Cryptosporidium* and *Giardia*. A small proportion of cases are not infectious and can be caused by, for example, pregnancy, bowel disorders, and medication; such cases are excluded from this study.

Acute gastroenteritis caused by infectious agents can be acquired and spread in a number of ways. It can be spread through close contact with other infected persons or through direct or indirect contact with infected farm animals or pets. Consuming contaminated food or water can also cause acute gastroenteritis.

Although improvements in hygiene and the treatment of disease have reduced the number of deaths attributable to acute gastroenteritis in developed countries, morbidity remains high.¹ Illness can sometimes have severe and chronic health consequences, particularly for more vulnerable groups such as children, older people, or those with an underlying disease. Illness also places a large economic burden on society, giving rise to direct healthcare costs and indirect costs such as loss of earnings.²⁻⁵

In Ireland, North and South, there are three main sources of information on acute gastroenteritis, though none provide a complete picture.

Medical practitioners are required by law to notify public health authorities of certain cases of acute gastroenteritis that they identify. All cases of acute gastroenteritis in children under two years are notifiable in both North and South. In the North, all cases of food poisoning are notifiable, and in the South, all cases of salmonellosis and bacterial food poisoning are notifiable. There is evidence however that this notification system is incomplete.⁶⁻⁹

Many laboratories in Ireland, North and South, though not all, voluntarily provide public health authorities with information on all microbiologically confirmed cases of acute gastroenteritis. This is a selective subset of those in the community with acute gastroenteritis, as it includes only those who seek medical care and submit a stool sample in which a pathogen is identified by a laboratory participating in this voluntary reporting scheme.

Information on acute gastroenteritis is available from the surveillance of outbreaks. Outbreaks are notified voluntarily to the national surveillance institutes in Ireland, North and South. Such surveillance provides very valuable information on the routes of transmission for infection, and on the contributory factors. It obviously excludes the majority of cases that arise in the community that are not associated with outbreaks.

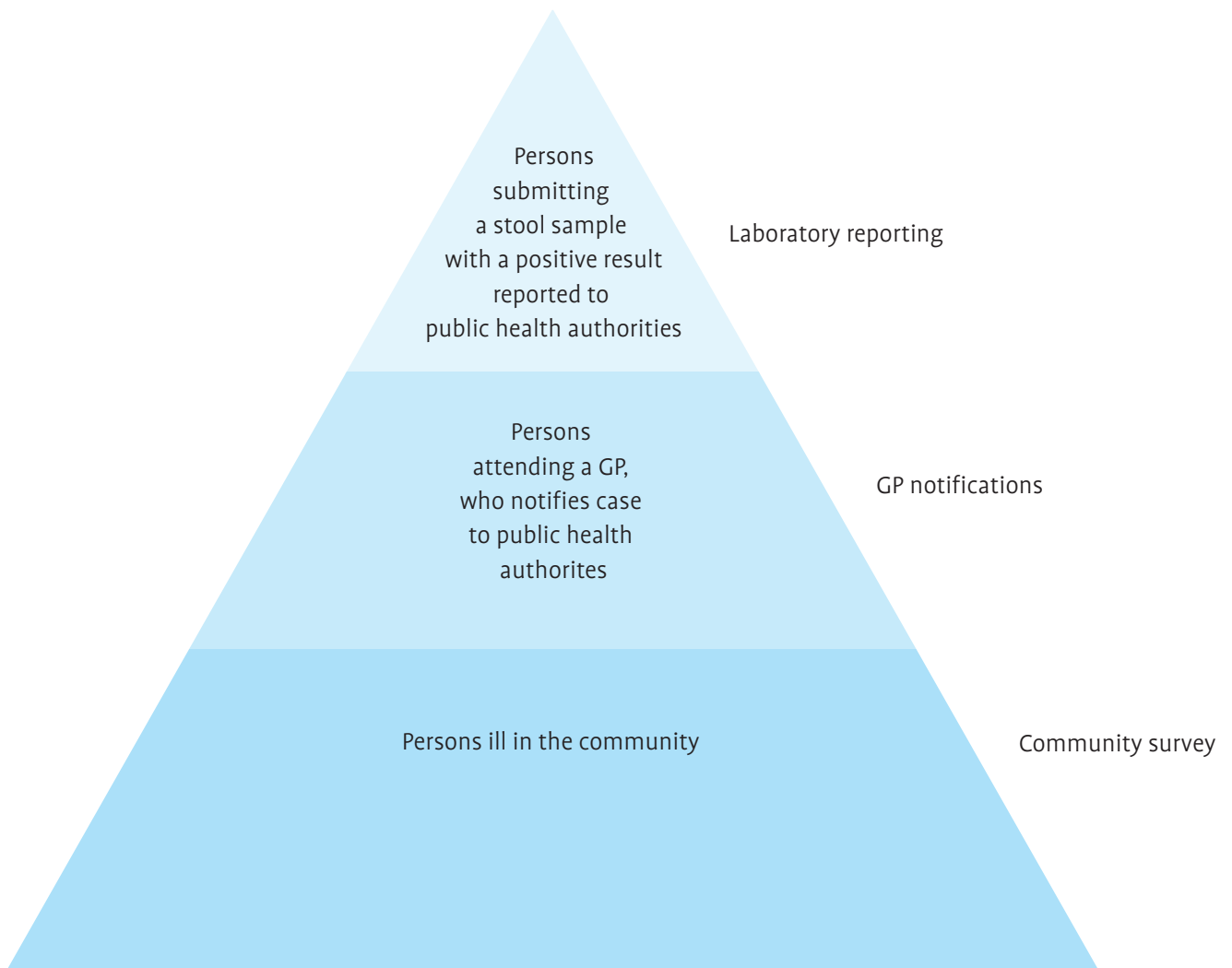
From work elsewhere, it is known that many people do not make contact with the health services when they have acute gastroenteritis and are not captured by any of the three routine surveillance systems.¹⁰ It is important to know about these people in order to understand the full magnitude of the problem and establish the need for prevention initiatives. In addition, there may be significant economic and social costs associated with this illness.

One way to identify the true extent of acute gastroenteritis in Ireland, North and South, is to measure illness in the community, and not just at the point where the individual has made contact with the health services. A study carried out in England and Wales found that for every 136 cases in the community, 23 presented to the general practitioner, 6.2 stool samples were submitted to laboratories, there were 1.4 positive laboratory results, and one case was reported to the national surveillance system.¹⁰ In the USA, it is estimated that only 5 percent of bacterial foodborne illness is reported.¹¹ This issue is often illustrated as an iceberg or pyramid, as shown in Figure 1.1.

The aim of the present study was to measure the extent of acute gastroenteritis in the community on the island of Ireland. The health-seeking behaviour of those suffering from acute gastroenteritis and the impact in terms of absence from work and school was also examined. This survey allows for identification of the proportion of people with acute gastroenteritis in the community that is not identified by routine means. The findings of this survey will lead to better interpretation of current information, and will be used to inform policy on public health, leading to better planning for the prevention, surveillance, and control of acute gastroenteritis.

The study was carried out in Ireland, North and South using a telephone survey. A random selection of households was contacted by telephone and one member of each household was selected to complete the interview. Almost 10,000 people were interviewed over the 12-month study period from December 2000 to November 2001. This method of obtaining health information on the general population has been used with success in other countries.¹²

Figure 1.1: Burden of acute gastroenteritis



2. Methodology

2.1 Introduction

This section describes the aim and objectives of the study and the methodology employed.

2.2 Aim and objectives

The aim of this survey was to estimate the frequency of acute gastroenteritis in Ireland, North and South using a telephone survey method.

The specific objectives were:

- to describe the epidemiology of acute gastroenteritis in terms of frequency, duration, seasonality, and the socio-demographic profile of those who report illness
- to examine the health-seeking behaviour of those with acute gastroenteritis in relation to self-medication and contact with the health services
- to describe the impact of acute gastroenteritis in the community in terms of absence from work and/or school
- to evaluate the practical use of a telephone survey method as a tool for health-related research.

This report describes the results from objectives 1, 2 and 3. A detailed report outlining the methodology employed and evaluating the use of a telephone survey methodology (objective 4) will be published at a later date.

2.3 Case definition

The case definition of acute gastroenteritis was based on self-reporting and as used in this report was:

- diarrhoea three or more times in a 24-hour period
or
- bloody diarrhoea
or
- vomiting together with at least one other symptom (diarrhoea, abdominal pain/cramps, fever)
 - in the four weeks prior to the interview
 - in the absence of a known non-infectious cause.

Respondents were excluded if they considered their symptoms to be due to non-infectious causes of diarrhoea or vomiting such as Crohn's disease, ulcerative colitis, excess alcohol, pregnancy, menstruation, or medication known to cause vomiting (e.g. chemotherapy).

2.4 Research methods

This study was carried out over the 12-month period from December 2000 to November 2001, inclusive. Households were randomly contacted by telephone and one member of each household was selected to complete the interview.

2.4.1 Telephone sample selection

Respondents were selected using a technique called random digit dialling (RDD). This method allows any household in the sampling area to be included in the survey even if the telephone number is not listed in a telephone directory (i.e. ex-directory number). Only fixed-line (land-line) telephone numbers were included; mobile telephone numbers were not. The majority of mobile telephone users also have access to a fixed-line and including both would have biased the survey.¹³

In the South, approximately 85%† of private households have a fixed-line. The corresponding figure in the North is 89% while in the UK overall this figure is 95%.¹⁴ Whilst coverage in Ireland, North and South is lower than reported in other countries, this survey method still provides better coverage than other methods.

An initial list of telephone numbers was chosen randomly using published residential telephone numbers from each of the eight telephone directories in Ireland, North and South. By deleting the last two digits of these numbers, valid area codes and stems were identified. One hundred valid telephone numbers (which would include unlisted numbers) were then generated for each area code and stem by replacing the deleted digits with the numbers 00 to 99. The telephone numbers used in the survey were then randomly chosen from this large list.

2.4.2 Respondent selection

Interviews were conducted on two days each week (eight to nine days each month). The days of the week interviews were conducted varied from week to week. The timeframes for interviewing were between 5.00p.m and 9.00p.m on weekday evenings and 1.00p.m and 6.00p.m at weekends. Interviewers received training before commencing the project and all interviews were conducted from a central location. There were four interviewers and the interviewing team remained consistent throughout the study period.

If a call to a sampled telephone number was engaged, rang out, or connected to an answering machine, the number was re-dialled on up to three more occasions, where possible at different times and on different days. Messages were left on answering machines explaining the purpose of the call and that the interviewer would call again.

Once contact was made, the interviewer asked if the telephone was in a private household. If the randomly selected number was a business, institution, or other non-residential premises, the number was considered ineligible and no interview was conducted.

† There are currently 1.09 million residential PSTN (Public Switched Telephone Network) lines in the South.³¹ The estimated number of households in the South is 1.29 million.³²

If the number of residential PSTN lines is divided by the number of residential households, the estimated percentage of households with a fixed line is $1.09/1.29 = 84.5\%$.

Interviewers used a standard introduction including a request for participation and assurance of confidentiality. Within each household a respondent was selected by asking to speak to the person who was next to celebrate a birthday. This is an established procedure intended to reduce any bias in favour of the type of person most likely to answer telephone calls. Only persons normally resident in the household and present in the household at the time of the call were included.

If the person selected was under 12 years of age, a parent or guardian was asked to conduct the interview on the child's behalf. If the person selected was aged 12–16 years, a parent or guardian was given the option of answering on the child's behalf or consenting for the child to be interviewed.

2.4.3 Sample size

The target sample size was 9,600, comprising 800 completed questionnaires each month for 12 months from December 2000 to November 2001 (400 in the South and 400 in the North). Calculations were based on the assumption that the prevalence of acute gastroenteritis was approximately 5%. This sample size allowed the frequency of acute gastroenteritis to be estimated to within $\pm 0.6\%$ in Ireland, North and South separately. Precision estimates were based on 95% confidence intervals (see section 2.4.7.2 for an explanation of confidence intervals).

2.4.4 Questionnaire

Similar survey instruments, used in other countries, were reviewed and a questionnaire was developed specifically for the purposes of this study (see appendix C). The questionnaire comprised five sections and collected information on:

- call details: information was collected on the number of people in the household at the time of the telephone call and whether the questionnaire was being answered on behalf of the selected respondent
- demographic information: the respondent's sex, age, and county of residence were recorded. Information on household size and the occupation of the main earner was also documented
- symptoms of acute gastroenteritis: respondents were asked if they had suffered from abdominal pain/cramps, fever, vomiting, diarrhoea, or bloody diarrhoea in the four weeks prior to interview. Respondents were also asked what they thought had caused their illness
- medical consultation and treatment: respondents were asked if they had consulted a GP, attended a hospital casualty department, been admitted to hospital, or submitted a stool sample for testing. Use of medication was also detailed
- social and economic impact of illness: respondents were asked if they or anyone else in their household had taken time off work or school/college due to their symptoms.

2.4.5 Pilot studies

A preliminary study was carried out during 1998 in order to determine the feasibility of conducting a telephone-based population survey, to establish the basis of the sample size calculations, and to identify operational problems. Three methods of sampling were examined:

- random selection from telephone directories followed by a letter being sent to the selected household giving prior notification
- random selection from telephone directories but with no letter of notification
- random digit dialling (RDD) as described above.

The populations identified using each of the three methods did not differ significantly from one another in terms of age, sex, or household size. In addition, no significant geographical variation was identified. The achieved response rate was higher with prior notification by post. However, RDD was considered the most appropriate method because, unlike sampling from the telephone directory, it gave access to all households with a fixed-line including those with ex-directory numbers.

A study was carried out during October 2000 to pilot the questionnaire.

2.4.6 Ethical approval

Ethical approval was sought from the Research Ethics Committee of the Queen's University Belfast. The committee were of the opinion that the study was an audit and therefore, formal ethical approval was not required.

2.4.7 Statistical analysis

2.4.7.1 Statistical weighting and presentation of results

The study was designed to have equal sample sizes in Ireland, North and South, in order to allow estimates to be calculated to the same precision in both jurisdictions. However, since 68% of the total population lives in the South and 32% lives in the North, the total sample is not representative of the population of the island (the South is under-represented and the North is over-represented). To obtain estimates that pertain to the island of Ireland, it is necessary to use a weighted analysis which accounts for this under/over-representation. Additionally, the age and sex distribution of the sampled persons did not completely match that expected in the populations based on census data (see section 3.3). Again, using an appropriate weighted analysis, results for the island also take account of these more minor discrepancies.

Accordingly, unless otherwise stated, percentages and means given in this report for the island of Ireland are adjusted for the different sampling fractions, North and South, and for age and sex imbalances *vis à vis* the population. These weighted results give a more accurate estimate of the underlying situation than the crude figures based on the entire sample. Percentage results are thus given without the component numbers since they are based on the appropriate weighting of the separate age/sex/area figures (see appendix D for more

detailed explanation of the weighting system used). The separate results for Ireland, North and South are, however, given as raw data including component numbers without any age/sex weighting (see appendices A and B).

Where the survey results are translated into numbers in the population, figures have been rounded up appropriately.

2.4.7.2 *Statistical precision*

All estimates given in this report are derived from the sample survey figures. It is important to realise however, that because only a sample was studied rather than the full population, there is a margin of error in these estimates. The margin of error is given for many of the major findings in the report and is expressed in brackets after the estimate itself. Thus 4.5% (4.1%–4.9%) of the respondents reported suffering from acute gastroenteritis in the four weeks prior to interview. Technically, what is presented is a '95% confidence interval' and the above example can be interpreted as follows: the best estimate available for the proportion of the population (of the island) who suffered from acute gastroenteritis, i.e. 4.5%; it may not be the exact percentage in the population, but with 95% certainty the true percentage in the population suffering symptoms is likely to be between 4.1% and 4.9%. In tables, the margin of error is called the precision.

With 95% certainty, the true population figure is within the margin of error given.

2.4.7.3 *Statistical significance*

When percentages or means are being compared between groups in a sample survey, the margin of error in the estimates should be allowed for. For instance, in this report (see section 4.2.1) 3.5% of males and 5.5% of females were estimated to have suffered from acute gastroenteritis in the previous four weeks. These sample estimates show a male/female difference but it is possible that this may not reflect the true situation in the population. The observed male/female difference may be due to chance and reflect nothing more than the margin of error in any sample results, rather than being due to a real difference between the male and female populations.

Rather than just looking at the margins of error in the sample figures, what is usually done in such a situation is to perform a statistical significance test (also called a hypothesis test). The result of the significance test tells if the observed finding (here a 3.5% versus 5.5% male/female difference) is likely to be due to chance or not, and is given by what is called a p-value. The p-value is the chance that the observed result is totally spurious. If the p-value is small (arbitrarily, less than 5% or 1 in 20) then chance is considered an unlikely explanation of the observed difference and it can be concluded that there is in fact a real difference in the population. This is usually written as ' $p < 0.05$ ' and is called a 'statistically significant result'. If the p-value is above 5% ($p > 0.05$), the result is referred to as 'non-significant' (NS), concluding that chance is a possible explanation of the observed difference. The observed male/female difference in the example is statistically significant, suggesting a real male/female difference in the population.

A statistically significant result is one not likely to be due to chance ($p < 0.05$).

In this study, comparisons between groups were statistically tested using the chi-square test (comparing percentages) and the t-test (comparing means). Analysis was performed using the SPSS version 10.0 (Statistical Package for the Social Sciences) computer package.

Confidence intervals for quantities based on a combination of results from different parts of the survey were based on the usual formula for the variance of a product applied to the standard errors of the components (e.g. to find the average time off work due to symptoms per person per year based on the time off work per episode).¹⁵

Lifetable methods were employed to estimate the mean and median duration of symptoms because a percentage of those with symptoms were still suffering from those symptoms at the time of interview.¹⁶

3. Completeness and Representativeness

3.1 Introduction

This section summarises the main results on the completeness and representativeness of the survey sample.

3.2 Response rate

Over 22,000 randomly selected telephone numbers were used during the 12-month study period (figure 3.1). Of these, 5,378 were ineligible, defined as invalid numbers, or numbers assigned to non-residential customers. There was no answer from 5,121 numbers (after up to four attempts), and for the remaining 11,782 numbers, contact was made with a private household. From these, 9,903 completed interviews were obtained.

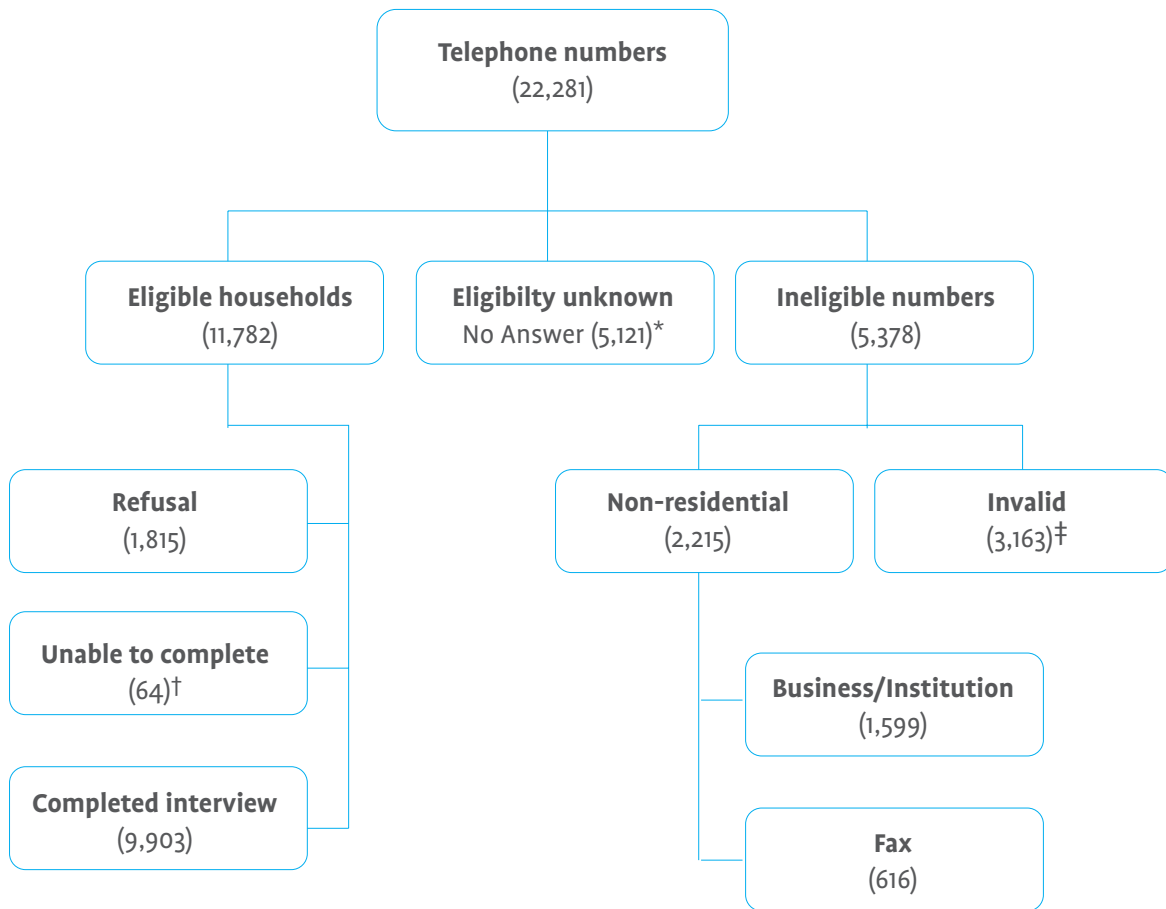
The response rate for any survey is taken as the number of completed interviews divided by the number of valid potential responders. Varying definitions of what should be included in the category 'valid potential responders' gives rise to different estimates of the response rate. If the valid potential responders are defined as known eligible telephone numbers in private households, this gives a response rate of 84.1% (9,903/11,782).

It could be argued that the valid potential responders should include private households that did not answer their phone. Unfortunately the distribution of residential and business numbers among the unanswered numbers is unknown. On the assumption that the distribution is the same as in the population†, 3,513 (68.6%) of the 5,121 unanswered telephone numbers would be residential raising the number from 11,782 to 15,295. This would correspond to a response rate of 64.8% (9,903/15,295). However, the proportion of business telephone numbers among those unanswered is likely to be much higher than that found in the general population due to the time at which interviews were conducted (i.e. evenings and weekends) and, therefore, this response rate underestimates the true value. If unanswered telephone numbers are to be accounted for, all that can be said about the response rate is that it lies somewhere between 64.8% and 84.1%.

† There are currently 1.59 million PSTN (Public Switched Telephone Network) lines in the South of which 68.6% (1.09 million/1.59 million) are residential and 31.4%

(0.5 million/1.59 million) are business lines.³¹ Because an estimate for the North was not available it was assumed that the distribution of residential/business was similar in the North.

Figure. 3.1: Outcome of telephone numbers called



* Telephone numbers where no answer was obtained include numbers which were ringing out, or were engaged or were connected to an answering machine (after up to three contact attempts were made)

‡ Invalid numbers are numbers which were not in use

† Respondents were unable to complete the interview due to language difficulties (7) or due to sickness or disability (57).

3.3 Representativeness

The distribution of survey respondents by county is detailed in appendix E. While some counties were under- or over-represented, the geographical distribution of respondents was broadly similar to that of the population of the island of Ireland.

Table 3.1 shows the sex distribution of survey respondents compared to the population. Males were somewhat under-represented in both the North and South. Previous studies using similar telephone survey methodologies have also reported a bias in favour of female respondents.^{17;18}

Table 3.1: Sex distribution of survey respondents compared to the population of Ireland, North and South

	North				South			
	Survey		Population		Survey		Population	
Sex	N	%	N('000)	%	N	%	N('000)	%
Males	2,040	41.4	828.6	49.0	2,017	40.6	1,800.2	49.6
Females	2,883	58.6	863.2	51.0	2,950	59.4	1,825.9	50.4
Total	4,923	100.0	1,691.8	100.0	4,967	100.0	3,626.1	100.0
Not recorded	(7)				(6)			

Younger age groups were under-represented in both regions (see appendix F). However, there was overall agreement with household size (see appendix G).

The under-representation in younger age groups may be due to children and younger adults being absent from the home at the time of the telephone call. Some parents may have been unwilling to complete a questionnaire about their child, though no objections to this were noted by the interviewers. Studies in the UK have reported that between 5% and 6% of households have access to a mobile telephone only.¹³ It is possible that households with mobile telephones only are occupied by younger people (e.g. students) and were, therefore, not included in the study sample.

As already mentioned however, estimates given in this report are corrected for these age/sex discrepancies and give figures applicable to the entire population of the island of Ireland.

4. Acute Gastroenteritis in the Community

4.1 Introduction

This section outlines the results on frequency and duration of acute gastroenteritis in the community in Ireland, North and South. The health-seeking behaviour of those with acute gastroenteritis and impact in terms of absence from work and school is also outlined.

The results presented here are the best estimate for the whole island. Results have been adjusted for the different sampling fractions, and are weighted to reflect the age and sex distribution on the island. Component numbers are not given as results are based on appropriate weighting of the separate age/sex/area figures. Separate results for the North and the South are given as raw data, including component numbers without any age/sex weighting, in appendices A and B respectively.

4.2 Estimated frequency of acute gastroenteritis

Four-and-a-half percent (4.5%; 4.1%–4.9%) of people were estimated to have suffered from acute gastroenteritis at least once in a four-week period (table 4.1). This means that approximately 1 in 20 people experienced at least one episode of illness in a four-week period.

The figure of 4.5% (or more precisely 4.49%) is an estimate of the percentage of persons in the population who, at any one time in the year, could report having had such symptoms in the previous four weeks. Therefore, among 100 people, approximately 4.5 would be expected to have at least one separate episode of acute gastroenteritis sometime in the previous four weeks. There are 13.04 periods of four weeks in the year (365 days/28 days) which means that among 100 people there would be $13.04 \times 4.49 = 58.55$ occurrences of acute gastroenteritis during the year. This represents an average of 0.586 occurrences of acute gastroenteritis per person per year, where an occurrence is defined as any symptoms in a four-week period.

However, the questionnaire asked about any symptoms in the past four weeks, and for a certain number of people a positive response may have represented more than one separate episode of acute gastroenteritis in the four-week period. It is possible to convert the 0.586 occurrences of acute gastroenteritis per person per year to an estimate of the number of separate episodes of acute gastroenteritis. This calculation yields an average of 0.60 (0.55–0.66) separate episodes of acute gastroenteritis per person per year (see appendix D for a detailed explanation). This is the figure that will be used in various calculations in the remainder of this report.

An average of 0.60 (0.55–0.66) separate episodes of acute gastroenteritis per person each year corresponds to approximately 3.2 million (2.9 million–3.5 million) episodes of acute gastroenteritis on the island of Ireland each year, or 8,800 (8,000–9,500) new episodes each day. This clearly indicates that acute gastroenteritis is a frequent and important cause of morbidity on the island.

Table 4.1: Estimated frequency of symptoms of acute gastroenteritis in a four-week period †

Symptoms	%
Case definition: Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and one other symptom*	4.5
Diarrhoea (any) or vomiting	5.8
Vomiting	3.5
Vomiting without diarrhoea	1.0
Diarrhoea (any)	4.8
Diarrhoea (any) without vomiting	2.2
Diarrhoea (any) with vomiting	2.6
Diarrhoea (3+ in 24 hours) or vomiting	5.0
Diarrhoea (3+ in 24 hours)	3.3
Diarrhoea (3+ in 24 hours) without vomiting	1.4
Diarrhoea (3+ in 24 hours) with vomiting	1.9
Bloody diarrhoea	□
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and two other symptoms*	3.9
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and one more symptom or vomiting and one other symptom*	4.8
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and two more symptoms or vomiting and two other symptoms*	3.9

† Non - infectious causes have been excluded including, Crohn's disease, ulcerative colitis, excess alcohol, pregnancy, menstruation or medication.

* Other symptoms include diarrhoea, vomiting, abdominal pain, abdominal cramps, fever.

□ Value is less than 0.1

4.2.1 Estimated frequency of acute gastroenteritis by age and sex

Age was significantly associated with acute gastroenteritis ($p < 0.05$). The estimated frequency of illness was higher in young children compared to older age groups. This finding is consistent with other studies.^{10,12,19–22} Females aged 5–24 years and 25–44 years were significantly more likely than males to suffer from acute gastroenteritis ($p < 0.05$). The estimated frequency of acute gastroenteritis in females was higher than males in each of the other age groups, but differences were not statistically significant. The frequency of acute gastroenteritis decreased with age for both males and females (table 4.2).

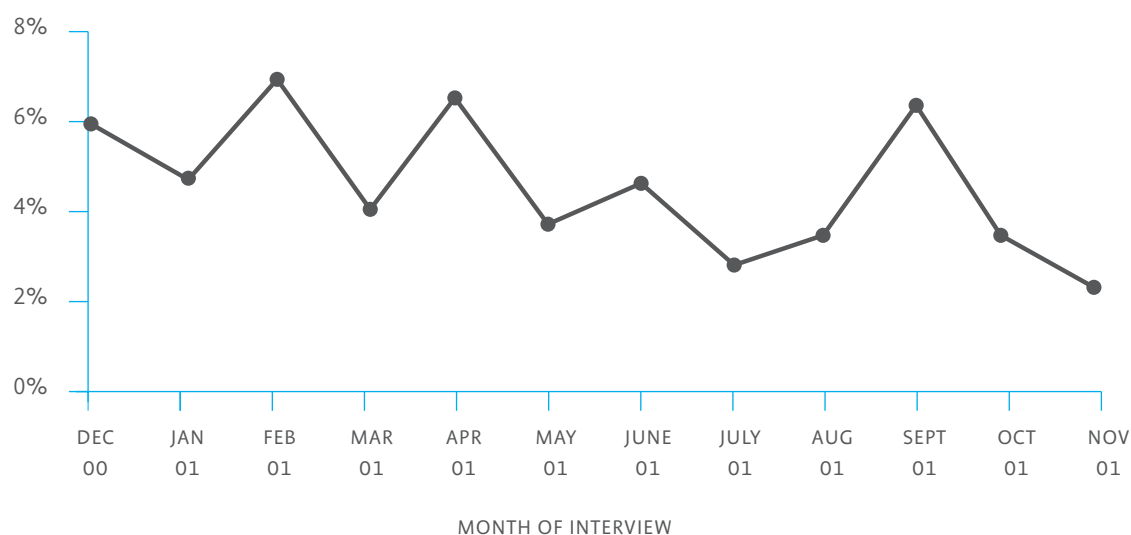
Table 4.2: Estimated frequency of acute gastroenteritis in a four-week period, by age and sex

	Males	Females	Total
Age group	%	%	%
<5 years	8.3	12.5	10.5
5–24 years	4.2	6.1	5.1
25–44 years	3.1	6.1	4.6
45–64 years	2.3	3.0	2.6
65+ years	1.2	2.7	2.1
All age groups	3.5	5.5	4.5

4.2.2 Estimated frequency of acute gastroenteritis by month of interview

The frequency of acute gastroenteritis differed significantly by month of interview, ($p < 0.05$) (figure 4.1). The highest frequencies were during interviews conducted in February (6.7%), April (6.4%) and September (6.1%). It is important to note that these figures refer to the month of interview and are not necessarily concurrent with the month of illness.

Figure 4.1: Estimated frequency of acute gastroenteritis in a four-week period, by month of interview



4.2.3 Estimated frequency of acute gastroenteritis by household size

Just over half the households (51.3%) had at least one household member under 18 years of age. People living in such households were significantly more likely to suffer from gastroenteritis than those living in households with no-one under the age of 18 years (5.8% compared to 3.1%; $p < 0.01$).

Households of three or more people were also more likely to suffer from acute gastroenteritis

($p < 0.05$) (table 4.3). However, these households were more likely to include someone under the age of 18 years and this explains their higher rate of illness. When data were analysed separately for households with and without a household member under 18 years, there is no significant increase in the frequency of acute gastroenteritis with household size.

Table 4.3: Estimated frequency of acute gastroenteritis in a four-week period, by household size and type

	Household size (number of persons)			All households
	1	2	≥ 3	
Household type	%	%	%	%
Household with someone under 18 years of age	—	7.6	5.8	5.8
Household with no-one under 18 years of age	3.0	2.8	3.6	3.1
All households	3.0	3.1	5.2	4.5

4.2.4 Estimated frequency of acute gastroenteritis by occupation of the main earner

The estimated frequency of acute gastroenteritis was lowest among respondents who gave ‘farmer’ or ‘unskilled manual worker’ as the occupation of the main earner in the household (table 4.4). In professional/senior managerial and non-manual occupations, the estimated frequency of illness in a four-week period was approximately 5%. Occupational differentials were statistically significant ($p < 0.05$).

Table 4.4: Estimated frequency of acute gastroenteritis in a four-week period, by occupation of the main earner

Occupation of main earner	%
Other non-manual worker	5.2
Professional/senior managerial	5.1
Self-employed (not farmer)	4.5
Skilled manual worker	4.4
Never worked	4.3
Farmer (self-employed)	2.9
Unskilled manual worker	2.9

4.2.5 Estimated frequency of acute gastroenteritis by foreign travel

It was estimated that, at any point in time, 8.6% of the population had travelled outside the island of Ireland in the previous two weeks. Travel was not found to be associated with acute gastroenteritis. It was estimated that a similar proportion of respondents suffered from acute gastroenteritis among those who had travelled (4.7%) and those who had not (4.5%).

4.3 Duration of illness

The average duration of illness was estimated to be four days (3.5–4.5). The median number of days ill was three and the mode was one. This was expected as most acute gastroenteritis is viral in origin which is usually characterised by mild illness of short duration.

While the estimated duration of illness was short, when coupled with the estimated frequency of illness it corresponds to approximately 34,600 (29,600–39,700) people in Ireland, North and South, ill each day due to acute gastroenteritis, or 12.6 million (10.8 million–14.5 million) days of illness each year.

The estimated number of days ill was 3.5 (3–4) for males and 4.1 (3.5–4.7) for females. Table 4.5 shows the estimated mean duration of illness by age group.

Table 4.5: Estimated mean number of days ill due to acute gastroenteritis, by age

Age group	Days ill	
	Mean	Range
<5 years	4.0	3.1–4.9
5–24 years	3.2	2.9–3.5
25–44 years	4.2	3.1–5.3
45–64 years	4.8	2.9–6.7
65+ years	5.2	2.6–7.8
All age groups	4.0	3.5–4.5

4.4 Suspected cause of illness

Over half of those with acute gastroenteritis did not know what might have caused their illness (table 4.6). Twenty-three percent suspected their illness had been caused by consuming contaminated food or water.

Table 4.6: "What do you think caused your illness?"

Cause	%
Don't know	53.8
Contaminated food	18.2
Contact with infected person	17.1
Contaminated water	5.1
Flu	2.0
Infection	1.9
Over-eating/diet	0.7
Food allergy/food intolerance	0.5
Other	0.6
Total	100.0

Of those who suspected that their symptoms were due to eating contaminated food, the majority thought it was food consumed outside the home (table 4.7). Seventy-four percent (73.8%) suspected their illness was due to food consumed in commercial premises such as restaurants, cafés, take-aways, hotels and public houses.

Table 4.7: "Where do you think you got the food that caused your symptoms?"

Location	% of respondents suspecting contaminated food
Restaurant/café	38.1
Take-away	29.1
Own home	13.6
Shop	3.8
Don't know	3.8
Hotel	3.3
Public house	3.3
School	1.8
Staff canteen	1.6
Private house (other than own home)	0.9
Other	0.7
Total	100.0

4.5 Health-seeking behaviour

It was estimated that 70.6% of those with acute gastroenteritis did not seek medical care for their symptoms. This would suggest that most people had relatively mild and self-limiting symptoms. Most of those seeking medical care consulted a GP (see section 4.5.1) while a small percentage attended a hospital casualty department (1.3%; 0.6%–2.9%) or were admitted to hospital (1.8%; 0.9%–3.5%).^{12;20;21}

4.5.1 General practitioner (GP) consultations

Twenty-nine percent (29.2%) of those with acute gastroenteritis consulted a GP. Age was significantly associated with consulting a GP ($p < 0.05$). The estimated frequency of consulting a GP was highest in children and in adults aged 65 years and over (table 4.8). This finding is consistent with other studies.^{12;19;21} There was no significant difference between males and females.

Table 4.8: Estimated frequency of those with acute gastroenteritis who consulted a GP, by age and sex

	GP Consulted		
	Males	Females	Total
Age group	%	%	%
<5 years	53.6	44.4	48.6
5–24 years	30.1	29.6	30.2
25–44 years	11.9	20	17.3
45–64 years	16.7	24.1	20.8
65+ years	50.0	42.1	44.0
All age groups	28.3	29.3	29.2

Of those consulting a GP, it was estimated that most (89.3%) did so only once, 6.1% were had two consultations, while 4.6% had between three and five consultations. This suggests that there are approximately 3,100 (2,600–3,500) acute gastroenteritis-related GP consultations in Ireland, North and South, each day, or 1.1 million (0.9 million–1.3 million) GP consultations each year.

It was estimated that almost two-thirds (62.5%) of consultations were made by visiting a GP’s surgery, 22.4% were made by telephone while 15.1% of consultations took place in the patient’s home.

The mean duration of illness for those consulting a GP was 5.1 days (4.2–6.0), compared to 3.2 days (2.8–3.6) in those who did not. The medians were four and two days respectively.

Of respondents who did not know what had caused their symptoms, 32.2% consulted a GP. This compares to 21% who attributed their symptoms to consuming contaminated food or water and 28.6% of respondents who said they had been in contact with an infected person (NS).

4.5.2 Stool samples

It was estimated that 9.1% of those with acute gastroenteritis who sought medical care were asked to submit a stool sample for testing, and of these 75.0% complied with this request (6.9% of all those seeking medical care). This represents an estimated 2.0% (1.1%–3.8%) of all those with acute gastroenteritis. Figure 4.2 shows this data. This means that approximately 180 (60–290) stool samples are submitted for testing each day for individuals with acute gastroenteritis on the island or 64,000 (21,500–106,500) samples annually (figure 4.3).

Another way of expressing this is that for every 100 persons in the community with acute gastroenteritis, 29 persons consult their GP, and 2 stool samples are submitted for laboratory testing (figure 4.4).

Estimates for the number of stool samples submitted are based on a small number of people. Only six respondents in the South and four respondents in the North said they had been asked to submit a stool sample for testing. Of the ten respondents, nine complied with this request; five in South and four in the North. Only one respondent said a 'bug' had been identified, however they were unable to recall the name of the bug. Of the remaining eight respondents, three said no pathogen was identified and five said they were not aware of the result of the test.

Figure 4.2: Estimated frequency of acute gastroenteritis and related GP consultations and stool sample submissions in Ireland, North and South

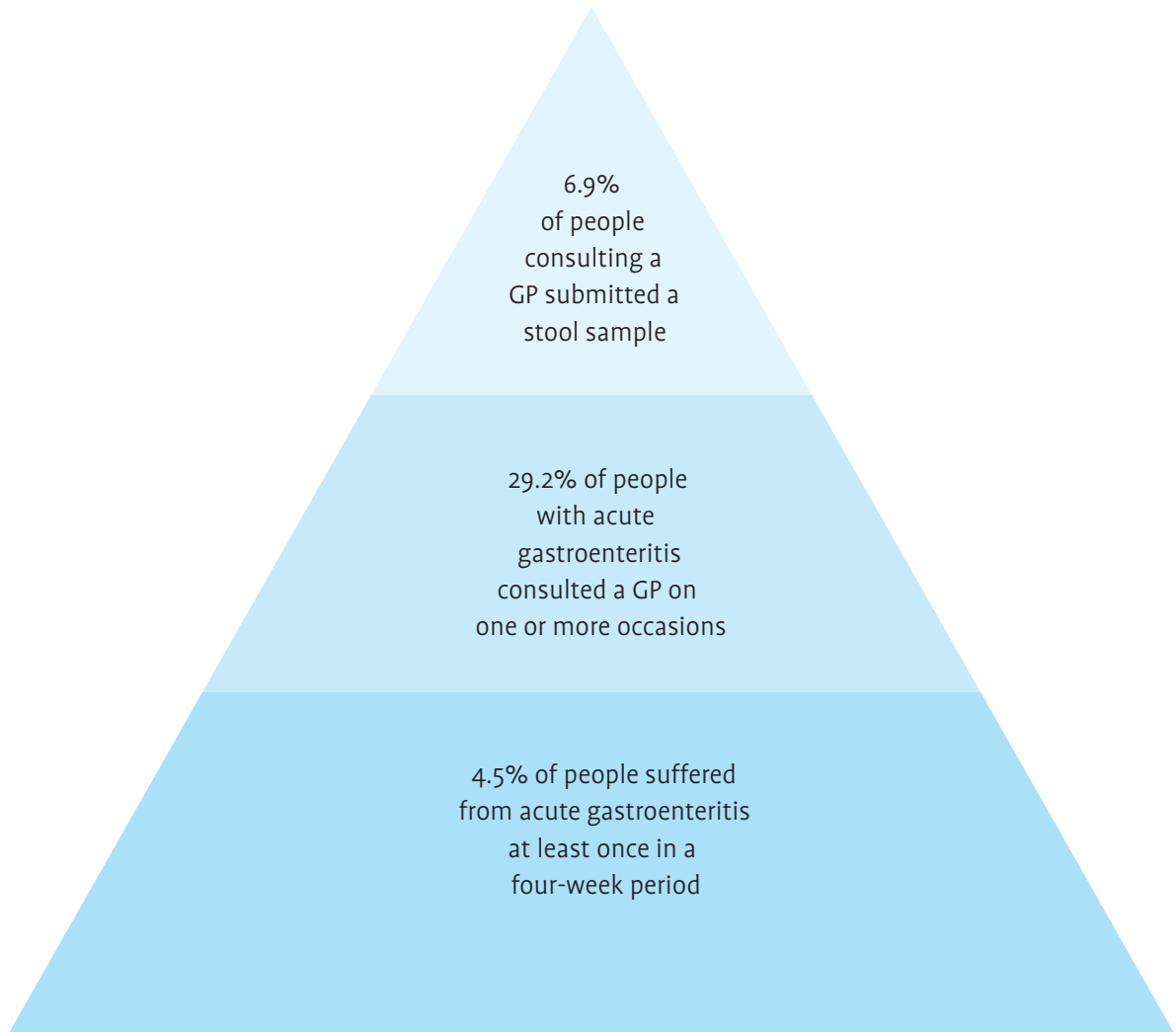
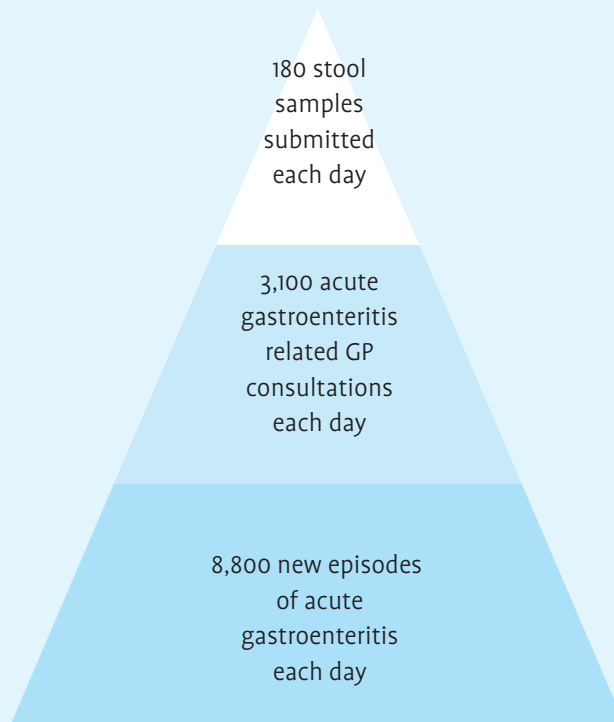
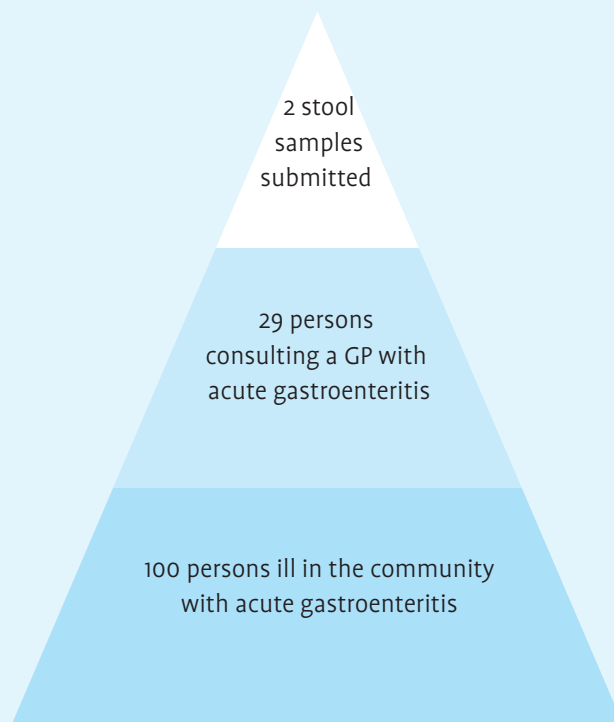


Figure 4.3: Estimated burden of acute gastroenteritis in Ireland, North and South: Population figures per day*



* This pyramid allows for more than one episode per person in a four-week period and/or more than one GP consultation per episode.

Figure 4.4: Estimated number of people with acute gastroenteritis in the community and consulting a GP, for each stool sample submitted for testing



4.6 Medication

Forty-seven percent (47.0%; 42.4%–51.6%) of those with acute gastroenteritis were estimated to have taken medication for their symptoms. Over half (50.7%) of females had taken medication, compared to 41% of males ($p < 0.05$). Age was not significantly associated with taking medication. Only a small proportion (4.0%) of those taking medication were estimated to have taken more than one type of medication.

The majority (56.5%) of those taking medication purchased it over the counter at a pharmacy, 37.4% were prescribed medication, while 9.3% obtained medication from another source (e.g. in the home already, or from a family member).[†] The high proportion of people who purchased over-the-counter medications suggests that pharmacists are an important point of contact for those with acute gastroenteritis.

Eighteen percent (17.6%; 14.4%–21.4%) of those with acute gastroenteritis were estimated to have taken anti-diarrhoeals*, while 7.4% (5.3%–10.1%) reported taking antibiotics (table 4.9). For 82.6% of those taking antibiotics, the medication had been prescribed, while the remainder (17.4%) reported getting antibiotics over the counter at a pharmacy.

The average number of days ill for those taking medication was 4.4 days (3.7–5.1) compared to 3.6 days (3.1–4.1) for those not taking any medication. Those taking antibiotics and anti-diarrhoeals were ill for an average of 5.9 days (4.3–7.5) and of 5 days (3.6–6.4) respectively.

The mean number of days for which medication was taken was estimated to be 3.5 days. The median was three and the mode was two. The mean number of days antibiotics were taken for ranges from one day to 14 days. The mean number of days was 4.8 and the median was five.

Table 4.9: Estimated proportion of those with acute gastroenteritis who took each type of medication

Type of medication	% of those with acute gastroenteritis
Anti-diarrhoeals	17.6
Analgesics and antipyretics	8.0
Antibiotics	7.4
Antacids	2.4
Homeopathic remedies	0.4
Other	1.7
Unknown	9.9
Any medication	49.0[‡]

[†] Because some people took more than one type of medication, the total percentage of people acquiring medication from each different source (i.e. over-the-counter, prescribed, other) exceeds 100%.

* The trade name of the medication was checked against the most recent version of MIMS (the Monthly Index of Medical Specialists) in order to categorise them appropriately.

[‡] The type of medication taken does not equal 49.0% because some people reported taking more than one from each type of medication.

4.7 Estimated number of days taken off work

It was estimated that for 17.4% (14.2%–21.2%) of those with acute gastroenteritis, they or a member of their family had to take time off work due to their or their illness. The number of days off work ranged from 1 to 14 days. For those who took time off work, the estimated mean time off was 2.7 days (the median was two and the mode was one). This represents an average of 0.5 days for each person suffering from acute gastroenteritis. This equates to approximately 1.5 million (1.1 million–2.0 million) working days lost each year on the island of Ireland due to acute gastroenteritis or an estimated €173.5 million (€124.4 million–€222.7 million) or £114.0 million (£81.7 million–£146.3 million) in loss of earnings.*

4.8 Estimated number of days taken off school/college

It was estimated that for 19.0% (15.6%–22.9%) of those with acute gastroenteritis, someone in the household had to take time off school or college due to their or their child's illness.

The number of days taken off school or college ranged from 1 to 10 days. For those who took time off school or college, the estimated mean number of days taken off was 2.1 (the median was two and the mode was one). This represents an average of 0.4 days for each person suffering from acute gastroenteritis, corresponding to approximately 1.3 million (1.0 million–1.7 million) school or college days lost each year in Ireland, North and South, due to acute gastroenteritis.

4.9 Other family members ill

Forty-six percent (45.9%) of those with acute gastroenteritis said other members of their household had similar symptoms.

4.10 Acute gastroenteritis in Ireland, North and South

The overall frequency of acute gastroenteritis was significantly higher in the North ($p < 0.05$). It was estimated that 5.4% (4.7%–6.1%) of those in the North had at least one episode of acute gastroenteritis in a four-week period, compared to 4.1% (3.6%–4.6%) in the South.

This North/South difference was only significant in those under 25 years of age. It is important to note that estimates of the frequency of acute gastroenteritis in younger age groups in Ireland, North and South are based on a small number of respondents (see table A.2. and table B.2 in appendix A and B respectively).

Age was significantly associated with acute gastroenteritis in the North, with significantly higher levels of illness in children aged under five years ($p < 0.05$) (table 4.10). In the South, there was a significant association between age and illness among females ($p < 0.05$), though, there was no significant difference among males (table 4.11).

Females in the South were significantly more likely than males to suffer from acute gastroenteritis in all age groups under 45 years ($p < 0.05$). There was no significant difference between males and females in the North.

* The average earnings per day for all occupations (all employees)

North and South was estimated at €113.18 or £74. See references ^{34-33:34}

Table 4.10: Estimated frequency of acute gastroenteritis in a four-week period, by age and sex in the North

	Males	Females	Total
Age group	%	%	%
<5 years	18.6	12.8	16.0
5–24 years	5.8	7.2	6.5
25–44 years	4.9	5.8	5.4
45–64 years	2.1	4.0	3.0
65+ years	1.2	2.7	1.9
All age groups	5.1	5.8	5.4

Table 4.11: Estimated frequency of acute gastroenteritis in a four-week period, by age and sex in the South

	Males	Females	Total
Age group	%	%	%
<5 years	4.2	12.4	8.6
5–24 years	3.6	5.5	4.5
25–44 years	2.3	6.3	4.3
45–64 years	2.4	2.6	2.5
65+ years	1.4	2.8	2.1
All age groups	2.8	5.4	4.1

The health-seeking behaviour of those with acute gastroenteritis was compared in Ireland, North and South both in terms of contact with the health services and use of medication. No significant differences were found. North/South comparisons will be looked at in greater detail in a subsequent report.

Separate results for Ireland, North and South are given in appendices A and B respectively.

5. Discussion and Conclusions

This is the first major epidemiological study of acute gastroenteritis looking at the burden of disease at the community level on the island of Ireland. Acute gastroenteritis is widely seen as a common but preventable illness, mainly characterised by diarrhoea and vomiting, and it is often managed at home. This telephone survey of self-reported symptoms is the first step in estimating the burden of this condition. The frequency and characteristics of acute gastroenteritis were examined, as were the health-seeking behaviour of those affected and the impact in terms of absence from work and school.

Conducting the survey by telephone was, in practical terms, an effective way of collecting community-based health information. Of the eligible households contacted during the 12-month study period from December 2000 to November 2001, 84.1% participated in the study. This response rate is high and greater than would have been expected if alternative methods such as a postal survey had been used. Telephone surveys should be considered a useful way of obtaining information about the epidemiology of other diseases and health-related behaviour.

A potential bias associated with this type of retrospective study design is recall bias. One form of recall bias called 'telescoping' is particularly pertinent in this type of study. It reflects a tendency for people to displace events in time. For example, someone may recall an event as occurring in the past six months although it may have happened seven months ago, thereby, over-estimating its frequency. Future studies should investigate ways of controlling for this. Another limitation was the under-representation in younger age groups, in that there were fewer children and teenagers than expected in the study. This was corrected for in the analysis.

This study shows that acute gastroenteritis is an important public health problem causing a large burden of illness in the community. In any four-week period, 4.5% of people suffered from acute gastroenteritis, which represents a frequency of 0.60 episodes per person per year. If extrapolated to the population, this amounts to approximately 3.2 million episodes of acute gastroenteritis each year on the island of Ireland. As expected, most illness was of short duration, an average of four days. However, when coupled with the frequency of illness, this corresponds to approximately 12.6 million days of illness due to acute gastroenteritis in the population each year on the island.

The economic cost of acute gastroenteritis is substantial. For 17.4% of those with acute gastroenteritis, they or a member of their family had to take time off work. This equates to approximately 1.5 million working days lost to the economies in Ireland, North and South and €173.5 million or £114.0 million in loss of earnings. The economic cost due to absence from work represents only a fraction of the total cost of acute gastroenteritis. Other costs include direct healthcare costs such as GP consultations, treatment, and laboratory tests and in-direct costs to the individual such as time off normal activities at home and lost leisure time.

With 4.5% of people suffering from acute gastroenteritis in any four-week period the frequency in Ireland, North and South, is lower than reported elsewhere. A similar telephone-based study in the United States reported 6.0% of people suffering from diarrhoeal illness in the four weeks before interview.¹² Studies in the UK also found higher rates, with between 7.0% and 8.0% of people reporting acute gastrointestinal illness in the previous month.^{23;24} It should be remembered that these studies were carried out between four and eight years before the current study, and over the last ten years rates of illness caused by enteric pathogens have decreased in Europe.

The findings in this study will help current surveillance information to be used more effectively. It is now known that for every 100 persons in the community with acute gastroenteritis, 29 persons consult their GP, and two stool samples are submitted from the community for testing. GPs are the main source of clinical notifications and, although under-reporting is a problem, it is now known that for every 10 potential GP notifications, there may be an additional 23 people ill in the community.

Those most commonly affected are children and younger people. This finding is in keeping with other community-based studies^{10;12;19–22} and information on infectious causes of acute gastroenteritis gathered from routine notification and laboratory reporting. In 2000 the surveillance agencies in Ireland, North and South, reported that children under five years of age had the highest incidence of *Campylobacter*, the most common bacterial cause of acute diarrhoea. Although the frequency of self-reported acute gastroenteritis in children may have been influenced by parental concern, this report appears to confirm findings from elsewhere that children are a high-risk group vulnerable to acute gastroenteritis. Those living in households with at least one family member under 18 years of age were also more likely to suffer from acute gastroenteritis.

Although comparison between Ireland, North and South was not a specific objective of this study, overall differences in the frequency of acute gastroenteritis were found. In the North, 5.4% of people suffered from acute gastroenteritis in the previous four weeks compared to 4.1% in the South. This difference was mainly due to the higher frequency of illness among younger people in the North, especially young males under the age of five years. It is important to note that these figures are based on relatively small numbers. A more detailed report comparing the findings in Ireland, North and South will be published at a later date.

No discernable seasonal patterns were identified over the 12-month period, suggesting that acute gastroenteritis is an all-year-round phenomenon. A higher frequency of illness was found where the occupation of the main earner was given as professional, senior managerial or non-manual, and lower rates of illness were found in those who gave unskilled manual worker or farmer as the occupation of the main earner. Other studies have found that the prevalence of diarrhoeal illness increased with increasing levels of education.^{12;22}

GPs are an important point of contact for those suffering from acute gastroenteritis in Ireland, North and South. Twenty-nine percent (29.2%) consulted a GP, indicating approximately 3,100 acute gastroenteritis-related consultations each day. Thus in a typical GP practice treating 2,000 people, there would be 1,200 new episodes of acute gastroenteritis and 420 GP consultations in a year.

The usual treatment for acute gastroenteritis is fluid replacement, and in most cases no additional medication is required. In this study however, approximately half (49.0%) of those ill were taking other medication for their symptoms. Most of this medication was purchased 'over the counter' rather than on prescription. Almost one in five people were taking anti-diarrhoeal agents despite a lack of evidence for their effectiveness in reducing symptom frequency or duration, especially in young children.²⁵

Antibiotics are very rarely required for the treatment of acute gastroenteritis, particularly for patients outside hospital.²⁶ However, 7.4% of those with symptoms were taking antibiotics. This usage of antibiotics is of major concern, particularly in view of the increase in antibiotic-resistant pathogens, generated by the selective pressure of antibiotics, and complications arising from taking antibiotics.²⁷⁻²⁹ In addition, 17% of those taking antibiotics reported receiving them 'over the counter' at a pharmacy. However, this is based on self-reporting and needs external corroboration.

This study was not designed to look at the causes of acute gastroenteritis. However, respondents were asked what they thought caused their illness. Over half (53.8%) said they did not know what caused their illness, while 23.3% thought their illness was due to consuming contaminated food or water. Of those who suspected that their symptoms were due to eating contaminated food, the majority said it was food consumed outside the home in places like take-aways, restaurants, and hotels. Seventeen percent (17.1%) of respondents thought that their illness was due to person-to-person contact. It is important to note however that people's perceptions of what caused their illness may not be the actual cause of illness.

Conclusions

- Acute gastroenteritis is an important public health problem in Ireland, North and South
- The magnitude of the problem is much higher than that suggested by statutory notifications or laboratory reporting
- Further research should look at the burden of acute gastroenteritis in general practice. GPs are the primary point of contact for those seeking medical care, however, little is known about GPs management of patients with acute gastroenteritis or what is considered by GPs to be best practice
- Consideration should be given to raising public and professional awareness of the importance of fluid replacement
- There is a need for increased awareness among both professionals and the public regarding the appropriate use of antibiotics
- Further research should examine the risk factors for acute gastroenteritis so that appropriate prevention measures can be implemented
- The economic cost of acute gastroenteritis is substantial. The costs involved in implementing interventions would be offset by the savings achieved through a reduction in the rate of illness
- Measures to prevent acute gastroenteritis are simple. Hand-washing, for example, remains one of the most effective ways to prevent the spread of illness. Following the simple rules of safe food preparation would also control the spread of illness. The challenge is to find new and innovative ways of getting these simple messages across and changing people's behaviour.

APPENDIX A.

Summary of Key Findings in the North

A.1 Introduction

This section details the main results on self-reported acute gastroenteritis in the community in Northern Ireland. Please note that data shown in this section have not been weighted by age and sex as in the main report.

A.2 Frequency of acute gastroenteritis

Over four percent (4.4%; 3.8%–5.0%) of respondents reported suffering from acute gastroenteritis at least once in the four weeks prior to interview (table A.1). This represents approximately 1 in every 23 respondents surveyed and indicates an average of 0.59 (0.51–0.67) episodes of acute gastroenteritis per person each year.

Table A.1: Self-reported symptoms of acute gastroenteritis in the four weeks prior to interview in the North†

Symptoms	N=4,930	%	Weighted figure‡ (%)
Case definition: Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and one other symptom*	217	4.4	5.4
Diarrhoea (any) or vomiting	288	5.8	7.1
Vomiting	143	2.9	4.0
Vomiting without diarrhoea	31	0.6	0.9
Diarrhoea (any)	257	5.2	6.2
Diarrhoea (any) without vomiting	145	2.9	3.1
Diarrhoea (any) with vomiting	112	2.3	3.1
Diarrhoea (3+ in 24 hours) or vomiting	232	4.7	5.8
Diarrhoea (3+ in 24 hours)	163	3.3	3.9
Diarrhoea (3+ in 24 hours) without vomiting	89	1.8	1.8
Diarrhoea (3+ in 24 hours) with vomiting	74	1.5	2.1
Bloody diarrhoea	5	0.1	0.1
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and two other symptoms*	192	3.9	4.8
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and one more symptom or vomiting and one other symptom*	241	4.9	6.0
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and two more symptoms or vomiting and two other symptoms*	194	3.9	4.8

† Non-infectious causes have been excluded including Crohn's disease, ulcerative colitis, excess alcohol, pregnancy, menstruation or medication.

‡ Weighted frequency adjusted for age and sex (see appendix D)

* Other symptoms include diarrhoea, vomiting, abdominal pain, abdominal cramps and fever.

A.2.1 Frequency of acute gastroenteritis by age and sex

A greater proportion of females (4.8%; 137/2883) than males (3.9%; 80/2040) reported suffering from acute gastroenteritis, this was not found to be statistically significant. As shown in table A.2, age was significantly associated with reporting acute gastroenteritis with a higher frequency of reporting in young children ($p < 0.05$).

Table A.2: Frequency of reporting acute gastroenteritis in the four weeks prior to interview, by age and sex in the North

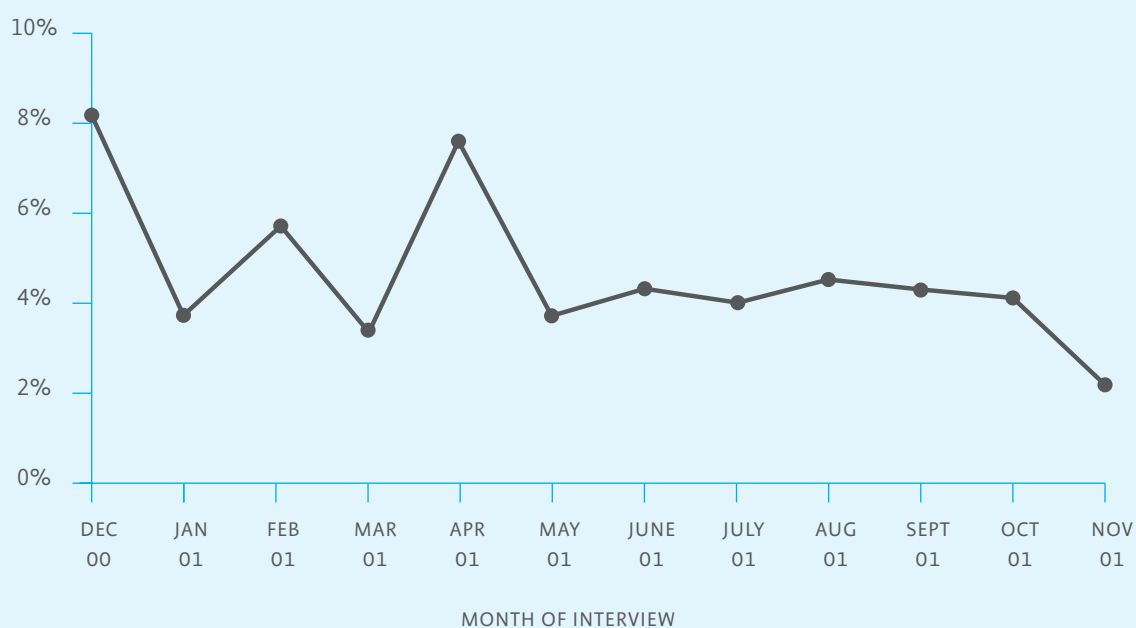
Age group	Acute gastroenteritis reported*					
	Male		Female		Total	
	N	%	N	%	N	%
<5 years	12/65	18.5	7/56	12.5	19/121	15.7
5–24 years	22/432	5.1	33/495	6.7	55/931	5.9
25–44 years	31/667	4.6	49/838	5.8	80/1506	5.3
45–64 years	12/572	2.1	30/795	3.8	42/1369	3.1
65+ years	3/303	1.0	18/686	2.6	21/989	2.1

*Age/sex data missing for 21 respondents.

A.2.2 Frequency of acute gastroenteritis by month of interview

There was a significant difference in the frequency of acute gastroenteritis reported each month ($p < 0.05$) (figure A.1). The highest frequency of acute gastroenteritis was reported during interviews conducted in December (8.2%) followed by April (7.3%) and February (5.5%). It is important to note that these figures refer to the month of interview and are not necessarily concurrent with the month of illness.

Figure A.1: Frequency of reporting acute gastroenteritis in the four weeks prior to interview, by month of interview in the North



A.2.3 Frequency of acute gastroenteritis by household size

In 62.6% (3087/4929)[†] of households, no member was under 18 years of age. People living in a household with no-one under 18 years were significantly less likely than those with at least one member under 18 years of age to suffer from gastroenteritis (3.4%; 104/3087 compared to 6.1%; 113/1842; $p < 0.01$).

Households of three or more people were also more likely to suffer from acute gastroenteritis ($p < 0.05$) (table A.3). However, these households were more likely to include someone under the age of 18 years and this explains their higher rate of illness. When data were analysed separately for households with and without a member under the age of 18 years, there is no significant increase in the frequency of acute gastroenteritis with household size.

Table A.3: Estimated frequency of acute gastroenteritis in a four-week period, by household size and type in the North*

	Household size (number of persons)							
	1		2		≥3		All households	
	(N=1015)		(N=1365)		(N=2549)		(N=4929)	
Household type	N	%	N	%	N	%	N	%
Household with someone under 18 years of age (N=1842)	—	—	8	10.7	105	5.9	113	6.1
Household with no-one under 18 years of age (N=3087)	34	3.3	42	3.3	28	3.6	104	3.4
All households	34	3.3	50	3.7	133	5.2	217	4.4

* Household data missing for one respondent.

A.2.4 Frequency of acute gastroenteritis by occupation of the main earner

The highest frequency of acute gastroenteritis was reported among respondents who gave 'skilled manual worker' as the occupation of the main earner in the household (NS) (table A.4).

[†] Data on household size is missing for one respondent

Table A.4: Frequency of reporting acute gastroenteritis in the four weeks prior to interview, by occupation of the main earner in the North

Occupation	Acute gastroenteritis reported*	
	N	%
Self-employed (excluding farmers)	17/358	4.8
Farmer (self-employed)	2/226	0.9
Professional/senior managerial	65/1325	4.9
Other non-manual worker	49/1094	4.5
Skilled manual worker	57/1117	5.1
Unskilled manual worker	14/393	3.6
Never worked	9/300	3.0

*Occupational data missing for 117 respondents.

A.2.5 Frequency of acute gastroenteritis by foreign travel

Seven percent (7.2%; 355/4922) of respondents reported travelling outside the island of Ireland in the two weeks prior to interview. A higher proportion of those who had travelled abroad reported suffering from acute gastroenteritis (5.1%; 18/355 compared to 4.4%; 199/4567), but this was not found to be significant.

A.3 Duration of illness

The average duration of illness was estimated at 4.2 days (3.4–5.0). The median number of days was three. Males were ill for a mean of 3.7 days (3.1–4.3) compared to 4.3 days (3.4–5.2) for females. The estimated mean duration of illness by age is shown in table A.5.

Table A.5: Estimated mean number of ill days reported due to acute gastroenteritis, by age in the North

Age group	Days ill	
	Mean	Range
<5 years	3.2	2.1 – 4.3
5–24 years	3.4	2.9 – 3.9
25–44 years	4.4	3.2 – 5.6
45–64 years	3.7	2.4 – 5.0
65+ years	5.9	2.8 – 9.0
All age groups	4.2	3.4 – 5.0

A.4 Suspected cause of illness

As outlined in table A.6, a high proportion of respondents did not know what might have caused their illness. Seventeen percent of respondents suspected their illness was due to eating contaminated food.

Table A.6: "What do you think caused your illness?"

Cause	N	%
Don't know	124	57.1
Contaminated food	36	16.6
Contact with infected person	27	12.4
Contaminated water	14	6.4
Flu	6	2.8
Infection	4	1.8
Over-eating/diet	2	0.9
Food allergy/food intolerance	1	0.5
Other	2	0.9
Total	217	100.0

Of the 36 respondents who said their symptoms were due to eating contaminated food, 75.0% (27) thought they had got the suspected food outside their own home (table A.7).

Table A.7: "Where do you think you got the food that caused your symptoms?"

Location	N	% of respondents suspecting contaminated food
		%
Restaurant/café	12	33.3
Takeaway	9	25.0
Own home	6	16.7
Hotel	1	2.8
Public house	1	2.8
Private house (not own home)	1	2.8
Shop	1	2.8
School	1	2.8
Other	1	1.8
Don't know	3	8.3
Total	36	100.0

A.5 Health-seeking behaviour

Of the 217 respondents meeting the case definition for acute gastroenteritis, 28.6% (62) reported coming into contact with the health services; 28.6% (62) had consulted a GP, 1.8% (4) attended a hospital casualty department and 2.3% (5) were admitted to hospital.

A.5.1 General practitioner (GP) consultations

Twenty-nine percent (28.6%; 62/217) of respondents with acute gastroenteritis consulted a GP. A greater proportion of males (36.2%; 29/80) than females (24.1%; 33/137) consulted a GP, however, this failed to reach a level of statistical significance. A GP was consulted for a significantly larger proportion of children under 5 years of age compared to older age groups ($p < 0.05$) (table A.8).

Of the 62 respondents who consulted a GP, most (83.9%; 52) did so only once; 86 GP consultations were made in total. Most consultations (53.5%; 46/86) were made by visiting the GP's surgery, 32.6% (28/86) were made by telephone, while 14% (12/86) of consultations took place in the respondent's own home.

Table A.8: Frequency of GP consultations among those suffering from acute gastroenteritis, by age in the North

Age group	N	%
<5 years	11/19	57.9
5–24 years	20/55	36.4
25–44 years	14/80	17.5
45–65 years	8/42	19.0
65+ years	9/21	42.9

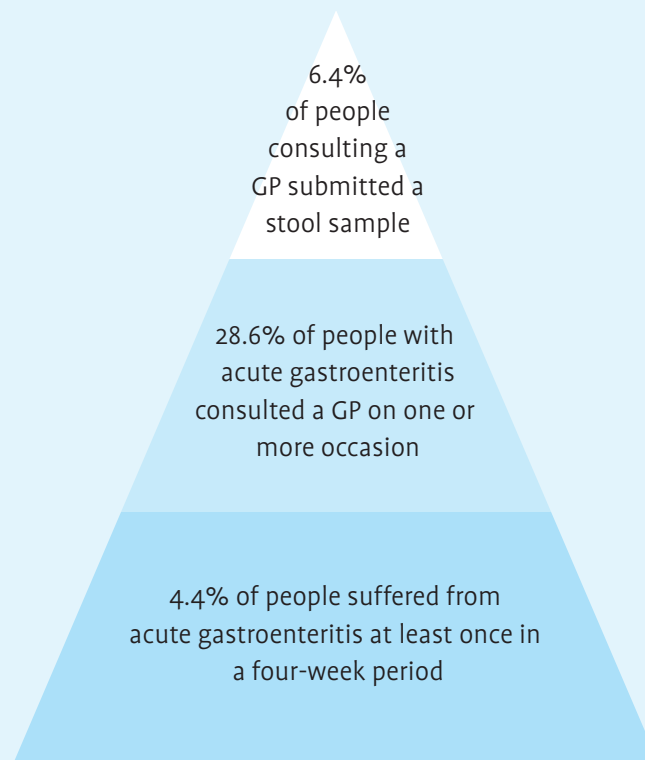
Respondents consulting a GP reported being ill for an average of 6.2 days (4.5–7.9) compared to 3.2 days (2.4–4.0) for those not consulting a GP ($p < 0.05$). The median numbers of days were four and three respectively.

There was no significant difference between the suspected cause of illness and whether or not a GP was consulted. Only 22% (11/50) of respondents who attributed their symptoms to consuming contaminated food or water consulted a GP, compared to 37.0% (10/27) of those who attribute their illness to person-to-person contact. Twenty-eight percent (28.2%; 35/124) of those who did not know what caused their illness consulted a GP.

A.5.2 Stool samples

Six percent (6.4%; 4/62) of respondents with acute gastroenteritis who sought medical attention said they had been asked to submit a stool sample for testing; all complied with this request. This figure represents 1.8% (4/217) of all respondents suffering from acute gastroenteritis. Figure A.3 shows these data. Of those who submitted a stool sample, two were not aware of the result of the test, while in two cases no pathogen was identified.

Figure A.2: The frequency of acute gastroenteritis and related GP consultations and stool sample submissions in the North



A.6 Medication

Forty-seven percent (47.0%; 102/217) of respondents who reported suffering from acute gastroenteritis had taken medication for their symptoms. A similar proportion of males (43.8%; 35/80) and females (48.9%; 67/137) took medication. Age was not significantly associated with the use of medication.

The majority of those who took medication (91.2%; 93/102) took only one type of medication. Sixty-three percent (62.7%; 64/102) of respondents purchased medication over the counter at a pharmacy, 37.3% (38/102) were prescribed medication, while 4.9% (5/102) obtained medication from another source (e.g. in the home already, or from a family member).[†]

Seventeen percent of those reporting acute gastroenteritis had taken anti-diarrhoeals while 5.5% reported taking antibiotics (table A.9). Of those taking antibiotics, 75.0% (9/12) said the antibiotic had been prescribed, while 25.0% (3/12) said they purchased it over the counter at a pharmacy. The mean number of days of taking medication was 4.1. The median and the mode were both three.

[†] Because some respondents took more than one type of medication, the total percentage of respondents acquiring medication from each different source (i.e. over-the-counter, prescribed, other) exceeds 100%.

Table A.9: Proportion of respondents reporting acute gastroenteritis who took each type of medication in the North

Type of medication	N=217	% of those with acute gastroenteritis
Anti-diarrhoeals	37	17.1
Analgesics and antipyretics	18	8.3
Antibiotics	12	5.5
Antacids	8	3.7
Homeopathic remedies	2	0.9
Other	5	2.3
Unknown	23	10.6

A.7 Days taken off work

Sixteen percent (16.1%; 35/217) of respondents reporting acute gastroenteritis reported that they or a member of their family had to take time off work due to their illness.

The number of days off work ranged from 1 day to 14 days. For those who took time off work, the mean number of days off work was 3.2, giving an average of 0.5 days for all respondents reporting illness.

A.8 Days taken off school/college

Fifteen percent (14.8%; 32/217) of respondents who reported acute gastroenteritis reported someone in the household having to take time off school or college due to their illness.

The number of days taken off school or college ranged from 1 day to 10 days. For those who took time off school or college, the mean number of days taken off was 2.8 days, representing 0.4 days for all respondents reporting illness.

A.9 Other family members ill

Forty-one percent (41%; 89/217) of respondents reported other members of their household having similar symptoms.

APPENDIX B.

Summary of Key Findings in the South

B.1 Introduction

This section details the main results on self-reported acute gastroenteritis in the community in the South. Please note that data shown in this section have not been weighted by age and sex as in the main report.

B.2 Frequency of acute gastroenteritis

Almost four percent (3.6%; 3%–4.1%) of respondents reported suffering from acute gastroenteritis at least once in the four weeks prior to interview (figure A.1). This represents approximately one in every 28 respondents surveyed and indicates an average of 0.47 (0.39–0.55) episodes of acute gastroenteritis per person each year.

Table B.1: Self-reported symptoms of acute gastroenteritis in the four weeks prior to interview[†]

Symptoms	N=4,973	%	Weighted figure [‡] (%)
Case definition: Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and one other symptom*	177	3.6	4.1
Diarrhoea (any) or vomiting	221	4.4	5.2
Vomiting	135	2.7	3.4
Vomiting without diarrhoea	39	0.8	1.0
Diarrhoea (any)	182	3.7	4.1
Diarrhoea (any) without vomiting	86	1.7	1.7
Diarrhoea (any) with vomiting	96	1.9	2.4
Diarrhoea (3+ in 24 hours) or vomiting	194	3.9	4.6
Diarrhoea (3+ in 24 hours)	138	2.8	3.1
Diarrhoea (3+ in 24 hours) without vomiting	59	1.2	1.2
Diarrhoea (3+ in 24 hours) with vomiting	79	1.6	1.9
Bloody diarrhoea	1	—	—
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or vomiting and two other symptoms*	154	3.1	3.5
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and one more symptom or vomiting and one other symptom*	187	3.8	4.3
Diarrhoea (3+ in 24 hours) or bloody diarrhoea or diarrhoea, any and two more symptoms or vomiting and two other symptoms*	156	3.1	3.5

[†] Non-infectious causes have been excluded including Crohn's disease, ulcerative colitis, excess alcohol, pregnancy, menstruation or medication.

[‡] Weighted frequency adjusted for age and sex (see Appendix D).

* Other symptoms include diarrhoea, vomiting, abdominal pain, abdominal cramps and fever.

— Value is less than 0.1.

B.2.1 Frequency of acute gastroenteritis by age and sex

Females (4.3%; 127/2950) were significantly more likely than males (2.5%; 50/2017) to report suffering from acute gastroenteritis ($p < 0.05$). As shown in table B.2, the highest frequency of reporting was in children under five years of age ($p < 0.05$).

Table B.2: Frequency of reporting acute gastroenteritis in the four weeks prior to interview, by age and sex in the South

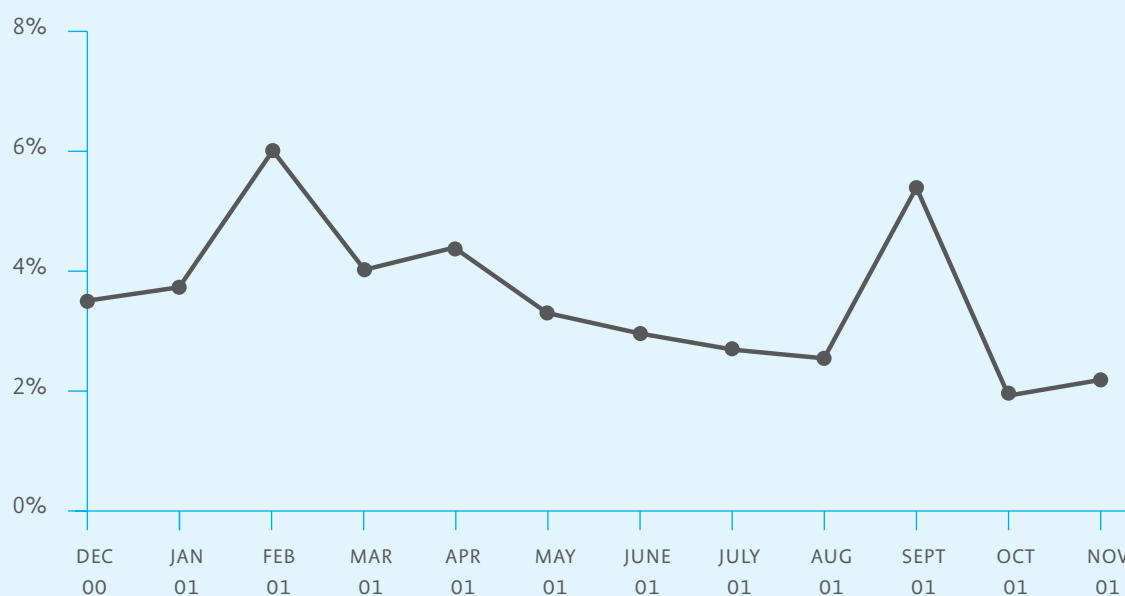
Age group	Acute gastroenteritis reported*					
	Male		Female		Total	
	N	%	N	%	N	%
<5 years	3/71	4.2	11/88	12.5	14/159	8.8
5–24 years	15/455	3.3	23/450	5.1	38/906	4.2
25–44 years	15/631	2.4	54/860	6.3	69/1492	4.6
45–64 years	13/549	2.4	20/851	2.4	33/1403	2.4
65+ years	4/300	1.3	19/686	2.8	23/987	2.3

*Age and sex data missing for 32 respondents

B.2.2 Frequency of acute gastroenteritis by month of interview

There was a significant difference in the frequency of acute gastroenteritis reported each month ($p < 0.05$) (figure B.1). The highest frequencies of acute gastroenteritis were reported during interviews conducted in February 6.0% and September (5.2%). It is important to note that these figures refer to the month of interview and are not necessarily concurrent with the month of illness.

Figure B.1: Frequency of reporting acute gastroenteritis in the four weeks prior to interview, by month of interview in the South



B.2.3 Frequency of acute gastroenteritis by household size

In 61.0% (3030/4970)* of households no member was under 18 years of age. People living in these households were significantly less likely than those with at least one member under 18 years of age to suffer from gastroenteritis (2.8%; 86/3030 compared to 4.7%; 91/1940; $p < 0.01$).

Households of three or more people were also more likely to suffer from acute gastroenteritis ($p < 0.05$) (table B.3). However these households were more likely to include someone under the age of 18 years and this explains their higher rate of illness. When data were analysed separately for households with or without a member under the age of 18 years, there is no significant increase in the frequency of acute gastroenteritis with household size.

Table B.3: Estimated frequency of acute gastroenteritis in a four-week period, by household size and type in the South†

	Household size (number of persons)							
	1		2		≥3		All households	
	(N=816)		(N=1,275)		(N=2,879)		(N=4,970)	
Household type	N	%	N	%	N	%	N	%
Household with someone under 18 years of age (N=1940)	—	—	1	2.9	90	4.7	91	4.7
Household with no-one under 18 years of age (N=3,030)	22	2.7	30	2.4	34	3.5	86	2.8
All households	22	2.7	31	2.4	12.4	4.3	177	3.6

† Household data missing for three respondents

B.2.4 Frequency of acute gastroenteritis by occupation of the main earner

The lowest frequency of acute gastroenteritis was reported among respondents who gave 'farmer' as the occupation of the main earner in the household (NS) (table B.4).

* Data on household size is missing for three respondents

Table B.4: Frequency of reporting acute gastroenteritis in the four weeks prior to interview by, occupation of the main earner in the South

Occupation	Acute gastroenteritis reported*	
	N	%
Self-employed (excluding farmers)	15/474	3.2
Farmer (self-employed)	12/620	1.9
Professional/senior managerial	55/1268	4.3
Other non-manual worker	36/891	4.0
Skilled manual worker	29/929	3.1
Unskilled manual worker	12/414	2.9
Never worked	11/199	5.5

*Occupational data missing for 178 respondents.

B.2.5 Frequency of acute gastroenteritis by foreign travel

Almost ten percent (9.8%; 489/4968) of respondents reported travelling outside the island of Ireland in the two weeks prior to interview. A higher proportion of those who had travelled abroad reported suffering from acute gastroenteritis (4.7%; 23/489 compared to 3.4%; 153/4479) but this was not found to be statistically significant.

B.3 Duration of illness

The average duration of illness was estimated at 4.3 days (3.4–5.2). The median number of days was three. Males were ill for a mean of 3.6 days (2.4–4.8) days compared to 4.4 days (3.2–5.6) for females. The estimated mean duration of illness by age is shown in table B.5.

Table B.5: Estimated mean number of ill days reported due to acute gastroenteritis, by age in the South

Age group	Days ill	
	Mean	Range
<5 years	4.5	2.2–6.8
5–24 years	3.3	2.4–4.2
25–44 years	3.5	2.8–4.2
45–64 years	5.0	2.4–7.6
65+ years	4.3	2.2–6.4
All age groups	4.3	3.4–5.2

B.4 Suspected cause of illness

As outlined in table B.6, a high proportion of respondents did not know what might have caused their illness. Almost one-quarter suspected their illness was due to eating contaminated food.

Table B.6: "What do you think caused your illness?"

Cause	N	%
Don't know	80	45.2
Contaminated food	43	24.3
Contact with infected person	33	18.6
Contaminated water	6	3.4
Flu	5	2.8
Infection	6	3.4
Over-eating/diet	2	1.1
Food allergy/food intolerance	1	0.6
Other	1	0.6
Total	177	100.0

Of the 43 respondents who said their symptoms were due to eating contaminated food, 79.1% (34) thought they had got the suspected food outside their own home (table B.7).

Table B.7: "Where do you think you got the food that caused your symptoms?"

Respondents suspecting contaminated food		
Location	N	%
Restaurant/café	16	37.2
Take-away	11	25.6
Own home	8	18.6
Hotel	2	4.7
Public house	2	4.7
Shop	2	4.7
Staff canteen	1	2.3
Don't know	1	2.3
Total	43	100.0

B.5 Health-seeking behaviour

Of the 177 respondents meeting the case definition for acute gastroenteritis, 27.1% (48) reported coming into contact with the health services; 26.6% (47) had consulted a GP, 2.3% (4) attended a hospital casualty department, and 2.8% (5) were admitted to hospital.

B.5.1 General practitioner (GP) consultations

Twenty-seven percent (26.6%; 47/177) of respondents with acute gastroenteritis consulted a GP. A greater proportion of females (29.9%; 38/127) than males (18.0%; 9/50) consulted a GP, but this was not found to be significant. As outlined in table B.8, a GP was consulted for 42.9% of children under five years of age and for 43.5% of those aged 65 years and over (NS).

Of the 47 respondents who consulted a GP, most (91.5%; 43) did so only once; 54 GP consultations were made in total. Most consultations (70.4%; 38/54) were made by visiting the GP's surgery, 7.4% (4/54) were made by telephone, while 22.2% (12/54) of consultations took place in the respondent's own home.

Table B.8: Frequency of GP consultations among those suffering from acute gastroenteritis, by age in the South

Age group	N	%
<5 years	6/14	42.9
5–24 years	11/38	29.0
25–44 years	12/69	17.4
45–65 years	8/33	24.2
65+ years	10/23	43.5

Respondents consulting a GP reported being ill for an average of 5.8 days (4.0–7.6) compared to 3.4 days (2.7–4.1) for those who did not consult a GP. The median numbers of days were three and two respectively.

There was no significant relationship between the suspected cause of illness and whether or not a GP was consulted. Twenty percent (20.4%; 10/49) of respondents who attributed their symptoms to consuming contaminated food or water and 24.2% (8/33) of those who attributed it to person-to-person contact said they consulted a GP, this compares to 30.0% (24/80) of those did not know what caused their illness.

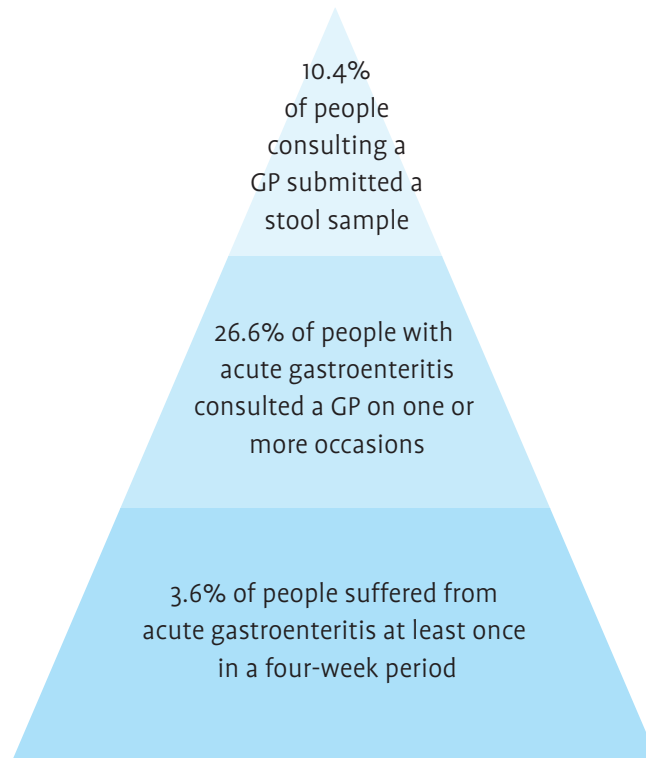
Respondents with a General Medical Services (GMS) card were significantly more likely to consult a GP (47.1%; 16/34) than those who did not have a GMS card (21.4%; 28/131) ($p < 0.05$).

B.5.2 Stool samples

Thirteen percent (12.8%; 6/47) of respondents with acute gastroenteritis who consulted a GP were asked to submit a stool sample for testing; 83.3% (5/6) complied with this request (10.4% of all those seeking medical care). This figure represents 3.4% (6/177) of all respondents suffering from acute gastroenteritis. Figure B.2 shows these data. Of those who submitted a

stool sample, three were not aware of the result while in one case no pathogen was identified. One respondent said a 'bug' had been identified but was unable to recall its name.

Figure B.2: Frequency of acute gastroenteritis and related GP consultation and stool sample submissions in the South



B.6 Medication

Forty-five percent (45.2%; 80/177) of respondents who reported acute gastroenteritis had taken medication for their symptoms. A higher proportion of females (48.8%; 62/127) than males (36%; 18/50) took medication (NS). Age was not significantly associated with the use of medication.

The majority of those taking medication (96.2%; 77/80) took only one type of medication. Fifty-two percent (52.5%; 42/80) of respondents purchased medication over the counter at a pharmacy, 40.0% (32/80) had been prescribed medication, while 8.8% (7/80) obtained medication from another source (e.g. in the home already, or from a family member).†

Twenty percent of those suffering from acute gastroenteritis had taken anti-diarrhoeals, while 7.3% reported taking antibiotics (table B.9). Of those taking antibiotics, 92.3% (12/13) said the antibiotic had been prescribed and 7.7% (1/13) said they purchased it over the counter at a pharmacy. The mean number of days respondents had taken medication was 3.4. The median was three and the mode was two.

† Because some respondents took more than one type of medication the total percentage of respondents acquiring medication from each different source (i.e. over-the-counter, prescribed, other) may exceed 100%.

Table B.9: Proportion of respondents reporting acute gastroenteritis who took each type of medication in the South

Type of medication	N (177)	% of those with acute gastroenteritis
Anti-diarrhoeals	36	20.3
Antibiotics	13	7.3
Analgesics and antipyretics	6	3.4
Antacids	5	2.8
Other	2	1.1
Unknown	18	10.2

B.7 Days taken off work

Eighteen percent (18.1%; 32/177) of respondents who reported acute gastroenteritis reported that they or a member of their family had to take time off work due to their illness.

The number of days out off work ranged from one day to seven days. For those who took time off work, the mean number of days off work was 2.5, giving an average of 0.4 days for all respondents who reported illness.

B.8 Days taken off school/college

Ten percent (10.2%; 18/177) of respondents who reported acute gastroenteritis reported someone in the household having to take time off school or college due to their illness.

The number of days taken off school or college ranged from one day to 10 days. For those who took time off school or college, the mean number of days taken off was 1.9 days, representing 0.2 days for all respondents who reported illness.

B.9 Other family members ill

Thirty-eight percent (38.4%; 68/177) respondents reported other members of their household having similar symptoms.

APPENDIX C.

Questionnaire

**Gastrointestinal Symptoms in Ireland North and South
– A Telephone Survey**

Interviewer _____ **Telephone number** _____
Date of interview _____ **Day of interview** _____

Section one: Call details

- a. Number of people in the household at the time of the call _____
- b. Is the 'person whose birthday comes next' known? Yes 1 No 2
If yes, whose birthday comes next: Person on the telephone 1
Other, child under 12 years 2
Other, child aged 12-16 years 3
Other, person > 16 years 4
- c. If the questionnaire being answered by another person on behalf of the selected respondent?
Yes 1 No 2
- If the respondent is < 12 yrs of age a parent or guardian must answer on the child's behalf.
If the respondent is aged 12-16 yrs, was parental consent given to interview the child?

Section two: Demographic information

1. **Interviewer:** Record sex Male 1 Female 2
2. What age are you (*is your child*)? _____
3. How many people are usually resident in your household? _____
4. How many are <18 years of age and 18 years and over? <18 yrs ____ 18+ yrs ____
5. What is the occupation of the main earner in the household? _____
Self-employed (not farmer) 1 Skilled manual worker 5
Farmer (self-employed) 2 Unskilled manual worker 6
Professional / Senior Managerial 3 Never worked 7
Other non-manual worker 4 Don't know 8
6. Do you share this telephone with another house or flat? Yes 1 No 2
- 7a. What county are you living in? _____
- 7b. Are you living in the city or the county? City 1 County 2
- 7c. **NI only:** Which Local Government District are you living in? _____
8. Have you (*your child*) travelled outside the island of Ireland in the past two weeks?
Yes 1 No 2

Section three: Symptoms

9. During the past 4 weeks, have you (*your child*) suffered from the following symptoms?
- a. Abdominal pain/cramps Yes 1 No 2
- b. Fever Yes 1 No 2
- c. Vomiting Yes 1 No 2
If yes, 3 or more times per day? Yes 1 No 2
- d. Diarrhoea Yes 1 No 2
If yes, 3 or more times per day? Yes 1 No 2
- e. Bloody diarrhoea Yes 1 No 2

IF YES to vomiting or diarrhoea CONTINUE, IF NO to both vomiting and diarrhoea END.

Telephone number _____

10. Are you (*your child*) still suffering from any of these symptoms? Yes 1 No 2

11. How long did the symptoms last/have you (*your child*) had these symptoms?
Days _____ Hours _____

12. What do you think caused your (*your child's*) symptoms? **Do not prompt**

- | | | | |
|------------------------|----------------------------|---------------------------|-----------------------------|
| Food poisoning | <input type="checkbox"/> 1 | Medication | <input type="checkbox"/> 7 |
| Person-to-person | <input type="checkbox"/> 2 | Alcohol | <input type="checkbox"/> 8 |
| Water | <input type="checkbox"/> 3 | Bowel disorder | <input type="checkbox"/> 9 |
| Animal contact | <input type="checkbox"/> 4 | Chemotherapy/radiotherapy | <input type="checkbox"/> 10 |
| Non-specific infection | <input type="checkbox"/> 5 | Other, specify _____ | <input type="checkbox"/> 11 |
| Pregnancy/menstruation | <input type="checkbox"/> 6 | Unknown | <input type="checkbox"/> 12 |

13. **If food poisoning**, where do you think you (*your child*) got the food that caused your (*your child's*) symptoms? **Do not prompt**

- | | | | |
|------------------------------------|----------------------------|---|-----------------------------|
| Own home | <input type="checkbox"/> 1 | Mobile retailer (e.g. Chip van) | <input type="checkbox"/> 9 |
| Private house (excluding own home) | <input type="checkbox"/> 2 | Shop | <input type="checkbox"/> 10 |
| Hotel | <input type="checkbox"/> 3 | Hospital | <input type="checkbox"/> 11 |
| Guest house / B&B | <input type="checkbox"/> 4 | Residential institution (e.g. Nursing home) | <input type="checkbox"/> 12 |
| Public house | <input type="checkbox"/> 5 | School | <input type="checkbox"/> 13 |
| Staff canteen | <input type="checkbox"/> 6 | Crèche | <input type="checkbox"/> 14 |
| Restaurant / café | <input type="checkbox"/> 7 | Other, specify _____ | <input type="checkbox"/> 15 |
| Takeaway | <input type="checkbox"/> 8 | Unknown | <input type="checkbox"/> 16 |

14. Was this premises on the island of Ireland? Yes 1 No 2

Section four: Medical consultation and treatment

15. As a result of these symptoms did you (*your child*) consult your GP?

How many consultations did you have in the home _____ (enter '0' if none)

How many consultations did you have at the surgery _____ (enter '0' if none)

How many consultations did you have over the telephone _____ (enter '0' if none)

16. **If consulted GP**, did you consult your GP because you wanted diagnosis and treatment or required certificate for work?

a. Wanted diagnosis and treatment Yes 1 No 2

b. Required certificate for work Yes 1 No 2

17. Did you (*your child*) attend a hospital casualty department? Yes 1 No 2

Telephone number _____

18. Were you (*was your child*) admitted to hospital?

How many days did you (*your child*) spend in hospital _____ (enter '0' if none)

19. Were you (*your child*) asked to submit a stool sample for testing? Yes No

If yes, did you (*your child*) have a stool sample specimen taken?

Yes

No

What was the result of your test? _____ DK

Why did you (*your child*) not provide a stool sample?

a. Recovered

b. Inconvenience

c. Other, specify _____

d. Don't know / not sure

20. Did you (*your child*) take any medications for your symptoms? (If no tick all three 'no' boxes below)

Did you get the medication over the counter or on prescription?

(a) Over the counter Yes 1 No 2

(b) On prescription Yes 1 No 2

(c) Other, please specify _____ Yes 1 No 2

If took medications answer Q21(a) and Q21(b), if no medications skip to Q22.

21a. How many days were medications taken for _____

21b. Name of medication(s)? _____

22. **Republic of Ireland only.** Do you have a medical card? Yes 1 No 2

Section five: Social and economic impact of illness

23. Did these symptoms require **you or anyone else in the household** to miss work or college/school?

Total number of days missed from work due to symptoms _____ (enter '0' if none)

Total number of days missed from school/college due to symptoms _____ (enter '0' if none)

24. Is there anybody else in the household who had similar symptoms?

If yes, how many? _____ (enter '0' if none)

Interviewer: Thank the respondent for their participation and remind them that this survey is anonymous and confidential.

APPENDIX D.

Statistical Aspects of the Analysis

Introduction

This appendix contains some technical material relating to the statistical analysis performed. It is not necessary for reading the report but might be useful to those who want to know exactly what was done.

D.1 Weighted analyses: estimating the adjusted results

The idea of a weighted analysis will be illustrated with the example of the frequency of acute gastroenteritis reported in the four weeks prior to interview.

In the North, 4.4% (217/4,930) of respondents reported acute gastroenteritis, while in the South the figure was 3.6% (177/4,973). These are the actual observed sample results and for this illustration age/sex weighting is not considered. Overall, the percentage of those reporting acute gastroenteritis in the sample is $(217 + 177) / (4,930 + 4,973) = 394/9,903 = 4.0\%$. However, this figure, the overall sample result, is not a good estimate of the percentage with symptoms in the whole island because it gives equal importance to the 4.4% in the North and the 3.6% in the South. In fact, the figure of 4% is just a simple average of the two component percentages of 4.4% and 3.6%.

As already mentioned in section 2.4.7.1, the North is over-represented in the sample and the South is under-represented because the relevant percentages of the population of the North and the South are 32% and 68% respectively. This suggests that the best estimate of the percentage reporting acute gastroenteritis for the island of Ireland should be closer to the 3.6% figure in the South than to the 4.4% figure in the North. Thus, it should be somewhat less than the mid-way figure of 4%.

The essential idea of a weighted analysis is to answer the question as to what the acute gastroenteritis rate would be in the whole island, given the separate rates estimated in the North and in the South (4.4% and 3.6%).

The population of the North is approximately 1.7 million (32%). That of the South is 3.6 million (68%). This means that in the North, at any one time, one would expect 4.4% of 1.7 million persons to have suffered from acute gastroenteritis in the previous four weeks. This is 74,800 persons. Similarly, in the South one would expect 3.6% of 3.6 million or 129,600 persons to have suffered. In the North and the South, one would then expect $74,800 + 129,600 = 204,400$ to have suffered from symptoms. Out of the total population of the island of Ireland of 5.3 million, this gives a frequency of acute gastroenteritis of $204,400/5,300,000 = 3.9\%$. This is the best estimate of the percentage for the island as a whole, and as pointed out above, is in fact less than the 4% calculated on the basis of the total sample.

This estimate is called a weighted estimate since it can be obtained by weighting the component rates of 4.4% and 3.6% by the appropriate population sizes or, equivalently, by the percentage distribution of the population (32% and 68%).

$$3.9\% = [1.7 (4.4\%) + 3.6 (3.6\%)] / (1.7 + 3.6)$$

$$3.9\% = [32 (4.4\%) + 68 (3.6\%)] / (32 + 68)$$

Because the sample sizes were equal (or as near as makes no difference) for the North and the South, the overall sample result essentially uses weights of 50% for the component percentages giving the usual average of 4% in the total sample.

The figures above did not take into account any lack of representativeness of the sample in terms of the population age/sex distribution. When this is done by weighting the age/sex/North-South specific acute gastroenteritis percentages (with six age groups this is a total of 24 component percentages) by the corresponding population sizes, an overall rate of acute gastroenteritis of 4.5% is obtained for the whole island. It was this more complex weighting, correcting for the sampling fractions and the age/sex distributions that was used in this report for all estimates presented.

D.2 Weighted analysis: significance testing and confidence intervals

All significance tests and confidence intervals are based on the weighting system being normalised to give an equivalent total sample size for the weighted results equal to the actual sample size (9,903 persons). From the computing point of view, this means that each actual case in the dataset of 9,903 actual surveyed individuals is given a weight based on their age, sex and location (North or South), and that these weights add to 9,903. All statistical computations for the adjusted figures are then based on the same sample size as that actually used.

In the above example, the normalised weights would have to be of relative sizes 32% and 68% for North and South, but should add up to 9,903. This means that the weights for the North should be 32% of 9,903 = 3,168 and for the South 68% of 9,903 = 6,734. Using these normalised weights, the weighted percentage with acute gastroenteritis would be

$$[3,168 (4.4\%) + 6,734 (3.6\%)] / 9,903 = 3.9\%$$

Because there were 4,930 persons in the sample in the North (49.8%) and 4,973 in the sample in the South (50.2%), the weights assigned to individuals in the dataset would be 3,168/4,930 = 0.6436 for those in the North and 6,734/4,973 = 1.3541 for those in the South. This is achieved in SPSS using the WEIGHT CASES command.

For the analysis in this report weights were assigned to each individual based on their age, sex and North–South status rather than just on North-South status as described here. In general, the weights assigned to each individual were defined for each age/sex/North–South group by:

$$\text{Weight} = (\text{proportion in group in population}) / (\text{proportion in the group in the sample})$$

Applied to the above illustrative example, with 49.8% of the sample and 32% of the population in the North and 50.2% of the sample and 68% of the population in the South, this formulation gives the same as the direct results:

$$\text{Weight for individuals in the North} = 0.32/0.498 = 0.64$$

$$\text{Weight for individuals in the South} = 0.68/0.502 = 1.35$$

D.3 Estimating the number of episodes of acute gastroenteritis each year

The questionnaire employed in this survey asked for symptoms of acute gastroenteritis "during the past four weeks". Adjusted for the sampling fractions for the North and the South and for age/sex distributions, this gave an estimate for the population of an average of 4.5% who could report such a symptom occurrence, i.e. at least one episode of acute gastroenteritis in the previous four weeks. In the body of the report (section 4.2) this was shown to correspond to 58.55 occurrences of acute gastroenteritis in 100 persons per year. What is of more interest than an occurrence defined over a four-week period however is the number of separate episodes of acute gastroenteritis experienced over time. Deriving this from the survey data requires some statistical manipulation.

Experiencing an episode of acute gastroenteritis is a rare event and can be assumed to have what is called a Poisson distribution. This is a statistical distribution with certain properties. If the mean number of episodes of acute gastroenteritis per person per year is known then, on a theoretical basis, one can calculate the probability of observing a particular number of episodes in a given time period. In particular, the probability of observing at least one episode in a given four-week period can be calculated.

In essence, assuming a risk spread evenly over the population, the 4.49% figure obtained from the survey data is the probability of observing at least one episode of acute gastroenteritis in a four-week period in an individual and one needs to be able to work backwards from this 4.49% to a 'mean number of episodes of acute gastroenteritis each year'. A special program was written by Leslie Daly to calculate the probability of observing at least one episode of acute gastroenteritis in a four-week period for a range of values for the mean number of episodes of acute gastroenteritis. Using the results of this, a mean of 0.60 separate episodes per person per year corresponded to a probability of 4.49%. This is how this and other figures were derived.

Confidence intervals for the mean number of episodes of acute gastroenteritis each year are based on the substitution method, which essentially involves working backwards from the confidence limits on the observed probability of at least one episode of acute gastroenteritis in four weeks (as described above) to give the corresponding limits for the mean.³⁰

APPENDIX E.

Geographical Distribution by County

Table E.1: Geographical distribution by county of survey respondents in the North compared to the population

County	Survey		Population	
	N	%	N	%
Antrim	1885	38.2	655539	38.6
Armagh	458	9.3	143416	8.4
Londonderry	549	11.1	244454	14.4
Down	1539	31.2	441585	26
Fermanagh	109	2.2	57623	3.4
Tyrone	390	7.9	155159	9.1
Total	4930	100.0	1697776	100.0

Table E.2: Geographical distribution by county of survey respondents in the South, compared to the population

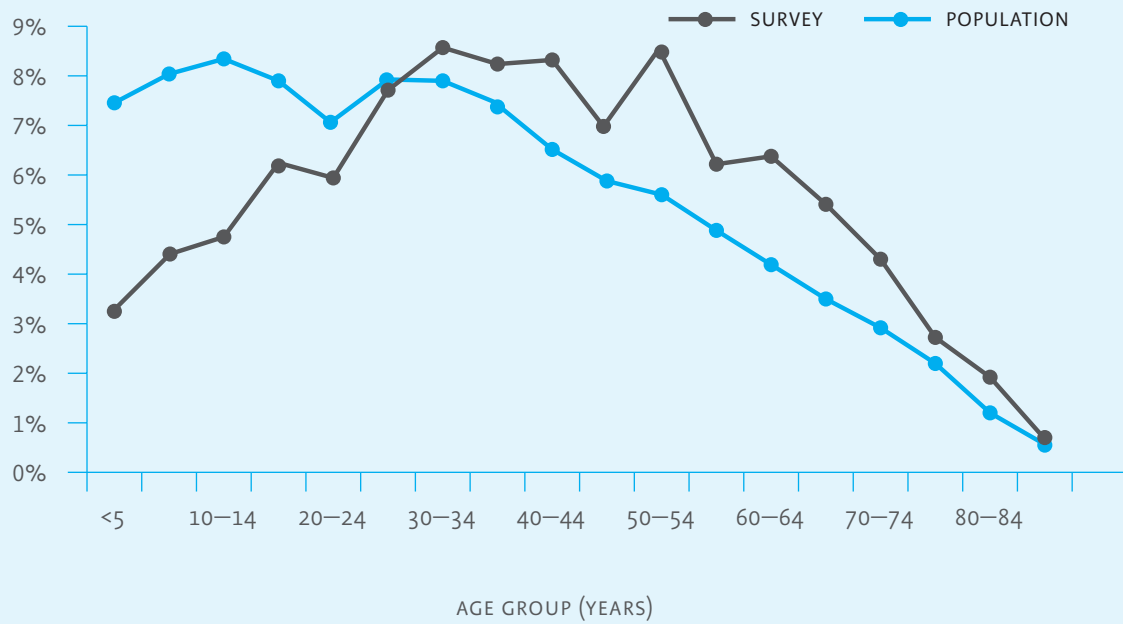
County	Survey		Population	
	N	%	N	%
Carlow	22	0.4	41600	1.1
Cavan	71	1.4	52900	1.5
Clare	158	3.2	94000	2.6
Cork	583	11.7	420500	11.6
Donegal	255	5.1	130000	3.6
Dublin	1375	27.6	1058300	29.2
Galway	291	5.9	188900	5.2
Kerry	203	4.1	126100	3.5
Kildare	152	3.1	135000	3.7
Kilkenny	71	1.4	75300	2.1
Laois	56	1.1	52900	1.5
Leitrim	46	0.9	25100	0.7
Limerick	208	4.2	165000	4.6
Longford	49	1.0	30200	0.8
Louth	115	2.3	92200	2.5
Mayo	238	4.8	111500	3.1
Meath	116	2.3	109700	3
Monaghan	69	1.4	51300	1.4
Offaly	73	1.5	59100	1.6
Roscommon	113	2.3	52000	1.4
Sligo	69	1.4	55800	1.5
Tipperary	162	3.3	133500	3.7
Waterford	115	2.3	94700	2.6
Westmeath	74	1.5	63300	1.7
Wexford	196	3.9	104400	2.9
Wicklow	93	1.9	102700	2.8
Total	4973	100.0	3626100	100.0

APPENDIX F.

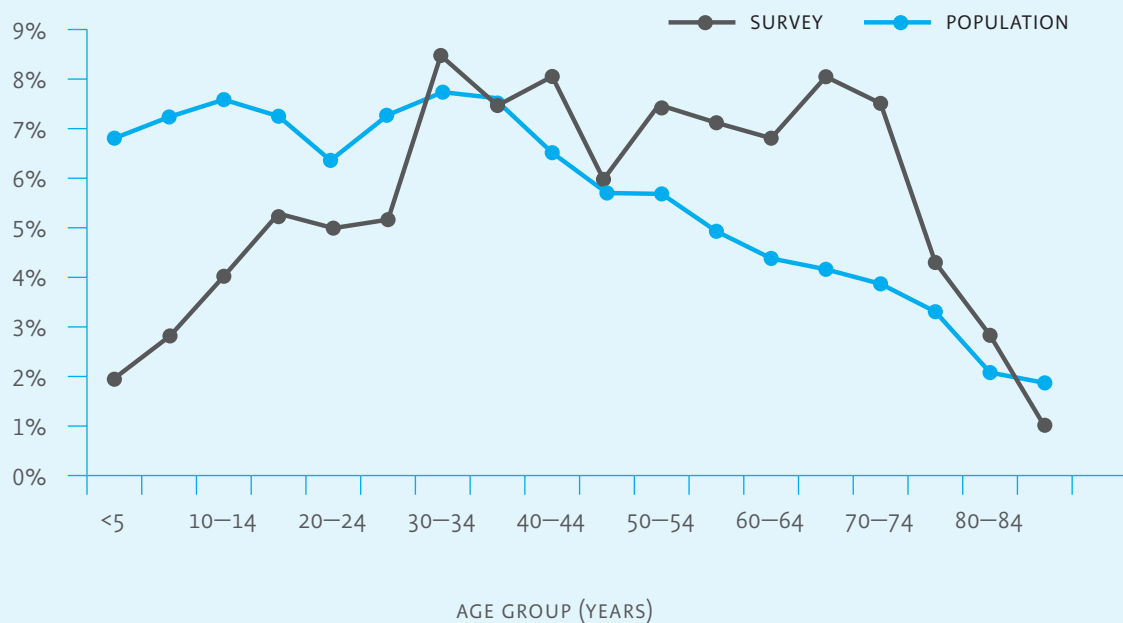
Age and Sex Distribution

Figure F.1: Age and sex distribution of survey respondents in the North, compared to the population*

(a) Males



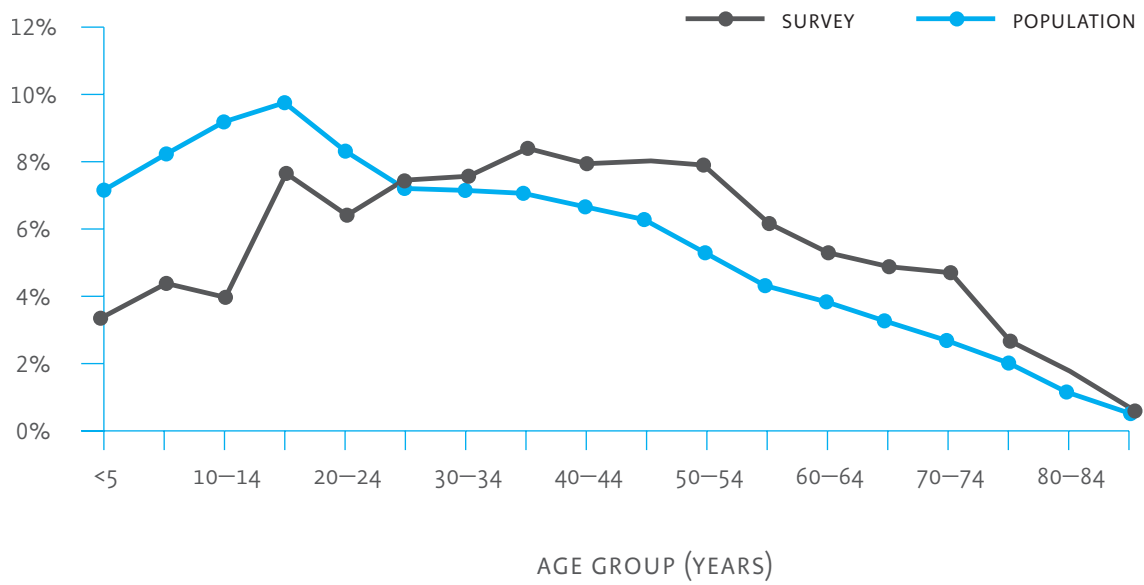
(b) Females



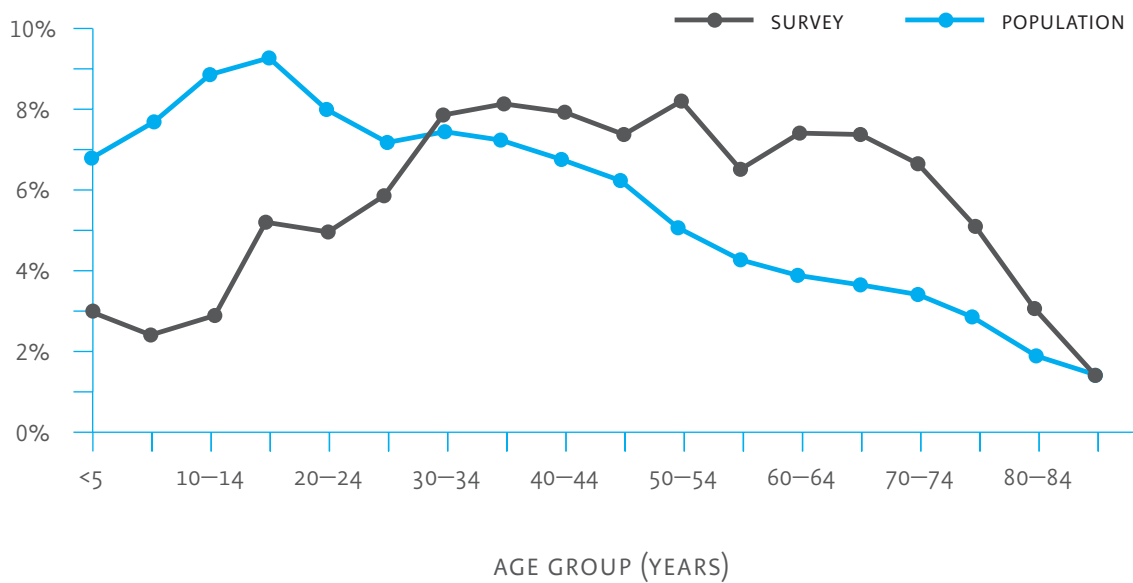
*Age and sex data missing for 21 respondents

Figure F.1: Age and sex distribution of survey respondents in the South, compared to the population*

(a) Males



(b) Females



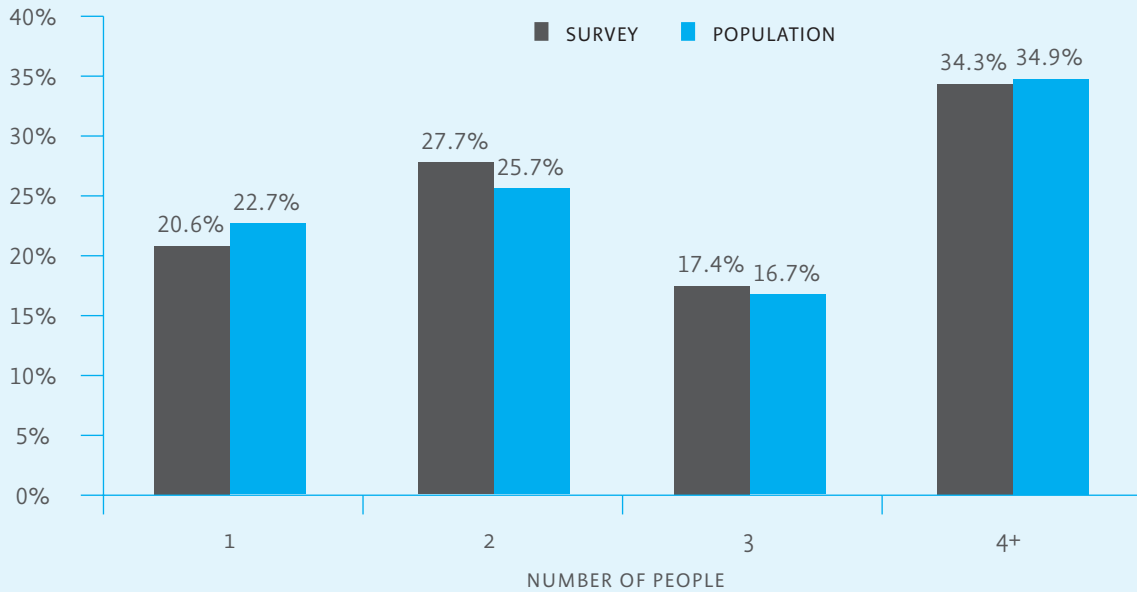
*Age and sex data missing for 32 respondents

APPENDIX G.

Household Size

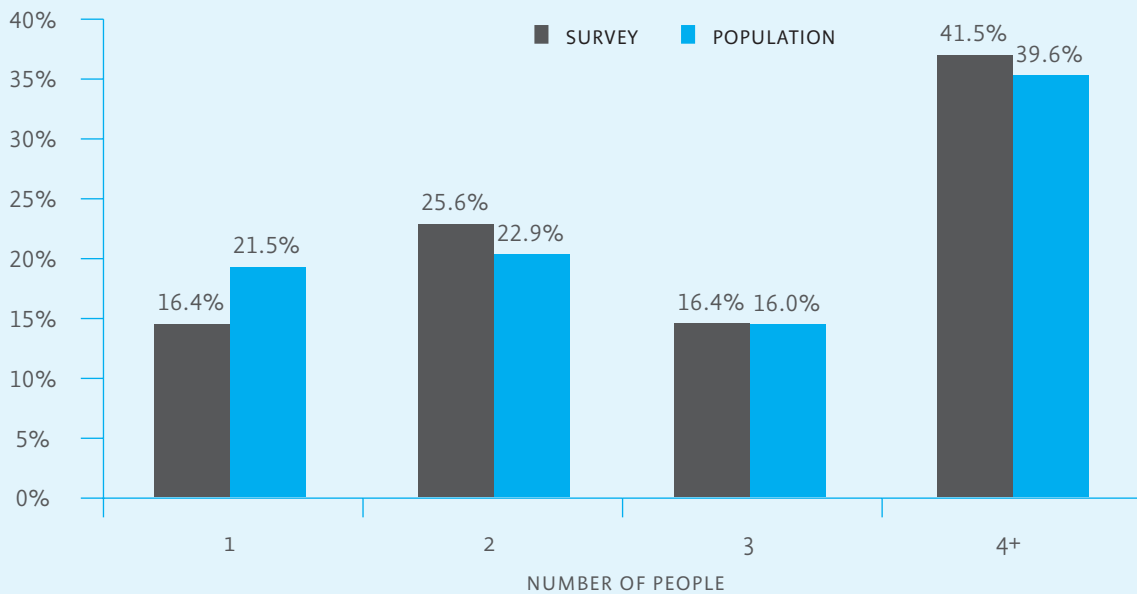
Figure G.1: Survey household size compared to the household size in the population, North and South

(a) North†



† Household size data missing for 1 respondent

(b) South*



*Household size data missing for 3 respondents

Abbreviations

CDSC (NI)	Communicable Disease Surveillance Centre (Northern Ireland)
FSA (NI)	Food Standards Agency (Northern Ireland)
FSAI	Food Safety Authority of Ireland
FSPB	Food Safety Promotion Board
GP	General Practitioner
NDSC	National Disease Surveillance Centre
NS	Non-significant
PSTN	Public Switched Telephone Network
RDD	Random Digit Dialling
A&E	Accidents and Emergency

Glossary of Terms

Acute gastroenteritis: In this study, acute gastroenteritis was defined as:

- diarrhoea three or more times in a 24 hour period
- or
- bloody diarrhoea
- or
- vomiting together with at least one other symptom (diarrhoea, abdominal pain/cramps, fever)
 - in the absence of a known non-infectious cause

Analgesics and antipyretics: Medicines that reduce pain and help to reduce high temperatures. Examples include paracetamol and aspirin.

Bacteria: Living single-celled organisms. They can be carried by water, wind, insects, plants, animals and people. Bacteria survive well on skin and clothes and in human hair. They also thrive in scabs, scars, the mouth, nose, throat, intestines and room-temperature foods.

Bias: Deviation of results or inferences from the truth, or processes leading to such systematic deviation. Any trend in the collection, analysis, interpretation, publication, or review of data that can lead to conclusions that are systematically different from the truth.

Case definition: A set of standard criteria for deciding whether a person has a particular disease or health-related condition, by specifying clinical criteria and limitations on time, place, and person.

Coeliac disease: A condition that makes affected individuals unable to eat foods containing gluten, a protein found in many grains used to make flour.

Confidence interval: A range of figures that gives the margin of error due to sampling for a quantity measured in a survey. See section 2.4.7.2. This is also called the precision in the tables in this report.

Crohn's disease: A condition in which the lining of the bowel becomes very inflamed.

Demographic information: Personal characteristics such as age, sex, race, and occupation used to characterise a population.

Epidemiology: The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.

Fixed-line telephone: A standard telephone connected to the telephone network by a wire (or land-line).

Incidence: A measure of the frequency with which an event, such as a new case of illness, occurs in a population over a period of time. For the incidence rate, the denominator is the population at risk; the numerator is the number of new cases occurring during a given time period. It is usually expressed per 1,000 or other appropriate unit.

Mean: The measure of central location, also called the average. It is calculated by adding together all the individual values in a group of measurements and dividing by the number of values in the group (e.g. Set = 1, 2, 3; Mean = $6/3 = 2$).

Median: The measure of central location which divides a set of data into two equal parts (e.g. Set = 1, 2, 3, 4, 5; Median = 3).

Medical consultation: When an individual seeks advice from a medical doctor or nurse.

Mode: The measure of central location, the most frequently occurring value in a set of observations

Morbidity: Any departure, subjective or objective, from a state of physiological or psychological well-being.

Non-significant (NS): See **Statistical significance**.

Notifiable diseases: A disease that, by law, must be reported to public health authorities upon diagnosis.

Outbreak surveillance: The systematic collection, analysis, interpretation, and dissemination of information relating to outbreaks on an ongoing basis, to gain knowledge of the pattern of disease occurrence in order to control and prevent disease in the community.

P value: See **Statistical significance**.

Pathogen: A disease-causing agent, such as a bacterium, parasite, virus, or fungus.

Population: The total number of inhabitants of a given area or country. In sampling, the population may refer to the units from which the sample is drawn,

not necessarily the total population of people.

Precision: See **Confidence interval**.

Prevalence: The total number of cases of a given disease at a particular point in time or during a specified time period, including new (i.e. incidence) as well as chronic cases.

Prospective studies: see **Retrospective studies**.

Protozoa: Single-celled microscopic animals. The term is taken from a Greek phrase meaning 'first animal'.

Random-digit dialling: A method of identifying the households to be contacted for a telephone interview. Either all the digits of the telephone number are randomly generated, or numbers are randomly selected from a directory and the last one or two digits are replaced by random numbers.

Respondents: The individuals who answer the survey questions.

Response rate: The number of completed interviews divided by the number of valid potential responders.

Retrospective studies: Studies that start at one point in time and look back to find information on events, such as illness or exposures, that have already taken place. In contrast, prospective studies start at a point in time and move forward to collect information on events as they occur.

Sample: Selected subset of a population. A sample may be random or non-random and representative or non-representative.

Sample, random: Sample of individuals

chosen in such a way that each one has a known probability of being selected. In a simple random sample, the probabilities are the same for each individual.

Sample, representative: A sample whose characteristics correspond to those of the original or reference population.

Seasonality: Change in physiological status or in disease occurrence that conforms to a regular seasonal pattern.

Self-medication: When an individual decides what medicine he/she should take, rather than seeking the advice of a doctor or pharmacist.

Statistical significance: A statistical result not likely to be due to chance. This occurs when the p-value is less than 5% ($p < 0.05$). If the p-value is less than 1% ($p < 0.01$), this means the result is highly significant. Non-significance (NS) arises when the p-value is greater than 5% and therefore chance is a possible explanation for the results. See section 2.4.7.3.

Ulcerative colitis: A condition where the lining of the bowel becomes very inflamed and does not work properly (similar in some ways to Crohn's disease).

Viruses: Protein-wrapped genetic material which is the smallest and simplest life-form known (for example Norovirus or Hepatitis A).

Weighting, statistical: A statistical method to adjust sample results so they reflect the populations from which they are taken. Because different proportions of the populations North and South were sampled in this survey, adjustment was made to the raw sample results to reflect the overall population North and South. This was also done to reflect the age and sex distribution. See section 2.4.7.1 and Appendix D.

References

1. Guerrant RL, Hughes JM, Lima NL, Crane J. Diarrhea in developed and developing countries: magnitude, special settings, and etiologies. *Rev.Infect.Dis.* 1990;12 Suppl 1:S41–S50.
2. Sockett PN, Roberts JA. The social and economic impact of salmonellosis. A report of a national survey in England and Wales of laboratory-confirmed Salmonella infections. *Epidemiol.Infect.* 1991;107:335–47.
3. Djuretic T, Ryan MJ, Wall PG. The cost of inpatient care for acute infectious intestinal disease in England from 1991 to 1994. *Commun.Dis.Rep.CDR Rev.* 1996;6:R78–R80.
4. Withington SG, Chambers ST. The cost of campylobacteriosis in New Zealand in 1995. *N.Z.Med.J.* 1997;110:222–4.
5. Scott WG, Scott HM, Lake RJ, Baker MG. Economic cost to New Zealand of foodborne infectious disease. *N.Z.Med.J.* 2000;113:281–4.
6. Harvey I. Infectious disease notification--a neglected legal requirement. *Health Trends* 1991;23:73–4.
7. Barrett P, Lau YK. Incompleteness of statutory notification of bacterial gastrointestinal infection. *Public Health* 1997;111:183–5.
8. Allen CJ, Ferson MJ. Notification of infectious diseases by general practitioners: a quantitative and qualitative study. *Med.J.Aust.* 2000;172:325–8.
9. Weir R, Williams D, Graham P. Notification of gastrointestinal illness by Canterbury and West Coast general practitioners. *N.Z.Med.J.* 2001;114:307–9.
10. Wheeler JG, Sethi D, Cowden JM, Wall PG, Rodrigues LC, Tompkins DS et al. Study of infectious intestinal disease in England: rates in the community, presenting to general practice, and reported to national surveillance. The Infectious Intestinal Disease Study Executive. *BMJ* 1999;318:1046–50.
11. Angulo FJ, Voetsch AC, Vugia D, Hadler JL, Farley M, Hedberg C et al. Determining the burden of human illness from food borne diseases. CDC's emerging infectious disease program Food Borne Diseases Active Surveillance Network (FoodNet). *Vet.Clin.North Am.Food Anim Pract.* 1998;14:165–72.
12. Herikstad H, Yang S, Van Gilder TJ, Vugia D, Hadler J, Blake P et al. A population-based estimate of the burden of diarrheal illness in the United States: FoodNet 1996–1997. *Epidemiol.Infect.* 2002;129:9–17.
13. Office of Telecommunications. Consumers' use of fixed telecoms services. 2002. London, Office of Telecommunications.
14. Office of Telecommunications. Homes without a fixed line phone. 2002. London, Office of Telecommunications.
15. Armitage P, Berry G. Statistical Methods in Medical Research. Oxford: Blackwell Scientific, 1987.

16. Daly L, Burke G. Interpretation and Uses of Medical Statistics. Oxford: Blackwell Science, 2000.
17. Watson EK, Firman DW, Heywood A, Hauquitz AC, Ring I. Conducting regional health surveys using a computer-assisted telephone interviewing method. *Aust.J.Public Health* 1995;19:508–11.
18. Davies M. The use of computer-assisted telephone interviewing for health surveys. *Aust.N.Z.J.Public Health* 1996;20:103.
19. Monto AS, Koopman JS. The Tecumseh Study. XI. Occurrence of acute enteric illness in the community. *Am.J.Epidemiol.* 1980;112:323–33.
20. Hoogenboom-Verdegaal AM, de Jong JC, During M, Hoogenveen R, Hoekstra JA. Community-based study of the incidence of gastrointestinal diseases in The Netherlands. *Epidemiol.Infect.* 1994;112:481–7.
21. de Wit MA, Hoogenboom-Verdegaal AM, Goosen ES, Sprenger MJ, Borgdorff MW. A population-based longitudinal study on the incidence and disease burden of gastroenteritis and Campylobacter and Salmonella infection in four regions of The Netherlands. *Eur.J.Epidemiol.* 2000;16:713–8.
22. de Wit MA, Koopmans MP, Kortbeek LM, Wannet WJ, Vinje J, van Leusden F et al. Sensor, a population-based cohort study on gastroenteritis in the Netherlands: incidence and etiology. *Am.J.Epidemiol.* 2001;154:666–74.
23. Feldman RA, Banatvala N. The frequency of culturing stools from adults with diarrhoea in Great Britain. *Epidemiol.Infect.* 1994;113:41–4.
24. Palmer S, Houston H, Lervy B, Ribeiro D, Thomas P. Problems in the diagnosis of foodborne infection in general practice. *Epidemiol.Infect.* 1996;117:479–84.
25. Murphy MS. Guidelines for managing acute gastroenteritis based on a systematic review of published research. *Arch.Dis.Child* 1998;79:279–84.
26. Guerrant RL, Van Gilder T, Steiner TS, Thielman NM, Slutsker L, Tauxe RV et al. Practice guidelines for the management of infectious diarrhea. *Clin.Infect.Dis.* 2001;32:331–51.
27. Glynn MK, Bopp C, DeWitt W, Dabney P, Mokhtar M, Angulo FJ. Emergence of multidrug-resistant Salmonella enterica serotype typhimurium DT104 infections in the United States. *N.Engl.J.Med.* 1998;338:1333–8.
28. Sirinavin S, Garner P. Antibiotics for treating salmonella gut infections. *Cochrane.Database.Syst.Rev.* 2000;CD001167.
29. Wong CS, Jelacic S, Habeeb RL, Watkins SL, Tarr PI. The risk of the hemolytic-uremic syndrome after antibiotic treatment of Escherichia coli O157:H7 infections. *N.Engl.J.Med.* 2000;342:1930–6.
30. Daly LE. Confidence limits made easy: interval estimation using a substitution method. *Am.J.Epidemiol.* 1998;147:783–90.
31. Office of the Director of Telecommunications Regulation. The Irish Communication Market Quarterly Review. 2002. Dublin, Office of the Director of Telecommunications Regulation.

32. Central Statistics Office. Quarterly National Household Survey - Household and Family Units. 2001. Dublin, Central Statistics Office.
33. Central Statistics Office. Industrial earnings and hours worked. 2002. Central Statistics Office, Ireland.
34. Department of Enterprise, Trade and Investment. The new earnings survey (NES). Department of Enterprise, Trade and Investment. 2002.

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