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The Infectious Intestinal Disease Study of England: A prospective evaluation of symptoms and health care use after an acute episode

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SUMMARY

The sequelae of Infectious Intestinal Disease (IID) in a population-based sample of cases and matched controls were investigated for a period of 3 months following the initial infection. Incident cases of IID presenting to GPs or occurring in the community and controls were studied at 3 weeks and over a 3-month follow-up period. Cases were six times more likely than controls to have gastrointestinal symptoms, particularly diarrhoea, at 3 weeks. Ten per cent of cases consulted their GP in the 3 months after episode and 2·3% were referred to hospital. GP presentation rates were twice as high in cases. Gastrointestinal symptoms persist after IID, leading to an increased likelihood of GP consultation and hospital referral. Diagnosis of irritable bowel syndrome may be more likely following IID. The burden of IID is likely to be considerable given its high incidence and the frequency of such sequelae.

INTRODUCTION

Food poisoning and infectious intestinal disease (IID) are important diseases in the United Kingdom [1]. Food poisoning notifications and laboratory reports of pathogens responsible for IID have been falling in the last 4 years. However, in 2001 there were over 85 000 food poisoning notifications and 1 in 60 people consulted a GP for IID [2, 3] in England and Wales. This represents a considerable burden of disease. Bacterial gastroenteritis may not be a short self-limiting illness, but instead may have longer term consequences [4]. Several conditions have been specifically associated with prior bacterial gastroenteritis, such as reactive arthritis (RA), irritable bowel syndrome (IBS), Guillain–Barre syndrome (GBS) and haemolytic uraemic syndrome (HUS) [4–7]. Although relatively uncommon, such conditions cause a considerable burden of ill health. There have been no population-based studies described which aim to ascertain the full range of sequelae of all types of IID. The national IID study was a population-based study in England which assessed the frequency of IID in the community and presenting to GPs. It had a case control component to assess factors associated with new IID. This paper presents the findings of a 3-month prospective follow-up of IID cases and their controls. Most of the cases would not have reached routine surveillance systems, so the findings in this paper are unique in that they include cases of IID who are not routinely detected by health services.

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METHODS

The Study of IID in England was based in 70 volunteer GP practices throughout England from the Medical Research Council's General Practice Research Framework. The study population was representative of general practices in England in terms of geographical region, urban and rural mix, and socio-demographic characteristics [8]. Approval was obtained from the Royal College of General Practitioners, participating research bodies, and all local research ethics committees. The methods have been fully described elsewhere [9]. Cases were ascertained either presenting to the general practice clinic (in 34 practices) or arising within a community cohort of an average of 135 individuals selected at random from each of 70 practices.

The case definition of IID was: loose stools or significant vomiting lasting less than 2 weeks, in the absence of a known non-infectious cause and preceded by a symptom-free period of 3 weeks [9]. For each case an age-sex matched control was selected at random from the GP list or from within the community cohort. Both cases and controls were followed up prospectively for 3 months after the case episode.

Information was collected on clinical symptoms using postal questionnaires; at case onset and at 3 weeks. In children under 16 years, the questionnaire was filled by the parent or guardian. Self assessment of symptom severity in cases at onset were graded as mild, moderate or severe. The symptoms related to the gastrointestinal, musculo-skeletal, neurological. GP case notes were searched 3 months after incident IID by the research nurse in each practice to record all symptoms, diagnoses, and hospital referrals in the preceding 10-week period (excluding the 2 weeks after the onset of IID) on a standardized proforma. Read codes were used to classify the reason for the GP consultation. The Read code is a hierarchical coding system. Whenever possible the disease code was used in preference to a symptom code, treatment code or referral code [10]. If a patient had been referred to hospital for gastrointestinal, neurological, renal or rheumatological problems, letters were sent to the referral consultant requesting details. Consequences of specific interest were RA, IBS, GBS and HUS.

Information on potential gastrointestinal pathogens detected in stools of cases and controls from the IID study was available, but not for the follow-up period. Inclusion of subjects in this component was dependent on receiving informed written consent to access clinical notes. 2·5% of cases and 4·5% of controls were excluded at this stage.

Statistical methods

The representativeness of subjects giving consent compared to the total cases and controls sample with respect to age, sex and Jarman score was investigated using multiple logistic regression. Symptoms were compared between cases and controls in three age groups: 0–4 years (infants and young children), 5–15 years (older children) and 16 years and over (adults). Symptoms persisting at 3 weeks and their severity were compared to those at the onset of illness. Persistent symptoms were assessed as rates of GP presentation and hospital referral rates per week over the 3 months post episode. Presentation rates were analysed using random effects Poisson regression to account for patient level clustering. The follow-up period was divided into two time intervals, 2–3 weeks and 4–12 weeks, after the initial IID episode. For the controls the relevant time period was taken from the time of the matched case IID episode. GP consultations in the 3-months period prior to the IID episode were studied in a sub-sample of subjects. Comparisons of GP consultation rates per week in cases and controls by diagnosis and age (<16 years and $\geqslant 16$ years) are reported as odds ratios.

RESULTS

Recruitment of cases and controls

In the general practice case-control component 30 practices of 34 in the IID general practice presentation study and 55 of 70 in the IID study community component took part in the present study. A total of 1441 (40%) cases and 1448 (56%) controls gave consent for a note search in the general practice case-control component. In the community case-control component compliance was higher: 458 (63%) and 385 (60%) respectively. A note search was carried out on 96% of those giving consent. There was no difference in either component in the compliance of cases by age and sex although there was a tendency for cases in higher Jarman score practices (more deprived), to be less likely than controls to give consent for a note search.

For the 3 month follow-up there were note searches for 1413 cases and 1377 controls in the general practice case-control component and 442 cases and 373 controls in the community case-control component.

Table 1. *GP presentation and hospital referral, 2–12 weeks after case IID episode, by diagnosis and age*

	GP case-control component						
			Hospital referral				
	Case	Control	Case	Control	OR	(95% CI)	*P* value
Musculoskeletal disease							
Child	597	611	0	1			
Adult	815	753	11	7	1·46	(0·51–4·46)	0·484
Gastrointestinal disease							
Child	597	611	10	4	2·59	(0·74–11·35)	0·113
Adult	815	753	23	5	4·34	(1·60–14·69)	0·002
Other							
Child	597	611	25	16	1·63	(0·82–3·29)	0·153
Adult	815	753	50	42	1·11	(0·71–1·73)	0·668
No diagnoses or symptoms coded							
Child	597	611	6	7	0·85	(0·24–2·98)	0·789
Adult	815	753	8	11	0·67	(0·23–1·84)	0·490

A total of 111 hospital letters about cases and 69 about controls were received, 78 and 66% of those requested, respectively. Matched cases numbering 508 in the general practice case-control component and 255 in the community case-control component completed questionnaires gave information on symptoms at 3 weeks.

Frequency of reactive arthritis, irritable bowel syndrome, Guillain–Barre syndrome and haemolytic uraemic syndrome

There were no cases diagnosed with or referrals for RA, GBS or HUS in the 3-month period of follow up. In the note search at 3 months, adults were more likely to have musculo-skeletal complaints than the controls but the difference was not statistically significant. Among hospital referrals, cases from general practice were not more likely than controls to be referred for musculo-skeletal symptoms (Table 1).

Gastrointestinal symptoms 3 weeks after onset of IID

In all age groups, the cases were more likely than controls to have gastrointestinal symptoms at 3 weeks: diarrhoea, vomiting, abdominal pain, loss of appetite and loss of weight (Table 2). Overall 24% of cases with diarrhoea at onset of IID reported persistent diarrhoea 3 weeks after onset. The proportion was highest in children aged 0–2 years, 28% (24–31%), and in adults increased from 15% to 29% relative to severity at onset. Thirteen per cent (12–15%) of cases with vomiting and 28% (27–30%) of those with abdominal pain at onset had persistent symptoms at 3 weeks. There was no consistent pattern with any other symptoms.

Three-month follow up: GP presentation rates from all causes

A total of 1413 cases in the general practice case-control component and 440 cases in the community case-control component were followed up for 12 weeks after initial case episode. In the general practice component 12·3% of cases presented each week in the 2–3 weeks after the initial episode compared to 6·4% of controls. A total of 9·4% of cases presented per week at 4–12 weeks after episode compared to 6·0% of controls. These weekly rates in cases and controls, if extrapolated, are equivalent to 4·9 and 3·1 consultations per person per year. The rates increased with Jarman score in cases whereas they were higher with low and high Jarman score in controls (Table 3). The presentation rates in cases in the community component were lower, 8·7% at 2–3 weeks and 7·0% at 4–12 weeks.

Young children and adults were more likely to present to the GP than older children. Females were more likely to present than males after adjustment for age in the general practice case-control RR 1·21 (1·09–1·35), with no effect of Jarman score. In both study components cases were significantly more likely to present to the GP (for all causes) than contorls, both at 2–3 weeks and 4–12 weeks after IID episode,

Table 2. *Symptoms in matched cases and controls 3 weeks after case episode, by age*

	0–4 years				5–15 years				>16 years			
Symptom	Case ($n=172$) *n*	Control ($n=172$) *n*	OR	(95% CI)	Case ($n=48$) *n*	Control ($n=48$) *n*	OR	(95% CI)	Case ($n=288$) *n*	Control ($n=288$) *n*	OR	(95% CI)
GII												
Diarrhoea	45	10	5·74	(2·8–11·8)	9	2	5·59	(1·14–27·49)	82	17	6·34	(3·67–10.97)
Blood in stool	2	1	2·01	(0·18–22·13)	0	0			11	9	1·23	(0·52–2·94)
Vomiting	20	8	2·70	(1·18–6·17)	8	1	9·4	(1·13–78.41)	20	6	3·51	(1·43–8·61)
Abdominal pain	18	9	2·12	(0·94–4·76)	13	7	2·18	(0·80–5.90)	88	35	3·18	(2·07–4·90)
Loss of appetite	38	23	1·84	(1·05–3·23)	6	2	3·29	(0·63–17·18)	60	10	7·32	(3·70–14·44)
Loss of weight	15	3	5·38	(1·63–17.6)	3	1	3·13	(0·31–31.25)	53	7	9·05	(4·11–19·89)
Flatulence	12	7	1·77	(0·70–4.47)	4	1	4·27	(0·50–39·72)	64	41	1·72	(1·12–2·65)
Discomfort passing urine	7	6	1·17	(0·40–3·40)	0	1			9	8	1·13	(0·44–2·88)

P values: <0·001 0·001–0·04 0·05–0·1

Table 3. *GP presentation rates* (*per 100 people per week*)

	GP case-control component								
	Cases					Controls			
		2–3 weeks		4–12 weeks			2–3 weeks		4–12 weeks	
	n	Rate	(95% CI)	Rate	(95% CI)	*n*	Rate	(95% CI)	Rate	(95% CI)
Age (years)*										
0–4	473	14·3	(12·2–16·8)	11·2	(10·2–12·2)	481	8·2	(6·6–8·3)	7·4	(6·6–8·3)
5–15	124	10·1	(7·0–14·8)	6·0	(4·7–7·6)	130	1·4	(0·5–3·8)	4·0	(3·0–5·3)
16+	815	11·5	(10·0–13·2)	8·8	(8·1–9·5)	753	5·9	(4·9–7·3)	5·4	(4·9–6·0)
Sex										
Male	671	11·7	(10·0–13·6)	8·4	(7·7–9·2)	612	6·6	(5·4–8·2)	5·4	(4·8–6·1)
Female	742	12·9	(11·2–14·8)	10·2	(9·5–11·0)	764	6·2	(5·1–7·5)	6·5	(5·9–7·1)
Jarman score										
Low	232	10·5	(8·0–13·7)	9·0	(7·8–10·4)	212	9·0	(6·6–12·3)	6·2	(5·1–7·4)
Mid	817	11·8	(9·2–14·4)	10·3	(8·7–11·1)	850	5·3	(4·3–6·4)	5·8	(5·3–6·4)
High	364	14·6	(12·2–17·6)	9·4	(8·4–10·5)	315	7·6	(5·7–9·9)	6·4	(5·5–7·4)
Total	1413	12·3	(11·1–13·6)	9·4	(8·8–9·9)	1377	6·4	(5·5–7·4)	6·0	(5·6–6·5)

* Missing age data: 1 case, 13 controls.

even after adjustment for sex, age and Jarman score (Table 4). There was no evidence of interaction with sex or age.

There was information on prior presentation in 831 (57%) of cases and 548 (40%) of controls. The adjusted rate ratios in this subset were lower, RR = 1·55 (1·24–1·82) ($P<0·001$) at 2–3 weeks and RR = 1·16 (1·05–1·29) ($P=0·005$) at 4–12 weeks. After additional adjustment for prior presentation to the GP, the rate ratios were reduced but still significant, RR = 1·48 (1·22–1·81) ($P<0·001$) at 2–3 weeks and RR = 1·13 (1·02–1·25) ($P=0·021$) at 4–12 weeks, in the general practice case-control component.

Three-month follow up: GP presentation by symptom type

Adult cases were three times more likely and children two times more likely than controls to present to their GP with gastrointestinal complaints 4 to 12 weeks after the episode (Table 5).

The diagnosis in consultations for most children was presumed infectious diarrhoea and gastroenteritis, whereas in adults the diagnoses were more evenly distributed among presumed infectious diarrhoea, IBS and gastroenteritis. In the general practice case-control component 21 cases of 815 cases (2·6%) and

Table 4. *GP presentation rates*

	GP case-control component					
	Univariate			Adjusted		
Factor	Rate ratio	(95% CI)	*P* value	Rate ratio	(95% CI)	*P* value
Case: Control (weeks)						
2–4	1·93	(1·60–2·33)	<0·001	1·98	(1·64–2·39)	<0·001
4–12	1·56	(1·39–1·75)	<0·001	1·57	(1·40–1·76)	<0·001
Sex (female)	1·15	(1·04–1·28)	0·009	1·21	(1·09–1·35)	<0·001
Age (years)*						
0–4	1·88	(1·52–2·34)	<0·001	1·92	(1·55–2·38)	<0·001
5–15	1·00			1·00		
16+	1·46	(1·18–1·81)	<0·001	1·41	(1·14–1·74)	0·001
Jarman score						
Low	1·00					
Mid	0·96	(0·83–1·12)	0·631			
High	1·07	(0·90–1·27)	0·421			

* Baseline, age group 5–15 years.

Table 5. *GP presentation by diagnosis, by age*

	GP case control component											
			2–3 weeks after case IID episode					4–12 weeks after case IID episode				
	Case *n*	Control *n*	Case *n*	Control *n*	OR	(95% CI)	*P* value	Case *n*	Control *n*	OR	(95% CI)	*P* value
Musculoskeletal												
Child	597	611	0	0				1	2	0·51	(0·05–5·65)	0·58
Adult	815	753	9	6	1.39	(0·51–3·77)	0·53	30	23	1·21	(0·70–2·09)	0·49
Gastrointestinal disease												
Child	597	611	15	6	2·60	(1·03–6·53)	0·04	36	19	2·00	(1·14–3·50)	0·015
Adult	815	753	36	1	34·75	(4.75–254)	<0·001	52	16	3·14	(1·79–5·51)	<0·001
Other												
Child	597	611	74	47	1·70	(1·16–2·49)	0·007	150	144	1·09	(0·84–1·42)	0·53
Adult	815	753	67	60	1·03	(0·72–1·49)	0·85	166	135	1·17	(0·91–1·51)	0·22
No diagnoses or symptoms coded												
Child	597	611	514	558	0·59	(0·41–1·05)	0·004	429	452	0·90	(0·70–1·16)	0·41
Adult	815	753	723	687	0·75	(0·54–1·05)	0·10	608	595	0·78	(0·62–0·99)	0·04

P values: <0·001 0·001–0·04 0·05–0·1

3 of 753 controls (0·4%) were recorded as having IBS. Five cases diagnosed with IBS had campylobacter infection but this was not a statistically significantly high proportion compared to all cases. No cases had known salmonella infection. More cases than controls presented to the GP with abdominal pain. There were no cases of Crohn's disease though two GPs diagnosed cases of idiopathic proctocolitis and ulcerative enterocolitis.

Three-month follow up: hospital referral

In the general practice component cases were more likely than controls to be referred to hospital for gastrointestinal disease in adults $P<0·001$ (Table 1). This association was not statistically significant for children. Two adult cases, diagnosed by their GP as having diarrhoea of presumed infective origin, were diagnosed at hospital as having IBS. Three of the

four children with a diagnosis of gastroenteritis of presumed infectious origin had this confirmed on hospital referral.

DISCUSSION

Main findings

Cases of IID were one and a half times more likely to consult their GP with gastrointestinal symptoms over a period of 3 months after the intial IID episode, were more than four times as likely to be referred to hospital and six times as likely to receive a diagnosis of IBS. Our findings show that after IID gastrointestinal symptoms persist in more patients than is commonly acknowledged [11]. Almost a quarter of all cases had persistent diarrhoea 3 weeks after the onset of the incident illness, over an eighth had persistent vomiting and nearly a third of older children and adults had abdominal pain. The persistence of diarrhoea in cases 3 weeks after onset resulted in a rate sixfold higher than in controls. A tenth of patients who had had IID sought repeat consultation (for all causes) with their GPs over 3 months follow-up. Though this fell with time there was a more than 50% increase in presentation compared to controls. This had not been previously described in a cohort of cases with IID. Whilst it was partly explained by whether patients had previously consulted their GP, thus reflecting health seeking behaviour, it remained a statistically significant and clinically important independent risk factor after adjustment for prior presentation.

Cases were more likely to consult their GP than controls if they were either children under 5 years old, adults over 60, or of female sex. Increased health service use has been previously described in females when compared to males [12] and in the extremes of age [13]. This suggests that once ill with IID, GP consultation is higher in these groups because of health seeking behaviour, but it also increased with greater severity of illness. It is not known whether consultations related to initial, repeat or new infections. In this study there was no association between practice Jarman score and repeat consultation for IID. Others have described higher GP consultation rates in association with area deprivation [14, 15].

Controls were age- and sex-matched, so were not fully representative of the population. However, estimates from weekly presentation rates in controls, if extrapolated to annual rates, give a rate of more than three consultations per year per patient. Fleming estimated the figure to be 3·5 consultations per year per patient [16].

The reasons for the increase in cases seeking repeat consultation with their GP was examined. Our approach was hierarchical, in keeping with the Read classification system [10]. This approach revealed that there was an increased risk of the cases re-consulting their GP with a gastrointestinal complaint, overall a tenth of cases, and the illness was severe enough to warrant hospital referral in 2·3% of cases. There was a fourfold increase in risk for hospital referral in adults. In adults, at a more specific level of analysis, the risk of seeking repeat consultation with their GP specifically for diarrhoea and gastroenteritis were about 28-fold and there was a sixfold increase in risk for the diagnostic label IBS.

Comparison with other studies

Few studies have followed up cases of community acquired IID. Neal et al. [4] showed that the prevalence of altered bowel habit in cases of bacterial gastroenteritis was 25% at 6 months. This supports our finding of self-reported persistent gastrointestinal symptoms during the shorter follow up period of 3 weeks. The prevalence of IBS following IID in our study was 2·8%. In contrast the prevalence of IBS following bacterial gastroenteritis has been reported as higher at 4·4 and 7·0% where the follow up was 6 months [4, 17]. This could be explained by the fact that our case definition was based on clinical criteria as opposed to being bacteriologically confirmed. It is likely that cases in those two studies were more severe as they had stools sent for testing as part of the clinical consultation, and only those that were positive were included. We have previously shown that only 22% of cases presenting to GPs with IID had stools sent for routine testing, often among the more severe cases. An even smaller proportion of cases in the community have stools sent for testing [1, 18].

We found rates of IBS of 25·8 and 4 per 1000 in cases and controls respectively. This compares to estimates of incidence ranging from 3·5 per 1000 person years in a general practice cohort population to 39·7 per 1000 person years in a cohort with bacterial gastroenteritis [17]. The same authors found a relative risk of 12 after bacterial gastroenteritis. Our result may reflect a case mix that included milder cases and the study design which depended on clinically diagnosed cases identified from case notes, rather than more sensitive and specific methods such as

questionnaires with criteria specific for IBS. Whilst it is possible that cases in our study with pre-existing IBS might have been misclassified as having IID at presentation this is unlikely as our case definition excluded cases with pre-existing chronic diarrhoea [9]. Our study however raises the possibility that IBS may develop after infection with infectious agents of unknown origin and may also be a complication of cases with less severe IID. Campylobacter and salmonella have been identified as causative organisms in the development of IBS [4, 19]. In our study only five of our cases who developed IBS, had campylobacter isolated. None had salmonella isolated.

In the study by Neal et al. [4] only 5% of those with bacterial gastroenteritis sought care from their GP regarding symptoms of altered bowel habit. Our study found a higher presentation rate of 10·3% for gastrointestinal symptoms by 3 months. This difference could be explained by the fact that we used note searches, whereas Neal et al. [4] used a questionnaire administered at 6 months, which may have led to under-ascertainment.

The strength of our study was the prospective follow-up of unselected incident cases of IID that included cases in a community cohort and those presenting to their GP. The design of the study was based upon the assumption that it would be possible to recruit cases and their controls for long-term follow-up. The response rate by subjects was lower than expected. However, comparison between those recruited and those who were not, indicates there was no statistically significant difference in terms of age and sex. There was a tendency for refusal for consent to be higher in practices in more deprived areas, which may have led to an underestimate of absolute presentation rates, as GP consultation is higher in more deprived areas [15]. We had no standardized assessment to ascertain cases with sequelae, but used data from GP case notes and examination of copies of hospital letters which might have lead to misclassification and most likely under ascertainment of sequelae.

There were small numbers of cases for each organism. This decreased the power of the study to test specific associations. For example, reports from outbreaks suggest that the prevalence of reactive arthritis following bacterial gastroenteritis is 2–3%, but this is highest following yersinia infection [20]. The GP morbidity study in 1995 [21] described a rate of reactive arthritis of 13·7 per 100 000 person years. We found no increase in suggestive symptoms of RA or cases of RA but we had very few cases ($n=26$) with yersinia infection so our study lacked power. This is also true for rarer outcomes such as GBS which has an estimated national incidence of 1 per 100 000 per year [22]. Another limitation was the relatively short duration of follow up. In GBS only 70% of cases appeared at 12 weeks after infection [23] and cases of IBS and RA have been described several months after bacterial gastroenteritis [4].

Implications of our study

IID causes considerable burden of ill health, over and above the initial event, requiring a considerable proportion of cases to seek repeat consultation with the GP within 3 months of illness, some of whom required referral to hospital. Such effects are not confined to bacterial gastroenteritis. There are health service costs associated with these, as well as broader socio-economic costs. The findings suggest that IBS could be triggered by prior IID or possibly some of our cases were really manifestations of IBS and not IID. This could be further investigated by following up a large number of notified cases of campylobacter infection or other specific organisms. Standardized ascertainment of cases of IBS, using clear diagnostic criteria should be used. Another approach, to identify other possible agents that may act as a trigger for IBS, may be to use a network of Sentinel general practices with the routine linkage of surveillance data. Ascertained cases of IBS could be linked retrospectively to cases of IID, thus broadening the knowledge base of causative organisms and long-term sequelae.

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REFERENCES

1. Wheeler JG, Sethi D, Cowden JM, et al. Study of Infectious Intestinal Disease in England: Rates in the community, presenting to GPs and reported to national surveillance. BMJ 1999; **318**: 1046–50.
2. Statutory Notifications of Infectious Diseases, PHLS, 2002. www.phls.co.uk.
3. Fleming DM, Ross AM, Chapman RS. Weekly Returns Service Annual Report for 2001, Birmingham: Birmingham Research Unit of the Royal College of General Practitioners, 2001.
4. Neal KR, Hebden J, Spiller R. Prevalence of gastrointestinal symptoms six months after bacterial gastroenteritis and risk factors for development of the irritable bowel syndrome: postal survey of patients. BMJ 1997; **314**: 779–82.
5. Keat A. Infections and the immunopathogenesis of seronegative spondyloathropathies. Current Opin Rheumatol 1992; **4**: 494–9.
6. Moake JL. Haemolytic uraemic syndrome – basic science. Lancet 1994; **ii**: 393–7.
7. McCarthy N, Giesecke J. Incidence of Guillain–Barre Syndrome following infection with *Compylobacter jejuni*. Am J Epidemiol 2001; **153**: 610–4.
8. Infectious Intestinal Disease Study Executive Committee. A Report of the Study of Infectious Intestinal Disease in England. London: HMSO, 2000.
9. Sethi D, Wheeler JG, Cowden JM, et al. A study of infectious intestinal disease in England: plan and methods of data collection. Commun Dis Public Health 1999; **2**: 101–7.
10. Department of Health. New clinical classification system will streamline computerised medical records. London: Department of Health, 1990.
11. Benenson AS. Control of communicable diseases in man. Washington: American Public Health Association, 1990.
12. Cooper H, Smaje C, Arber S. Use of health services by children and young people according to ethnicity and social class: secondary analysis of a national survey. BMJ 1998; **317**: 1047–51.
13. Collins E, Klein R. Equity and the NHS: self reported morbidity, access and primary care. BMJ 1980; **28**: 1111–5.
14. Carr-Hill RA, Rice N, Roland M. Socio-economic determinants of rates of consultation in general practice based on fourth morbidity survey of general practices. BMJ 1996; **312**: 1008–12.
15. Balarajan R, Yuen P, Machin D. Deprivation and general practitioner workload. BMJ 1992; **304**: 529–34.
16. Fleming DM. Consultation rates in English general practice. J R Coll Gen Pract 1989; **39**: 68–72.
17. Garcia Rodriguez LA, Ruigomez A. Increased risk of irritable bowel syndrome after bacterial gastroenteritis: cohort study. BMJ 1999; **318**: 565–6.
18. Feldman RA, Banatvala N. The frequency of culturing stools from adults with diarrhoea in Great Britain. Epidemiol Infect 1994; **113**: 41–4.
19. McKendrick MW, Read NW. Irritable bowel syndrome – post salmonella infection. J Infect 1994; **29**: 1–3.
20. Hay EM. Review of UK data on the rheumatic diseases: Reiter's syndrome and reactive arthritis. Br J Rheumatol 1991; **30**: 474–5.
21. Morbidity Statistics from General Practice. Fourth National Study 1991–1992. OPCS 1995; Series MB5, no. 3.
22. Hughes RAC, Rees JH. Clinical and epidemiological features of Guillian–Barre syndrome. J Infect Dis 1997; **176** (Suppl 2): S92–8.
23. Rees JH, Soudain SE, Gregson NA, Hughes RAC. *Campylobacter jejuni* infection and Guillain–Barre syndrome. New Engl J Med 1995; **33**: 1374–9.