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Healthcare utilization and lost productivity due to infectious gastroenteritis, results from a national cross-sectional survey Australia 2008–2009

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SUMMARY

The aim of this study was to estimate the healthcare usage and loss of productivity due to gastroenteritis in Australia using the National Gastroenteritis Survey II. In 2008–2009, 7578 participants across Australia were surveyed about infectious gastroenteritis by telephone interview. A gastroenteritis case was defined as a person experiencing $\geqslant 3$ loose stools and/or $\geqslant 2$ vomits in a 24-h period, excluding cases with a non-infectious cause for their symptoms, such as pregnancy or consumption of alcohol. Lost productivity was considered any lost time from full- or part-time paid work due to having gastroenteritis or caring for someone with the illness. Interference with other daily activities was also examined along with predictors of healthcare-seeking practices using multivariable regression. Results were weighted to obtain nationally representative estimates using Stata v. 13·1. Of the 341 cases, 52 visited a doctor due to gastroenteritis, 126 reported taking at least one medication for their symptoms and 79 cases reported missing $\geqslant 1$ days' paid work due to gastroenteritis. Gastroenteritis results in a total of 13·1 million (95% confidence interval 6·7–19·5) days of missed paid work each year in Australia. The indirect costs of gastroenteritis are significant, particularly from lost productivity.

Key words: Australia, healthcare utilization, infectious gastroenteritis, lost productivity.

INTRODUCTION

Gastroenteritis is a common illness, resulting in an estimated 15·9 million cases in Australia in 2010 [1]. While not all cases of gastroenteritis will present to a doctor or hospital due to the mild nature of symptoms for the majority of episodes, gastroenteritis-associated healthcare utilization and lost productivity can result in considerable costs to society [2, 3].

Gastroenteritis often interferes with daily activities, such as working, school attendance, and recreational activities. In particular, examining how much time is taken off from paid work to recover from gastroenteritis or care for someone else who is ill highlights the effect of gastroenteritis on lost productivity. This productivity loss can be very expensive and has been identified as the largest contributor to total costs for all gastroenteritis [3–6]. Lost productivity attributable to gastroenteritis can have a substantial burden on society due to its commonness.

In 2001, a nationally representative cross-sectional survey, the National Gastroenteritis Survey I (NGSI 2001), was undertaken to determine the population burden of infectious gastroenteritis in Australia [7]. The NGSI found that about 20% of people with gastroenteritis attended a medical practitioner and,

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of these, 20% submitted faecal specimens for testing [8]. In addition, gastroenteritis resulted in around 0·9 million prescriptions for antibiotics [8]. Robust estimates of healthcare-seeking behaviour can improve the understanding of the number of cases reported to public health surveillance systems and highlight the impact of gastroenteritis on the healthcare system.

In 2008–2009, we conducted the National Gastroenteritis Survey II (NGSII 2008) – a retrospective cross-sectional survey to identify the population burden of infectious gastroenteritis in Australia in that year. The methodology applied in NGSII was a repeat of NGSI to assess changes in the prevalence of gastroenteritis in Australia. In this paper we analyse healthcare system utilization, medication usage, and lost productivity for cases reporting gastroenteritis during NGSII.

METHODS

The NGSII was a retrospective cross-sectional computer-assisted telephone survey across all States and Territories of Australia during a 1-year period from February 2008 to January 2009 with a sample of 7578 individuals. The full methods for NGSII are described elsewhere [9]. Information on demographic characteristics, gastrointestinal and respiratory symptoms, duration of illness, illness risk factors, healthcare-seeking behaviour, medication usage, and interference of illness with daily life were included in the survey questionnaire. This paper is concerned with the data collected from cases on questions of healthcare-seeking behaviour, medication usage, and lost productivity due to gastroenteritis.

Case definition

The case definition for gastroenteritis used in our study was a respondent experiencing $\geqslant 3$ episodes of diarrhoea and/or $\geqslant 2$ episodes of vomiting in a 24-h period over the previous 4 weeks, excluding cases who identified a non-infectious cause for their symptoms, such as pregnancy or consumption of alcohol. As respiratory infections can result in gastrointestinal symptoms, an adjustment was made by applying a stricter definition if the person had concomitant respiratory symptoms, requiring $\geqslant 4$ loose stools and/or $\geqslant 3$ vomits in a 24-h period [10]. The number and duration of gastrointestinal symptoms were evaluated. Duration was calculated from the first to the last day of experiencing either diarrhoea or vomiting. Lost productivity was defined as any time lost from full- or part-time paid work due to having gastroenteritis, or caring for someone with the illness.

Analysis

To provide nationally representative results, post-stratification was applied to all analyses to adjust for known differences between the survey sample and the Australian population by weighting to the 2008 resident population age, sex and State from the Australian Bureau of Statistics. All estimates were based on the Australian population in 2008 (21·4 million persons). The method is described in detail elsewhere [9].

We calculated weighted proportions and estimated the number of cases nationally that sought health advice, took medications or submitted a stool for culture. Time lost from work and daily activities due to infectious gastroenteritis were examined in relation to demographic characteristics of survey respondents and the severity of their illness. Daily activities was defined as 'working, attending school, or recreational activities'.

To examine whether symptoms and duration of illness were associated with the likelihood of cases visiting a doctor, design-based logistic regression was used to calculate crude odds ratios of explanatory variables of all individual symptoms, duration of illness, age group, sex, income, and Indigenous status [11]. Those explanatory variables that were statistically significant were then entered into a backwards stepwise multivariable logistic regression process and those that significantly improved the fit of the model formed the final model. Statistical significance was taken at $P < 0{\cdot}05$. The Hosmer–Lemeshow test was used to check model fit [12].

Survival analysis was used to estimate the mean duration of illness to account for respondents with ongoing illness at the time of interview. Analyses were undertaken with Stata statistical package, version 13·1. The 'svyset' commands in Stata was used to account for survey design and post-stratification to the Australian population [13].

Ethical considerations

Verbal consent was obtained from all participants and from parents and guardians on behalf of children during the interview. Where the respondent was a child aged <15 years, questions were answered by their carer. Adolescents aged 15–17 years answered questions themselves following consent from their parents or guardians. The study and consent procedures were approved by the ethics committees of the Australian Government Department of Health, the Australian National University and the NSW Cancer Council.

Table 1. *Age and sex distribution of survey respondents and cases with gastroenteritis, Australia, 2008–2009*

Variables	No. of respondents (weighted %) ($n = 7578$)	No. of respondents with gastroenteritis (weighted %)	Weighted proportion of cases by groups (%)
Age group (years)			
0–4	249 (6·4)	42 (6·3)	12·1
5–9	249 (6·3)	16 (4·4)	6·4
10–19	497 (13·4)	20 (12·8)	5·6
20–29	507 (14·1)	47 (15·6)	9·1
30–39	802 (14·3)	53 (15·4)	6·1
40–49	1064 (14·3)	54 (16·0)	6·1
50–59	1374 (12·6)	52 (12·4)	3·5
60–64	755 (5·3)	25 (4·3)	2·7
⩾65	2081 (13·3)	32 (12·9)	1·2
Sex			
Male	3024 (49·7)	142 (47·6)	6·2
Female	4554 (50·3)	199 (52·4)	5·2

RESULTS

Of 7578 respondents in the NGSII survey, 555 respondents reported experiencing diarrhoea or vomiting in the 4 weeks prior to interview, with 341 meeting the case definition for infectious gastroenteritis. Reporting of recent gastroenteritis episodes was highest in children aged <5 years (Table 1).

Health-seeking behaviour

Overall, 123 cases presented their illness to a health professional, of which doctors and pharmacists were the health professionals most frequently seen. There were 52 cases visiting a doctor, of these, 11 cases submitted a stool sample for testing. When weighted to the Australian population by age, sex, and State, there were an estimated 2·7 million [95% confidence interval (CI) 1·8–3·6] people visiting health professional due to gastroenteritis in Australia annually, with 517 219 (95% CI 119816–914621) stool tests submitted in one year (2008–2009).

Factors associated with cases visiting a doctor

In univariate analysis, age, sex, household income, Indigenous status, diarrhoea, blood in stool, nausea, loss of appetite, aches, headache, stiff neck and vomiting were not found to be statistically significantly associated with visiting a doctor. Earache, stomach cramps, respiratory symptoms, fever, and the duration of illness were significantly associated with cases visiting a doctor for gastroenteritis, and were therefore entered into the backward stepwise regression building. In the final model, having stomach cramps, fever, respiratory symptoms, and duration of illness were significantly associated with cases visiting a doctor (Table 2). Cases with stomach cramps were less likely to seek medical consultation [adjusted and weighted odds ratio (aOR) 0·3, $P = 0·001$], while cases with fever were more likely to visit a doctor for their illness (aOR 2·5, $P = 0·01$). Cases symptomatic for 3 or 4 days were more likely to see a doctor compared to those who were ill for 1 or 2 days (aOR4·2, $P < 0·001$, as were those ill for ⩾5 days (aOR 6·1, $P < 0·001$).

Overall, 12 of the cases that visited a doctor were asked to submit a stool specimen. Of those who were asked, 11 out of 12 cases submitted a specimen. Duration of ⩾5 days was associated with higher likelihood of a case submitting a specimen (OR 4·6, $P = 0·08$).

The Hosmer-Lemeshow goodness-of-fit test showed a good fit for the final logistic model ($P = 0·8$)

Medications for gastroenteritis

Of the 341 cases, 126 (weighted 32·2%) reported taking at least one medication to treat or relieve symptoms and of these, 19 (21·0%) received a prescription from a doctor, 28 (18·6%) chose medication based on a chemist's advice, 41 (29·3%) chose medication without professional advice, and 19 (9·2%) used left-over medication or received it from a friend. Half of cases reporting medication usage for gastroenteritis reported taking only one medication, while 16 cases reported taking at least three types of medication.

Overall, 64 (15·5%) cases took antidiarrhoeal medication for their conditions. Sixty respondents reported the generic or brand name of the antidiarrhoeal medication, among which the main type reported was loperamide. Additionally, 68 (15·6%) respondents with gastroenteritis used a painkiller for their conditions, and the main types reported were paracetamol and non-steroidal anti-inflammatory drugs (NSAIDS). Of all cases, eight (1·8%) reported antibiotic usage and five of those provided the specific brand name, including four courses of penicillin usage and one course of augmentin.

Extrapolating data to the Australian population, there were an estimated 5·5 million (95% CI 4·4–6·6) courses of medication usage for gastroenteritis each year, including 2·1 million (95% CI 1·4–2·8) courses of antidiarrhoeals (Table 3).

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Table 2. *Unadjusted and adjusted odds ratios and 95% confidence intervals for 341 cases to visit a doctor by symptoms of gastroenteritis and duration of illness (weighted to the Australian population by age, sex, and State), Australia, 2008–2009*

Variable	Cases reporting (n = 341)	No. visiting a doctor (n = 52)	Univariate OR (95% CI)	Adjusted OR (95% CI)*
Symptoms				
Diarrhoea	298	46	1·1 (0·4–3·0)	
Blood in stool	12	2	1·4 (0·3–7·2)	
Stomach cramps	216	28	0·5 (0·2–0·8)	0·3 (0·1–0·6)
Nausea	225	37	2·2 (1·0–4·9)	
Loss of appetite	256	43	3·4 (1·0–10·7)	
Fever or chills	151	34	3·2 (1·7–6·2)	2·5 (1·5–5·2)
Muscle/body aches	135	24	1·9 (1·0–3·6)	
Headache	142	23	0·8 (0·4–1·6)	
Stiff neck	51	10	0·9 (0·4–2·3)	
Respiratory symptoms	87	26	3·6 (1·8–7·0)	2·3 (1·0–5·4)
Earache	22	10	3·2 (1·2–8·1)	2·7 (0·7–9·8)
Vomiting	161	32	1·6 (0·9–2·9)	
Gastroenteritis duration				
1–2 days	215	18	Reference	
3–4 days	75	19	5·3 (2·6–10·8)	4·2 (1·9–9·2)
⩾5 days	51	15	5·2 (2·0–13·5)	6·1 (2·3–16·4)

OR, Odds ratio; CI, confidence interval.
* Final model after backward stepwise logistic regression for significant variables, with stomach cramps, fever or chills, respiratory symptoms, earache, and duration of illness remaining in final model.

Table 3. *Number and proportion of cases taking medication for symptoms of gastroenteritis and median duration of treatment, Australia, 2008–2009*

Medication type	Number taking medication (weighted %) (n = 341)	Median duration of treatment (days)	Weighted number of medication taken/year in Australia (million) (95% CI)
Antidiarrhoeal	64 (15·5)	2	2·1 (1·4–2·8)
Painkiller	68 (15·6)	2	3·4 (2·5–4·3)
Anti-nausea	29 (7·1)	2	1·3 (0·7–1·9)
Anti-cramps	11 (2·1)	3	0·4 (0·05–6·5)
Antibiotics	8 (1·8)	8	0·5 (0·06–1·0)

CI, Confidence interval.

Missed work or activities

In the 4 weeks prior to the survey, 189 (56·7%) of cases were in full- or part-time employment, 103 (33·5%) of cases either being retired, students or on home duties, 38 (11·1%) of cases were too young to attend school, and the rest were either unemployed or unable to work. Gastroenteritis had a considerable impact on cases' work, school and recreational activities in the survey, with 230 (68·9%) reporting that their illness interfered with daily activities for a median of 1 day. Forty-seven of the 230 respondents were answering on behalf of their child. Seventy-nine (23·3%) cases reported missing at least 1 day of paid work in the 4 weeks prior to the interview, the median being 2 days (range 1–28 days) missed for their own illness. Twenty-nine (7·1%) cases reported that someone else cared for them (13 respondents) or their child (16 respondents), and missed a median of 2 days (range 1–21 days) paid employment of the carers.

Based on these results, gastroenteritis results in an estimated 13·1 million (95% CI 6·7–19·5) missed days of productivity in Australia annually. This comprised 8·7 million (95% CI 5·2–12·2) missed days of employment for people with their own illness, and 4·4 million (95% CI 1·5–7·4) missed days of employment for people who cared for someone else experiencing gastroenteritis.

DISCUSSION

Gastroenteritis results in a substantial burden in Australia with over a million days of lost productivity each month, either for people suffering from gastroenteritis or caring for someone who was ill.

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Additionally, there were an estimated 2·7 million gastroenteritis-related medical consultations each year in Australia. Disease-associated medication usage, consultation of doctors and lost daily activities are considerable.

The BEACH dataset on General Practice consultations (Bettering the Evaluation of Care of Health) shows that gastroenteritis is one of the most frequently managed problems in general practice during 2008/2009 in Australia [14]. The proportion of cases who visited health professionals (36·1%) found in this study was similar to the proportion reported in New Zealand and France [15, 16], but lower than the proportion observed in a Chinese study [17]. These differences may reflect important differences in the healthcare system in the studied countries.

We found that approximately 13·4% of people experiencing gastroenteritis visited a doctor for their illness, suggesting that most cases are mild. Of all the respondents with gastroenteritis, only 3·1% provided a stool sample, which is similar to what was reported in the NGSI study, and these results are within the range for other high-income countries (2–8%) [8, 18, 19]. Our study also highlights that increasing duration of gastrointestinal illness was associated with cases presenting to a doctor. However, the small number of cases with some characteristics, such as blood in stool, meant we were unable to detect significant associations between these variables and cases visiting a doctor for gastroenteritis.

The percentage of cases taking medication for gastroenteritis in Australia (37·0%) is similar to New Zealand, but lower than that reported from France, Canada, and China [16, 17, 20]. Additionally, only 2·3% cases reported antibiotic usage for their illness, which is lower than reported from the NGSI study where about 5% of cases were prescribed antibiotics for gastroenteritis [21]. However, as the confidence intervals of these results overlap with the small numbers of cases reporting antibiotic usage, comparisons between the results are uncertain. The relatively low proportion of cases using antibiotics in our study may suggest a decrease in systemic antibacterial prescribing rates in Australia. It is appropriate that there is a low rate of empirical treatment of gastroenteritis with antibiotics in this country. People with gastroenteritis rarely benefit from antibiotic treatment [22], but antimicrobial therapies are still recommended for severe bacterial infections causing gastroenteritis.

In this study, we estimated that there are 13·1 million days of lost employment due to gastroenteritis annually. Our estimate is much higher than reported in the NGSI study, which estimated six million days of lost paid work due to gastroenteritis in Australia in 2001 [8]. This may be due to a change to questions to try to improve this variable, which probably influenced the results. While gastroenteritis is often mild, it leads to substantial lost productivity in terms of days off work for illness or caring for others. In Australia, estimated cost of lost productivity of foodborne illness due to gastroenteritis was responsible for 68% of all costs in 2004 [23]. Internationally, cost-of-illness studies have reported that lost productivity, including missed paid employment by sick individuals and employment missed by caregivers, accounted for the majority of indirect costs of gastroenteritis [5, 24].

Our study has several limitations, including the self-reported nature of the survey. However, similar symptom-based case definitions have been used previously, and therefore, comparison between studies is possible. The participation rate for the survey (49%) was less than the previous survey in Australia in 2001, but comparable to that obtained in other recent cross-sectional surveys [20, 25, 26]. Elderly females comprised the largest proportion of the respondents in our study, but we tried to minimize the impact of the skewed sample by weighting data to the Australian population to adjust for known difference between the sample and the target population. Based on the weighted data, we estimated that there were approximately 10·5 million employed persons (data not shown) in Australia during 2008/2009, which is similar to what was reported in the census data (10·6 million employed people) [27]. Therefore, post-stratification weighting by age/sex/State in our study should provide comparable estimates to the Australian population.

CONCLUSION

Gastroenteritis incurs considerable resource usage, and substantial costs for employers in Australia. The indirect costs of gastroenteritis are significant, particularly from lost productivity. It is important that we better understand the determinants of healthcare-seeking behaviour, medication usage for people with gastroenteritis, and submission of specimens for testing to address the costs of gastroenteritis. These estimates for Australia have important implications for addressing the burden of this illness and the impact on the healthcare system.

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DECLARATION OF INTEREST

None.

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