Acute Gastrointestinal Illness (AGI) Study:
FINAL STUDY REPORT

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SUMMARY

The Acute Gastrointestinal Illness (AGI) Study is a set of three linked surveys, with the following objectives:

- To determine the magnitude and distribution of self reported AGI in the New Zealand population;
- To estimate the burden of disease associated with AGI;
- To describe and estimate the magnitude of under-ascertainment of AGI at each stage in the national communicable disease surveillance process; and,
- To identify modifiable factors affecting under-ascertainment that, if altered, could reduce case loss throughout the AGI component of the surveillance system.

The three study elements were completed during 2005-2007 and each has been reported separately.

- Community study: a twelve month telephone survey conducted from February 2006 – January 2007 and reported as "Acute Gastrointestinal Illness (AGI) Study: Community Survey" (Adlam *et al.*, 2007).
- General practice study: a nationwide incidence study conducted over seven weeks from May – July 2006, using selected practices via a computer network practice management system, supplemented by a postal survey conducted in July 2006. This study has been reported as "Acute Gastrointestinal Illness (AGI) Study: General Practice Study" (Perera *et al.*, 2007)
- Laboratory study: a postal survey of 45 community and hospital laboratories conducted in June 2006, and reported as "Acute Gastrointestinal Illness (AGI) Study: Laboratory Survey" (King *et al.*, 2007).

The purpose of this report is to utilise the results from all three study elements to describe the underascertainment of AGI at each stage of the reporting pyramid, and provide an overview of the illness in the New Zealand population. The report also compares the AGI study results with those from previous studies conducted in New Zealand on individual components of the reporting pyramid, and selected aspects of overseas studies.

The pyramid of AGI reporting is summarised as:

Community cases: 222.3

Visits a GP: 49.1 (22% of community cases)

Stool samples requested: 15.4 (6.9% of community cases)

Stool samples submitted: 13.3 (6.0% of community cases)

Tests positive: 2.7 (1.2% of community cases)

Reported to notification system 1 (0.4% of community cases)

The AGI study has contributed an estimation of the overall burden of the illness in the community, and clarified rates and ratios in the reporting pyramid. The estimate that 0.4% of New Zealand community cases of AGI are notified to national surveillance is slightly higher than estimates for Australia and Canada, but lower than for England.

Provided factors influencing notifications (e.g. laboratory practices) remain static, then data on individual notifiable enteric diseases can be used to detect trends for these specific diseases. However, there are many causes of AGI which are not notifiable (especially illness caused by infection with viral pathogens) so notifications alone cannot be used to determine trends in the overall burden of AGI in New Zealand. In addition, ratios determined for the overall pyramid of AGI as a syndrome cannot be applied to determining the pyramids for specific illnesses such as campylobacteriosis, giardiasis or norovirus infection.

1 INTRODUCTION

The Acute Gastrointestinal Illness (AGI) Study is a set of three linked surveys, with the following objectives:

- To determine the magnitude and distribution of self reported AGI in the New Zealand population;
- To estimate the burden of disease associated with AGI;
- To describe and estimate the magnitude of under-ascertainment of AGI at each stage in the national communicable disease surveillance process; and,
- To identify modifiable factors affecting under-ascertainment that, if altered, could reduce case loss throughout the AGI component of the surveillance system.

The three study elements were:

- Population (community) study: A telephone survey of a randomly selected, suitably weighted, sample of the New Zealand population over a twelve month period, to determine the period prevalence and burden of AGI In New Zealand. The study design would utilise the experience of, and ensure compatibility with, the studies already performed in Australia, Canada, Ireland and USA and others being planned through the International Collaboration on Enteric Diseases "Burden of Illness" Studies.
- General practice study: A survey of a geographically representative random sample of general medical practitioners, focusing on under-ascertainment at the patient practitioner and practitioner-Public Health Service (PHS) interfaces.
- Laboratory Study: A survey of all community microbiological laboratories to describe and quantify the under-ascertainment of AGI at the phase when a stool sample is submitted for analysis for enteric pathogens.

The three study elements were completed during 2005-2007 and each has been reported separately.

- Community study: a twelve month telephone survey conducted from February 2006 – January 2007 and reported as "Acute Gastrointestinal Illness (AGI) Study: Community Survey" (Adlam, *et al.*, 2007);
- General practice study: a nationwide incidence study conducted over seven weeks from May – July 2006, using selected practices via a computer network practice management system, supplemented by a postal survey conducted in July 2006. This study has been reported as "Acute Gastrointestinal Illness (AGI) Study: General Practice Study" (Perera, *et al.*, 2007); and,
- Laboratory study: a postal survey of 45 community and hospital laboratories conducted in June 2006, and reported as "Acute Gastrointestinal Illness (AGI) Study: Laboratory Survey" (King, *et al.*, 2007).

1.1 Purpose of this report

The purpose of this report is to utilise the results from all three study elements to describe the underascertainment of AGI at each stage of the reporting pyramid, and provide an overview of the illness in the New Zealand population. The report also compares the AGI study results with those from previous studies conducted in New Zealand on individual components of the reporting pyramid, and selected aspects of overseas studies.

2 REPORTING OF AGI IN NEW ZEALAND: BACKGROUND

This report examines each stage in the reporting pyramid for AGI. The pyramid includes a number of elements, which will be common to all developed countries. These are described briefly in this section, to set out the structure of the system as it is configured in New Zealand.

Community: the overall prevalence of AGI in the community includes all cases of vomiting and/or diarrhoea. A substantial proportion of these cases do not present to the health system. AGI is mostly self-limiting, and many cases prefer to recover without interacting with the health system. A number of over-the-counter medications to counter the symptoms of AGI are available without prescription.

General practice (GP): General practitioners represent the primary health care source most likely to be used by cases of AGI. In New Zealand part charges are in place for visits to a GP, but at the time of this study assistance packages by way of patient subsidies were available. The subsidy for under 6 year olds is such doctor visits are of minimal cost or free.

After hours clinics: It is a common practice for organisations of GPs, particularly in the major urban centres, to establish clinics to handle patients presenting in evenings and weekends.

Notifications: New Zealand has a list of fifty diseases for which notification is required. The list of notifiable diseases includes many which can be categorised as AGI, and may be caused by bacterial or parasitic organisms. "Acute gastroenteritis" due to organisms not on this list is also a notifiable disease, but only where the clinician suspects it may be part of an outbreak, if the individual has a "high risk" occupation, if a toxin is involved, or if the gastroenteritis is due to verocytotoxic *Escherichia coli* (this latter illness is reported separately in surveillance reports). This category has the effect of capturing a small proportion of AGI cases caused by common viruses (norovirus, rotavirus). AGI cases notified through the notifiable disease surveillance system are reported with a variety of associated data and risk factors, but this information is often incomplete and inconclusive when assigning transmission routes.

Notification can be initiated on the basis of "clinical suspicion" by a GP, but in practice is usually based on the isolation of a pathogen from a clinical sample.

Hospitalisations: Data on cases of AGI resulting in hospitalisation can be obtained from two sources. Notified cases where hospitalisation occurred at the same time and this information is recorded on EpiSurv (a hospitalisation field is included on the case report form for all diseases), and the New Zealand Health Information Service (NZHIS) which record the diagnosis of all cases discharged from public hospitals.

Public Health Services (PHSs): These twelve regional units have a range of public health functions, including the identification and investigation of AGI incidents. These units receive the initial notification of cases of AGI from GPs, Community Accident and Emergency Clinics, and Hospitals under a statutory obligation to report notifiable diseases. They also receive reports of AGI directly from the public. PHSs units are the primary source for identification of clusters of cases that may represent an outbreak. The PHSs are responsible for investigating outbreaks, as well as gathering additional data on cases which is entered into the notifiable diseases database, EpiSurv. This interview is usually conducted by telephone.

Laboratory testing: New Zealand has a system of hospital and community laboratories which receive and test faecal samples for enteric pathogens (as well as other specimen types). Some

laboratories are associated with public hospitals (and may also receive community samples), while those processing solely community samples are usually private companies. Community samples are derived from cases presenting to GPs. Patients are requested to deliver a sample(s) back to the practice or to the laboratory directly. The results of testing are reported to the GP (or hospital clinician), and where a pathogen is identified as a notifiable disease, the GP reports that case to the local PHS. Laboratory testing is not charged to the patient, although there is still a fee for visiting a GP for referral.

Other relevant laboratories:

Reference laboratory: The Enteric Reference Laboratory at the Institute of Environmental Science and Research (ESR) receives isolates of selected bacteria from community or hospital laboratories for typing. All *Salmonella* isolates are received, along with some isolates of other bacteria.

Virus testing: Most laboratories will perform testing for rotavirus. Norovirus testing on faecal samples is performed by a few community and hospital laboratories, while the Norovirus Reference Laboratory (also at ESR) receives faecal samples for testing when enhanced molecular methods are indicated.

3 AGI IN NEW ZEALAND: REPORTING PYRAMID

This section describes the overall pyramid for AGI as a syndrome, with all cases in New Zealand as the base, and those reported as notifiable diseases via the national surveillance system as the apex. This represents an aggregation of the pyramids for AGI caused by a diverse range of microbiological agents, each of which will have a differently shaped pyramid. For example, a large base would be expected for norovirus infection, with few cases reported (as outbreaks) to the surveillance system. Conversely, illnesses with more severe AGI outcomes, such as salmonellosis, will have a much narrower base, and more cases reported. It is not possible to apply the pyramid findings to individual enteric diseases, only to the overall AGI syndrome.

3.1 Annual prevalence

The base of the reporting pyramid is the community prevalence. According to the community survey raw data, 297/3655 respondents fitted the case definition for AGI. The estimated number of cases (any diarrhoea or vomiting of infectious cause) in 2006 was 4,660,000 million (an incidence rate of 1.11 per person per year for a population of 4,184,600). The 95% confidence intervals were 3.9 to 5.2 million cases. This value has been adjusted from the raw data, to correct for age, gender and ethnicity.

3.2 Consultations with a GP

The community study identified that, of the people who reported an episode of AGI in the previous 4 weeks, 65/297 (22%) visited their GP during their most recent episode of AGI. After adjustment for age sex and indigenous status, this provided an estimate of 920,000 cases (95% CI 0.73 – 1.12 million), which is 19.7% of the total number of cases.

The incidence rate observed in the community study over the same quarter as the GP study (0.8 per person per year) extrapolates to 734,000 GP consultations per year. The incidence rate, based on the period of the GP study (May – July) is lower than the rate for the entire year (1.11 per person per year), as AGI is seasonal, with fewer cases during winter.

The laboratory study extrapolated from faecal sample requesting behaviour of GPs (Sarfati *et al.*, 1997) that there may be 790,000 GP consultations by people with symptoms of AGI.

3.3 Faecal samples

In the community study, there were 65 cases that visited a GP, 49 of whom had diarrhoea as a symptom. Of those AGI cases with diarrhoeal illness, 20 had a faecal sample requested for laboratory testing. Therefore 31% (20/65) of all AGI cases attending their GP had a faecal specimen requested (it was assumed that AGI cases without diarrhoea were not asked to provide faecal samples). This suggests 285,000 stool sample requests (6.1% of the community cases). The compliance estimated in the community study was 18/20 (90%) = 256,000 samples submitted for faecal analysis per year (5.5% of the community cases).

Using the number of GP visits from the community study (920,000), and the proportion of faecal sample requests from the GP study (23.3%) we estimate 211,600 requests for faecal analysis per year (4.5% of community cases). This estimate may be more accurate, being based on an electronic database. However, the GP study result does not indicate how many

samples were requested from each person, so the actual number of individual samples is likely to be higher.

The laboratory survey estimated that approximately 250,000 faecal samples were submitted in 2005 to community and hospital laboratories. It was also estimated that 77.1% of these samples originated from GPs, giving 193,000 samples. Using the faecal sample request result from the GP survey (23.3% of AGI cases), this suggests that these samples may result from approximately 839,000 GP visits. These figures are based on responses from 35 of 46 laboratories and estimations for non-responding laboratories.

The analysis of the laboratory survey indicated that of the 35 eligible laboratories, 18 tested at least some faecal samples from people in the community and could estimate the proportion of positive tests for a pathogen. From these laboratories, approximately 20% (12,000/59,000) of samples were estimated as testing positive.

3.4 Notifications as a component of AGI in New Zealand

Although notification can be initiated in the basis of "clinical suspicion", in practice for a case of AGI to be notified (apart from acute gastroenteritis associated with a suspected outbreak or individuals that self-report AGI to a PHS), a pathogen must be isolated from a faecal sample by a community or hospital laboratory, and the reporting chain from laboratory to GP to PHS to the notifiable diseases database needs to be completed.. The notifiable illnesses in New Zealand that can be classed as AGI are shown in Table 1, together with the number of cases notified in, 2005 and 2006, and the specific months of the community study, February 2006 – January 2007. This table excludes some of the more severe but uncommon food and waterborne illnesses such as invasive listeriosis, infection with hepatitis A virus, typhoid and paratyphoid fever, and cholera. These collectively cause less than 200 cases per year in New Zealand.

Table 1: Cases of notified disease that can be classed as AGI for 2005 and 2006 and the specific period of the community study, February 2006-January 2007.

Notifiable Illness	2005 (ESR, 2006)	2006 (ESR, 2007)	February 2006 - January 2007
Campylobacteriosis	13836	15873	16289
Cryptosporidiosis	889	736	737
Gastroenteritis	557	933	941
Giardiasis	1231	1214	1239
Salmonellosis	1382	1335	1296
Shigellosis	183	102	90
VTEC/STEC infection	92	87	87
Yersiniosis	407	487	489
Total	18577	20767	21168

Notifications represent a small proportion of the estimated total cases of AGI in the community. Notifications over the period of the AGI community survey (February 2006 to January 2007) represent approximately 0.5% of the estimated 4,660,000 total cases of AGI, and approximately 2.3% of the estimated 920,000 cases that visited a GP.

Notified cases represented approximately 8.5% of the estimated 250,000 faecal samples submitted in 2005. It was estimated in the laboratory survey that a pathogen was found in up to 50,000 samples (approximately 20% of the total) in 2005. The difference between the 8.5% notified cases and 20% total samples for which a pathogen is found will include common but non-notifiable diseases such as infection with rotavirus.

3.5 Pyramid

Rates:

Community cases of AGI : 1.11 per person per year

GP visits for AGI : 0. 22 per person per year (using results from the community study)

Faecal samples submitted to a community or hospital laboratory: 0.06 per person per year (using estimates from the community study)

Faecal samples submitted in which a pathogen is found: 0.012 samples per person per year (using estimates from the community and laboratory studies)

Reporting ratios

To calculate the reporting pyramid for New Zealand, the probabilities of each event in the disease pyramid from the crude data were treated as Beta distributions for a model constructed in @RISK (Version 5.0, Palisade Corporation). These probabilities were then multiplied by the revised June 2006 New Zealand estimated resident population provided by Statistics New Zealand (4,184,600), and divided by the number of notified cases for the relevant time period (21,168) to provide the ratios.

Community cases of AGI: 297/3655

Visit to a GP by a community case: 65/297

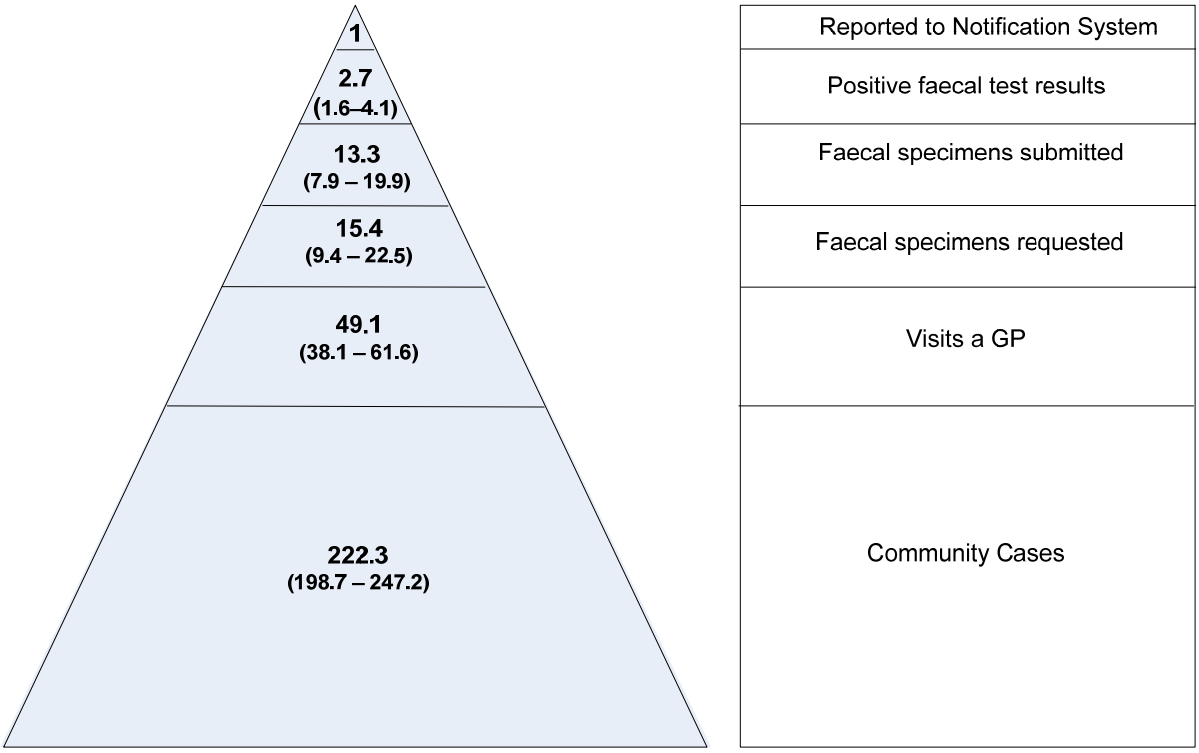
Stool sample requested by a GP: 20/65

Stool samples submitted: 18/20

Tests positive: 20% of stool samples submitted (12,000/59,000)

The results of the modelling are represented in Figure 1 Overall, it is estimated that 1/222.3 (0.4%) community cases results in a notification.

Figure 1: The New Zealand AGI reporting pyramid showing ratios of cases in the community, general practice, and clinical laboratory levels relative to notifiable diseases, 2006 (mean, 5th and 95th percentiles, areas to scale). Note that not all positive faecal test results will be for diseases that are notifiable.



3.6 Comparison of other aspects of AGI between surveys

3.6.1 Faecal sample requesting and compliance

The community study identified that faecal samples were requested in 31% of respondents attending their GP (40% of those with diarrhoea) and the compliance rate was 90%. The key predictor for having a faecal sample was duration of illness with a third of cases experiencing a duration of illness of 5 days or more being asked to submit a specimen. Of the 11 AGI cases with blood in the stools, 5 of these attended their GP and 4 (80%) had faecal cultures performed. Of those respondents who did have faecal analysis 50% were aware of an identified pathogen.

In the GP study 23% of all AGI encounters resulted in a request for faecal sampling. GPs indicated that 82% would always or usually request a faecal sample where AGI cases presented with blood in the stool . The next key predictor was duration of illness, where 75% indicated they usually or always requested a faecal sample if the duration of illness was 5 days or more.

In the GP study, compliance with faecal specimen requests was reported as good (30% of GPs), very good (40%) or excellent (20%). This apparently high level of compliance agrees

with the result from the community study that 90% of patients from whom a faecal sample is requested do provide a sample.

3.6.2 Faecal sample testing

The survey of GPs showed that a high proportion (90% or more) assumed that testing of faecal samples for *Campylobacter*, *Salmonella* and *Shigella* was routine. Only 51% of GPs assumed that testing for *Yersinia* was routine, but the laboratory survey indicated that, of the laboratories that provided such details, all tested for this bacterium.

Routine parasite testing for *Cryptosporidium* and *Giardia* was reported by some laboratories, but testing on request was more frequent than testing routinely. In addition, one laboratory reported that they were not able to test for these organisms. Approximately half of the GPs considered tests for these organisms to be routine. Similarly, in terms of viruses, rotavirus testing was the most commonly reported faecal analysis, usually driven by the youth of the patient. GPs appeared to overestimate the frequency of norovirus testing (22% of GPs considered this test to be routine, whereas just two of the 36 community and hospital laboratories who responded reported testing for this virus, and only on request).

4 LITERATURE REVIEW

4.1 New Zealand

4.1.1 Utilisation of general practitioner services

The New Zealand Health Survey conducted in 1996/97 has been analysed to examine how utilisation of GP services varied with income, ethnicity and government subsidies (Scott *et al.*, 2003). This analysis showed that women were more likely to visit a GP, and low income groups were less likely to have visited a GP at least once. Maori were significantly less likely to make at least one visit to the GP, though there was no difference between Maori and NZ European in terms of frequent visits.

This suggests that for acute illnesses Maori are less likely to visit a GP, which agrees with the findings of the GP study, but contrasts with the community study where the percentage of Maori AGI cases that reported attending their GP was higher than non-Maori respondents (32% vs. 19%). Although this may be due to non response bias it may also signal that recent changes to subsidies in primary health care are improving access.

4.1.2 Bay of Plenty

A study in the Bay of Plenty in 1995 examined 996 faecal samples from cases of gastroenteritis over a one year period (Wright, 1996). Of these, a total of 336 (34%) were found to contain at least one pathogen. Of the total of 336 samples in which a pathogen was detected, 38 contained rotavirus. This suggests that 11% of positive faecal samples might be positive for rotavirus. The laboratory study estimated that pathogens were found in approximately 50,000 samples (20%) in 2005. If the proportions of positive samples have remained the same since the 1995 study, then approximately 5,000 – 6,000 of these samples could be positive for rotavirus. As rotavirus infection is not a notifiable disease, then this number would form part of the difference between the 50,000 positive samples, and the approximately 19,000 positive samples that resulted in notifications in 2005 (Table 1).

4.1.3 GP sample requesting behaviour

A previous report (Sarfati *et al.*, 1997) indicates that patients (over 5 years) with AGI symptoms presenting to general practitioners (GPs) in New Zealand are requested to provide stool samples in:

- less than 25% of cases by 42% of general practitioners;
- 25 – 50% of cases by 31% of GPs; and,
- over 50% of cases by 23% of GPs.

This is in agreement with the community study where overall 31% of all cases of AGI visiting a GP (40% of cases of AGI with diarrhoea visiting a GP) reported that their visit included a stool sample request, but higher than the GP survey that indicated that 23% of AGI encounters resulted in a request for faecal pathogen testing. However, the GP survey result appears similar to other countries where a range of 14-27% of those seeking medical care with an acute diarrhoeal illness are asked to submit a stool sample (Scallan *et al.*, 2006).

4.1.4 Notification of gastrointestinal illness by general practitioners

A study of GPs in Canterbury and the West Coast (Weir *et al.*, 2001) compared the number of notified patients with the number of patients with laboratory detected disease (campylobacteriosis, salmonellosis, shigellosis, cryptosporidiosis, giardiasis and acute hepatitis A). Individual GP laboratory based notification rates had a mean of 0.92 and a median of 0.78. Two potentially important methods for improving notification rates were identified: increasing the rate of specimen request for high risk groups, and encouraging primary care teams to consider delegating the duty to notify to practice nurses.

Another evaluation of GP notification rates, in Auckland (Simmons *et al.*, 2002), found that the overall proportion of laboratory confirmed cases (five gastrointestinal illnesses plus listeriosis and infection with hepatitis A) that were notified by GPs was 77%. The notification rates of hospital and community based practitioners was almost the same.

4.2 Overseas

4.2.1 Netherlands

A comparison of gastroenteritis in general practice based and community based studies in the Netherlands (de Wit *et al.*, 2001) found that overall 5% of community cases visited a GP. This subset of cases were found to have more severe symptoms than the others. A separate study of laboratory surveillance (van Pelt *et al.*, 2003) found that the number of stools screened for bacterial pathogens was approximately 4% of the estimated annual incidence of gastroenteritis in the Dutch population.

The proportion of community cases that visit a GP in New Zealand (22%) is apparently higher than in the Netherlands, but the proportion of community cases who are asked to provide a stool sample in New Zealand (6.9%) is similar.

4.2.2 England

The 1993-1996 Infectious Intestinal Disease (IID) Study (Wheeler *et al.*, 1999) estimated that of the estimated 9.4 million estimated cases of illness each year (approximately 1 in 5 people each year), 1.5 million cases (17%) presented to their general practitioner. Approximately 4.5% of the total cases sent a stool sample for routine laboratory testing, and 1.1% were positive; these proportions are similar to New Zealand. For every case detected by national laboratory surveillance, the study estimated that there were 136 cases in the community. This suggests that 0.7% of cases are reported to national surveillance, which is slightly higher than the estimate for New Zealand (0.4%).

Underascertainment at the GP level was investigated in one component of the IID study (Sethi *et al.*, 1999). In this retrospective review of patient records of the participating general practices, only 64% of the cases of IID were actually recognised as such by the GPs and recruited for the IID study. This underascertainment was corrected for in the larger study.

The IID study failed to detect an enteric pathogen or toxin in 49% of cases of gastroenteritis. In a follow-up study (Amar *et al.*, 2007), polymerase chain reaction assays for the detection of a range of enteric pathogens were applied to archived samples from the case-control arm of the study. The percentage of archived samples from cases and controls in which at least one pathogen or toxin was detected increased from 53% in the original study to 75%, and from 19% to 42%, respectively. The greatest change was in the detection of viruses, with *C.*

jejuni dropping from being the most commonly identified pathogen, to being third after norovirus and rotavirus A. Amongst cases, norovirus and rotavirus were detected in 36% and 31% of faecal samples respectively. These results suggest that approximately 70% of all cases of infectious intestinal disease in the United Kingdom are caused by viruses (norovirus, rotavirus and sapovirus).

4.2.3 Australia

In the 2001-2002 survey in Australia 17.2 million cases of gastroenteritis meeting the case definition (0.9 cases per person per year) were estimated (Hall *et al.*, 2004). Of these, 22.2% visited a doctor. Excluding cases that had vomiting only, and considering only the cases that had diarrhoea and that visited a doctor, 22% had a stool test ordered. All but one complied (15/16). The New Zealand estimated rate of AGI (1.11 cases per person per year) is slightly higher than for Australia, but the proportion visiting a doctor is very similar.

In Australia in 2005 there were 29,422 notified gastrointestinal diseases (Owen *et al.*, 2007); this figure does not include giardiasis or yersiniosis (and excludes campylobacteriosis from New South Wales). Therefore the proportion of community AGI cases that are notified is approximately 0.17% (29,422/17,200,000) which is a lower percentage than that estimated for New Zealand.

4.2.4 Canada

Estimates for under-reporting of infectious gastrointestinal illness in Ontario have been reported (Majowicz *et al.*, 2005). Distributions of plausible values were estimated using input distributions derived from the Public Health Agency of Canada National Studies on Acute Gastrointestinal illness (NSAGI) Initiative. For each case of enteric illness reported, the estimated number of illness in the community ranged from 105 to 1,389, with a median of 285, and a mean and standard deviation of 313 and 128 respectively. Translating from the estimated mean results (Table II in the paper) gives ratios of:

Community cases 312.92 (100%)

Visits a GP: 72.80 (23.2% of community cases, 4.3:1)

Stool requested 18.73 (6.0% of community cases, 16.7:1; 25.7% of physician visits, 3.9:1)

Stool submitted 14.57 (4.6% of community cases, 21.5:1; 20.0% of physician visits, 5.0:1; 77.8% of stools requested, 1.3:1)

Stools tested 13.83 (4.4% of community cases, 22.6:1; 94.9% of stools submitted, 1.1:1)

Tests positive 1.56 (0.5% of community cases, 200.5:1; 10.7% of stools submitted, 9.3:1)

Reported to local health unit 1.24 (0.4% of community cases, 252.3:1; 79.5% of tests positive, 1.26:1)

Reported to province 1 (0.3% of community cases)

These ratios are similar to those for New Zealand, but the number of community cases overall is higher.

5 DISCUSSION

5.1 Estimate of AGI encounters from the GP survey

The GP survey estimated an annualised incidence rate of 18.01 AGI cases per 1,000 population (95% CI 17.29-18.72). This extrapolates to 74,552 AGI cases presenting to GPs for the entire population. The number of AGI cases in 2006 predicted from the GP survey is thus considerably lower than data from the community and laboratory surveys. There are a number of possible reasons for this:

1. The GP survey was prospective rather than retrospective: Prevalence of AGI in the IID study (Wheeler *et al.*, 1999) was 2.8 times higher in the retrospective study than the prospective. A retrospective estimate of reported diarrhoea in the month before recruitment was 6.5% (95% confidence interval 6.0-7.0%). This was extrapolated to a rate of 55/100 person years, nearly three times the prospective estimate (19.4/100 person years).
2. The denominator for the GP survey included GP consultation as well as nurse consultations (estimated as 30% of all consultations), telephone consultations (estimated as 5-10% of all consultations) and prescription requests.
3. Seasonality: The GP study was conducted in winter, which is usually a period when notifications of enteric illness are lowest.
4. Measurement error in the GP study data. In the same quarter the scheduled data extraction in the GP Study was being undertaken, the Community Study revealed a 4 week period prevalence in the general population of 6.3% which translates to a annualised incidence rate of AGI in the community of 0.8 per person per year and an annualised incidence rate of 176 AGI cases per 1000 population per year attending their GP (c.f. 18 AGI cases per 1000 in the GP Study) While some of this discrepancy could be explained by over reporting or a non response bias effect in the Community Study, it is difficult to explain away such a large underestimate by a factor of nearly 10. We acknowledge the possibility of measurement bias inherent in the GP study and possible issues regarding the validity of the results.

The number of AGI encounters derived from the GP survey was not used in the calculation of the reporting pyramid values.

5.2 Modifiable factors to reduce case loss

Ideally, data collected on AGI should be sensitive, complete, timely and accurate. A surveillance system would not aim to identify every case of AGI in the New Zealand population. Rather the intention would be to collect a representative and well understood dataset that allows the confident prediction of the community burden of AGI, and allows the detection of changes. This section discusses factors that influence the ratios in the AGI pyramid above, in terms of the overall syndrome.

More sensitive detection of cases that have a high outbreak potential or where it is necessary to identify every case for public health follow-up, requires more focused surveillance and is not discussed here.

5.2.1 Community level

The greatest factor in underascertainment concerns the loss of cases through patient choice not to consult a general practitioner. This is not likely to be easily modified by public health professionals.

The study of utilisation of general practitioner services (Scott *et al.*, 2003) found that the system of low-income targeted government subsidies reduces, but does not fully compensate for the barrier posed by doctors fees. Another set of subsidies were introduced on July 1 2007 for 24 – 44 years age groups, so that all age groups are now covered by government subsidies.

Cost may not be the only barrier for GP consultation; transport and communication difficulties may reduce that accessibility of primary care services. In addition there are alternative sources of healthcare advice, such as telephone services (Healthline in New Zealand).

5.2.2 GP level:

Apart from outbreaks or AGI in persons with "high risk" occupations, a prerequisite for notification of a case of AGI is the identification of a pathogen in a faecal sample (although occasionally identification of a toxin in vomitus may occur). The patient factors influencing faecal specimen request identified in the GP survey were:

> Clinical factors: blood in stool, duration of illness >5 days;
> Demographic factors: the age group of the patient did not appear to be a key factor, although the very young or very old were more frequently reported to be "always or usually" asked for a faecal sample;
> Transmission risk factors: if the patient was a worker in the food industry, childcare or health care sectors, or a rest home resident, were important factors; and,
> Exposure: suspected outbreak, recent immigration, recent travel overseas, immunocompromised patient, suspect water consumption, and suspect food consumption were important factors.

This information suggests that AGI patients from high risk groups are very likely to be asked to provide a faecal sample.

Compliance with provision of faecal samples is apparently high, based on information from both the community and GP surveys.

In the study of GP practices regarding notification of gastrointestinal illness in Canterbury and the West Coast (Weir *et al.*, 2001), it was found that reporting could be enhanced by emphasising the importance of specimen collection in high risk groups, encouraging delegation of notification to practice nurses, and encouraging the development of public health based guidelines to determine the need for specimen request.

The barriers to notification from the GP study were that respondents identified the belief that the laboratory reports notifiable diseases and the lack of feedback regarding notifications as most important.

Nevertheless, the studies of GP notification rates indicate that 75% or more of laboratory confirmed cases are notified. This suggests that potential gains in this level of the reporting pyramid are modest.

5.2.3 Laboratory level:

The testing conducted on faecal samples is detecting pathogens in only approximately 20% of samples. There is a variety of reasons for this (discussed in the report from the laboratory survey), but the most important is the infrequency of testing for viral pathogens.

There appears to be only a small proportion of samples which are discarded for various reasons before testing (most laboratories reported less than 1% of samples discarded).

5.2.4 Conclusion about modifiable factors

The notifiable disease surveillance system was not established for surveillance of AGI (as a whole) and results of this research confirm that it provides a very incomplete picture of the incidence and distribution of such illness. The use of notification data to analyse and track AGI at the community level is hindered by the fact that such cases are an extremely small proportion of the total AGI cases. While there are a number of under-reporting issues with the notification data that could be addressed, fundamentally notifiable illnesses do not include major contributors (particularly viral infections) to the overall burden of AGI in New Zealand.. There are modest improvements that could be made in reporting by GPs, and provision of faecal samples when requested. However, the largest case losses from patients presenting to a GP as an indicator of AGI in the community are caused by:

- Not requesting a faecal sample
- Limiting the range of pathogen tests conducted on faecal samples, particularly the limited testing for viral pathogens causing AGI.

5.3 Inferences about the sensitivity of New Zealand' notification system

This study has limited ability to assess the overall sensitivity of New Zealand's surveillance system for notifiable diseases. As described in Section 3.4, notified cases represent a very small proportion (0.5%) of the overall burden of AGI in New Zealand. They are also a very small proportion (2%) of the estimated number of cases of AGI that visit a GP.

Notified campylobacteriosis cases have reached a high level in New Zealand; a rate of 422 per 100,000 in 2006, from 15,873 cases. This is considerably higher than the rate of reported cases in other developed countries. If the reported:unreported ratio for campylobacteriosis in New Zealand is similar to that determined in the IID study (1:7.6) then we might expect approximately 120,000 community cases. This is too small a component of the overall burden of AGI (estimated at 4.6 million cases per year) to determine whether New Zealand has a truly higher burden from campylobacteriosis than comparable countries, or whether reporting factors are causing the higher rate of notified illness.

6 CONCLUSIONS

This study has contributed an estimation of the overall burden of AGI in the community, and clarified rates and ratios in the reporting pyramid. The estimate that 0.4% of New Zealand community cases of AGI are notified to national surveillance is slightly higher than estimates for Australia and Canada, but lower than for England.

Provided factors influencing notifications (e.g. laboratory practices) remain static, then data on individual notifiable enteric diseases can be used to detect trends for these specific diseases. However, there are many causes of AGI which are not notifiable (especially illness caused by infection with viral pathogens) so notifications alone cannot be used to determine trends in the overall burden of AGI in New Zealand. In addition, ratios determined for the overall pyramid of AGI as a syndrome cannot be applied to determining the pyramids for specific illnesses such as campylobacteriosis, giardiasis or norovirus infection.

The data reported in the three AGI studies are valuable in assessing the burden of this illness (including economic cost) to New Zealand. This will aid decision-making about future investment in controlling sources of illness, as well as future investment in surveillance. It may be that sentinel surveillance or episodic surveys such as the community study are more efficient in providing risk management information than notification data.

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8 APPENDIX 1: AGI STUDY SUMMARY

Study parameter	Community Study	GP Study	Laboratory Study
Methodology			
Study type	Retrospective 4 week recall	Prospective	Retrospective
Year	2006	2006	2005
Duration	1 year (Feb 2006 – Jan 2007)	7 weeks (May/June/July)	1 year
Methodology	CATI	Data extraction/survey	Postal survey
Cooperation/response rate	21%	87%/29%	76%
Sample size	3655 respondents	105 GP practices	46 laboratories
AGI			
Cases meeting case definition for AGI	297	1081	
Annualised prevalence	8.6%		
Incidence rate AGI (per person per year)	1.1		
Extrapolation to 2006 NZ	4.6 million		
GP attendance			
Percentage attending a GP	22% (20% adjusted)		
Incidence rate attending a GP (per 1000 population per year)	220	18	
Estimated GP consultations per year	0.92 million	75,000	791,000
AGI as a percentage of all GP encounters	6.4%	0.3%	
Predictor of cases to GP	Duration 5+ days, blood in stool		
Laboratory request			
GP request for laboratory testing	31% (all AGI cases) 40% (AGI cases with diarrhoea)	23%	
Predictors for laboratory test	Duration 5+ days, blood in stool	Duration 5+ days, blood in	

		stool	
Compliance in submitting specimen	90%	Good or very good	
GP Requests for laboratory tests per year	285,000	240,000	197,000
Positive result reported	50%		20%
Medications taken			
Medications taken	38%		
Medication prescribed	7%		
Geographical distribution			
Top five DHB	Wairarapa, Otago, Northland, Hawkes Bay, Tairawhiti	Hawkes Bay, Bay of Plenty, MidCentral, Otago, Hutt Valley	
Risk factors			
	Male sex*, age less than 4 years, males under age 15, females aged 25 to 44, late spring summer months, identify as Pacific*, identify as Maori, farm address, no socio-economic effect, no household size effect	Male – female, age less than 4 years, identify as European/other, quintile 5 over represented	
Illness factors			
Mean duration of illness	2.5 days		
Meet criteria for severe AGI	28%		
Missed work (mean days)	36% (3.1 days)		
Days paid work missed in 1 year due to AGI in NZ	4.52 million		
Others in household with similar illness	31%		