ELSEVIER

JCC

# IBD care in Europe: A comparative audit of the inpatient management of Crohn's disease and ulcerative colitis using the national UK IBD audit tool[☆]

Andrea Cassinotti [a,*], Satish Keshav [d], Sandro Ardizzone [a], Neil Mortensen [e], Gianluca Sampietro [b], Paolo Fociani [c], Piergiorgio Duca [a], Bruce George [e], Marco Lazzaroni [a], Gianpiero Manes [a], Brian Warren [f], Diego Foschi [b], Gianluca Vago [c], Gabriele Bianchi Porro [a], Simon Travis [d]

[a] Department of Clinical Sciences, Gastroenterology Unit, L. Sacco University Hospital, Milan, Italy
[b] II Department of Surgery, L. Sacco University Hospital, Milan, Italy
[c] Chair of Pathology, L. Sacco University Hospital, Milan, Italy
[d] Gastroenterology Unit, John Radcliffe Hospital, Oxford, United Kingdom
[e] Department of Colorectal Surgery, John Radcliffe Hospital, Oxford, United Kingdom
[f] Department of Cellular Pathology, John Radcliffe Hospital, Oxford, United Kingdom

Abstract

*Background and aims:* The National UK IBD audit tool is an electronic database created to improve the quality and safety of care for IBD patients by auditing individual patient care, service resources and organisation against national standards. We used the National UK IBD audit tool to compare the organisation and process of IBD care between services in Oxford (UK) and Milan (Italy), as a pilot study to evaluate its application outside national boundaries.
*Methods:* Clinical and demographic data of patients with CD and UC, consecutively admitted during a 2 month period, were collected and compared between the centres, to each other and to the UK IBD standards obtained by previous audit analyses performed in Oxford in 2006.
*Results:* 20 and 26 patients with UC were admitted in Oxford and Milan, as well as 21 and 20 patients with CD, respectively. Most admissions in Milan were planned admissions for moderately active treatment-refractory disease. No patient died. Oxford had a higher surgery rate. Endoscopy for UC consisted mainly of colonoscopy in Milan (92%) and flexible sigmoidoscopy in Oxford (64%). In CD, Oxford data revealed a higher use of immununomodulators and CT scan, compared with higher use of bowel ultrasound in Milan. CRP was the preferred biomarker of

---

disease activity. The following areas did not reach the standards set for the 2006 UK IBD Audit: the lack in Milan of IBD specialist nurses and few dietitian visits, as well as little attention to heparin prophylaxis and abdominal radiography in UC. Both sites paid little attention to stool cultures and revealed a high rate of active smokers in CD and little attention to bone protection in steroids users. Since the 2006 audit in Oxford, improvements include IBD specialist nurse visits, dietitian visits, number of active smokers, stool samples, prophylactic heparin, bone protection and nutritional assessment.

*Conclusions:* Consistent procedural differences between Oxford and Milan identified by audits of both UC and CD could be resolved by organisational change, with an improvement in the service. The UK IBD audit tool is an easy instrument to assess the processes and outcomes of care delivery in IBD and can be applied also outside UK.

## 1. Introduction

Inflammatory bowel diseases (IBD) are a group of chronic, relapsing–remitting, inflammatory conditions which include Crohn's disease (CD) and ulcerative colitis (UC). [1,2] Together, they affect about 200–400/100,000 of people, with a higher rate in England than in southern Europe. [3,4] They present in late adolescence or early adult life so typically affect people who are trying to earn a living and/or raise a family and affect work productivity. [5] At least 80% of CD patients need surgery at some time, as do 25% of patients with UC. There are many admissions each year for exacerbations of IBD and admissions are still associated with mortality. Many deaths occur around the time of surgery and data indicate that young people are disproportionately represented amongst those deaths. [6,7]

The British Society of Gastroenterology (BSG) and the European Crohn's and Colitis Organisation (ECCO) have published evidence-based guidelines that cover all the clinical aspects of management of IBD. [8–10] These can be used as standards of care to audit the local management of IBD. An audit should seek to improve the quality and safety of care for patients by auditing individual patient care, service resources and organisation, against defined standards.

The UK IBD Audit was the first UK-wide audit performed within gastroenterology. The first round was conducted from September 2006 to December 2006: 281 acute hospitals that admit patients with IBD in England, Northern Ireland, Scotland and Wales used the audit tool and a final report on outcomes and planned targets for a re-audit was published (http://ibdaudit.rcplondon.ac.uk/2006/ Appendix 1). Audit of IBD practice is not widely used in other countries and the UK IBD audit tool has never been validated outside the UK. Consequently, we have compared IBD care in this pilot study between two centres in Oxford (UK) and Milan (Italy), using the National UK IBD audit tool, to evaluate its application outside national boundaries.

## 2. Methods

The study was approved by our Institutional Review Board. Organisational, clinical and demographic data of patients with IBD consecutively admitted during a two month period (Feb–Mar 2008 in Milan, Apr–May 2008 in Oxford) were collected and compared between the centres, to each other and to the UK IBD standards obtained by previous audit analyses performed in Oxford in 2006 (Appendix 1).

The UK IBD audit tool consists of four parts. The first concerns the structure of hospital IBD services, analysing inpatient activity, organisation of care, interaction between hospitals and patient groups, and IBD support services. The other three sections (UC inpatients, CD inpatients, and CD outpatient care) require specific clinical and demographic data of patients to be entered during the observation period. The audit tool is web-based and includes context-specific online help, including definitions and clarification of terms, internal logical data checks and feedback to enable complete and accurate data. Security and confidentiality were maintained through the use of site-specific codes. Proformas were accessed using unique identifiers and passwords, with data saved during, as well as at the end of an input session. To assess patient care, the aim was to audit at least 40 consecutive inpatient case notes (at least 20 CD and 20 UC) at each centre in late spring of 2008.

### 2.1. Statistical analysis

An explorative statistical analysis was performed. Differences in management and outcomes were identified by comparing proportions of each event within classes of categorical variables using Pearson chi-squared statistic or Fisher's exact test when appropriate. $p$ values, when less than 0.05, were reported. No attention was paid to multiplicity of tests problem, since the analysis was judged just as a screening procedure, and considering significant $p$ values only as flags.

## 3. Results

The complete results of each audit section are presented in Tables 1–3. After a general presentation of the sites, below we focus on the potential key messages from a comparison of the results between Oxford and Milan, as well as between current (2008) and previous (2006) results in Oxford, in order to assess if they met the standards.

### 3.1. Organisation and structure of hospital IBD services

General hospital demographics were similar (Table 1). Both hospitals had a dedicated gastroenterology ward, with 4 beds per lavatory in Oxford and 2 beds per lavatory in Milan (*vs* max 3 recommended beds in the 2006 standards).

**Table 1** Organization and structure audit questions and results.

| Question | Oxford 2006 | Oxford 2008 | Milan 2008 |
|---|---|---|---|
| **General Hospital Demographics** | | | |
| Total No. of beds | 528 | 874 | 604 |
| Presence of an acute medicine unit | Yes | Yes | Yes |
| Presence of an acute surgical unit | Yes | Yes | Yes |
| Presence of an Intensive Therapy Unit on site | Yes (14 beds) | Yes (16 beds) | Yes (20 beds) |
| Presence of a High Dependency Unit on site | No | No | Yes |
| **Inpatient Activity** | | | |
| No. of patients discharged with a primary diagnosis of UC (2 months) | Not comparable | 20 | 26 |
| No. of patients discharged with a primary diagnosis of CD (2 months) | Not comparable | 21 | 20 |
| No. of patients operated for UC | Not comparable | 7 | 2 |
| No. of patients operated for CD | Not comparable | 19 | 5 |
| Ileo-anal pouch surgery performed on site | Yes | Yes | Yes |
| **Gastroenterology Services** | | | |
| Presence of a dedicated Gastroenterology ward | Yes | Yes | Yes |
| No. of beds per lavatory on the ward | 3.1 | 4 | 2 |
| No. of WTE Gastroenterologists | 2.9 | 4 | 5.5 |
| No. of SpRs + No. of associate specialists | 4+0 | 4+4 | 5+2 |
| No. of IBD Nurse Specialists | 0 | 1 | 0 |
| No. of sessions/week of Specialist Nurse time dedicated to IBD care | NA | 10 | NA |
| **Colorectal Services** | | | |
| No. of Colorectal Surgeons | 4 | 4 | 2 |
| No. of Colorectal SpR + No. of Colorectal Associate specialists | 4+0 | 6+0 | 3+2 |
| No. of Stomatherapy Nurses | 5 | 5 | 2 |
| No. of sessions/week of Stomatherapy Nurse time dedicated to stoma care | 40 | 40 | 5 |
| **Multidisciplinary Working** | | | |
| Presence of a searchable database of IBD patients | Yes | Yes | Yes |
| Timetabled meetings taken place between: Gastro & colorectal surgeons? | Yes | Yes | Yes |
| Gastro & pathologists? | Yes | Yes | No |
| Gastro & radiologists? | Yes | Yes | No |
| Colorectal surgeons & pathologists? | Yes | Yes | Yes |
| Colorectal surgeons & radiologists? | Yes | Yes | Yes |
| Presence of a specialist GI Pathologist | Yes | Yes | Yes |
| Presence of a specialist GI Radiologist | Yes | Yes | Yes |
| **Dietetics and Nutritional Services** | | | |
| Presence of a hospital nutrition team | Yes | Yes | Yes |
| Is it a multidisciplinary team? | Yes | Yes | No |
| Does the team conduct ward rounds? | Yes | Yes | No |
| If, yes how frequently? | Daily | Daily | NA |
| Number of dietetic sessions/week dedicated to GI disorders | 24 | 10 | On demand |
| **Outpatient Services** | | | |
| Written information on whom to contact in the event of a relapse | Yes | Yes | Yes |
| Latency to be visited after a relapse | <7 days | <7 days | <7 days |
| Methods of contact to an IBD specialist | Telephone | Telephone e-mail | Telephone e-mail |
| Presence of joint or parallel clinics between Gastroenterologists and Surgeons | Parallel | Parallel | Joint |
| **Patient Information** | | | |
| Written information about IBD? | Yes | Yes | Yes |
| **Monitoring of established immunosuppresive therapy** | | | |
| Monitoring established immunosuppresive therapy | Combination of primary and secondary care monitoring | Combination of primary and secondary care monitoring | Combination of primary and secondary care monitoring |
| **IBD Support Services** | | | |
| Presence of a paediatric to adult handover clinic for young patients with IBD | Yes | Yes | Yes |
| Presence of a psychologist attached to the Gastroenterology service? | No | No | No |
| Presence of an acute pain management team | Yes | Yes | Yes |

*(continued on next page)*

**Table 1** (*continued*)

| Question | Oxford 2006 | Oxford 2008 | Milan 2008 |
|---|---|---|---|
| **Management of Ulcerative Colitis** | | | |
| Written trust guidelines for the management of acute or severe colitis | Yes | Yes | Yes |
| **Interactions between your hospital and patients and patient groups** | | | |
| Open forums or meetings for patients with IBD | Yes, every 4–8 months | Yes, every 4–8 months | Yes, every 8–12 months |
| Are any of the following activities or systems in place to involve patients in giving their views on the development of your IBD services? | Individual patient representatives | Individual patient representatives | Regular patient surveys |

Both sites had at least 2 gastroenterologists. Since the initial audit in 2006, an IBD specialist nurse positions had been created in Oxford, while they do not exist yet in Milan. Moreover, Milan had a lower number of stomatherapy nurses (2 vs 5). Both sites had a searchable database of IBD patients, as well as timetabled meetings between colorectal surgeons and gastroenterologists, pathologists and radiologists. In contrast, there were no timetabled meetings in Milan between gastroenterologist and pathologists or radiologists, although both sites had at least one specialist gastrointestinal pathologist and radiologist. Both centres had a dietitic service, while only Oxford had a multidisciplinary nutritional team conducting daily ward rounds.

There was similar organisation for patients to contact the centre at both sites, to guarantee a clinic appointment within 7 days. Both centres made available written information about IBD and therapies, as well as organising periodic meetings with patients and scientific congresses. There were no psychologists attached to either gastroenterology service. Outpatient clinics were organised to run in parallel between gastroenterologists and colorectal surgeons in Oxford, while Milan conducted joint clinics between the two disciplines each week for patients suitable for surgical problems and treatments.

## 3.2. Ulcerative colitis inpatients

All data on the audit of inpatients with a primary diagnosis of UC are summarised in Table 2. *p* values are reported when less than 0.05.

### 3.2.1. Reason for, route of admission and outcome
Twenty (60% male, median age 45, range 28–73 years) and 26 (42% male, median age 41, range 18–85 years) consecutive patients with UC were enrolled in Oxford and Milan, respectively. The reasons and route of admission differed, with more patients with severe disease, more patients having elective surgery, and more tertiary referrals being admitted to Oxford. No patient died and the median duration of hospitalization was similar in both centres.

### 3.2.2. Assessment of disease
All patients (even tertiary referrals) were already known to both centres. As might be expected from the different routes and reasons for admission, Oxford patients were slightly sicker, with a higher number of bowel movements/day, CRP and highest recorded pulse rate and temperature, but differences did not reach statistical significance. ESR levels were similar between Oxford and Milan, but ESR was measured in only 6 (30%) of Oxford patients, but 25 (96%) in Milan ($p = 0.000$).

Stool samples for *Clostridium difficile* toxin (CDT) and standard stool cultures were sent in 71% of patients in Oxford, compared with 38% in 2006 ($p = 0.003$) and 57% in Milan ($p = NS.$), within a median of 0 and 1 days, respectively. Endoscopic assessment was performed in all patients in Milan (96% vs 64%, $p = 0.007$), where all procedures were full colonoscopy, compared to flexible sigmoidoscopy in all Oxford cases, probably reflecting the difference between elective and emergency admission. Median latency to endoscopy was similar in Milan vs Oxford (1–2 days, maximum 7 days). Nevertheless, the severity of mucosal disease was similar in both centres. Biopsies were taken in 89% of cases in Oxford and 100% in Milan, with the histopathology report available after similar intervals (median 4–5 days), except for 1 exceptional case at each centre, delayed for 14–18 days.

### 3.2.3. Post-admission monitoring
Stool frequency was monitored daily in all patients at both sites (vs 31% Oxford 2006; $p = 0.008$). Pulse and temperature were measured 1–3 times/day in Milan and at least 4 times daily in the current Oxford audit. CRP was monitored every 2–3 days in most patients. On the other hand, ESR was re-checked once in Milan in 77%, but in only 29% in Oxford ($p = 0.003$). A plain abdominal radiograph was less frequently performed in Milan (23% vs 86%; $p < 0.001$), reflecting a difference in disease severity.

### 3.2.4. Medical treatment
Most patients received intravenous or oral corticosteroids. Hydrocortisone was the steroid of choice in Oxford, but it was methylprednisolone in Milan. Steroids were given sooner in Oxford than in Milan (median 0, range 0–7 days, vs median 4, range 0–13 days), where the results of disease assessment by colonoscopy were usually awaited before starting steroids. Almost all Oxford patients (95%) received prophylactic heparin, compared to only 19% in Milan ($p = 0.000$), possibly reflecting differences in disease activity and indication for admission.

After failure of intravenous steroids, ciclosporin (CsA) 2 mg/kg was used in 3 patients, infliximab (IFX) in 2 patients in Oxford. Surgery was performed in 4 cases. In Milan, CsA 4 mg/kg was used in 1 patient and IFX in 1, but no operations were performed.

### 3.2.5. Surgical and other therapy
Data on surgical interventions are not comparable, since no operations were performed during the audit period in Milan,

**Table 2** Ulcerative colitis audit questions and results.

| Question | | Oxford 2006 | Oxford 2008 | P Oxford 2006 vs 2008 | Milan | P Milan vs Oxford 2008 |
|---|---|---|---|---|---|---|
| **Reason for, route of admission and outcome** | Source of admission: | 19% | 10% | 0.013 | – | 0.008 |
| | General Practitioner | – | 10% | | 8% | 0.000 |
| | Accident & Emergency | 57% | 60% | | 92% | |
| | Outpatients Department | 5% | 20% | | – | |
| | Other hospital | 19% | – | | – | |
| | Not documented | | | | | |
| | **Reason for admission:** | 57% | 65% | | 8% | 0.000 |
| | **Emergency, active UC** | 19% | 5% | | 92% | 0.000 |
| | **Planned, active UC** | 24% | 30% | | – | |
| | **Elective for surgery** | | | | | |
| | **Speciality responsible** | 6% | 7% | | – | 0.004 |
| | **for the patient's initial care:** | 81% | 71% | | 100% | 0.014 |
| | **Acute Medicine** | 13% | 21% | | – | |
| | **Gastroenterology** | – | – | | | |
| | **Colorectal Surgery** | | | | | |
| | **Geriatrics, General Medicine, General Surgery** | | | | | |
| | **IBD specialist nurse's visit** | 25% | 100% | 0.000 | – | 0.000 |
| | **Deaths** | 0 | 0 | | 0 | |
| | **Duration of hospitalization (days; median, range)** | 7 | 10 (1–25) | | 7 (4–22) | |
| **Assessment of disease** | No. of stools (median, range) | 5.5 | 8 (2–30) | | 5 (2–10) | |
| | **Pulse rate (median, range)** | 86 | 93 (64–150) | | 79 (60–110) | |
| | **Temperature (°C; median, range)** | 37.1 | 37 (35.9–38.8) | | 36.5 (36.4–38.5) | |
| | **CRP>5 mg/L** | 75% median 109 | 86% median 88 | | 73% median 23 | |
| | **Hb (g/dl; median, range)** | 12.5 | 12 (9–15.5) | | 12 (9–14.4) | |
| | **ESR (median, range). nd=not documented** | 13 | 24 (5–49) nd=70% | | 30 (5–78) nd=4% | 0.000 |
| | **Stool sample for Standard Stool Culture and CDT** | 38% | 71% | 0.003 | 57% | |
| | **Latency to stool sample (days; median, range)** | 1 | 0 (0–1) | | 1 (0–20) | |
| | **Endoscopy: Rigid Sigmoidoscopy** | – | – | | – | 0.000 |
| | **Flexible Sigmoidosc.** | 44% | 64% | | – | 0.000 |
| | **Colonoscopy** | – | – | | 96% | 0.007 |
| | **None of the above** | 56% | 36% | | 4% | |
| | **Latency to endoscopy (days; median, range)** | 2 | 1 (0–7) | | 2 (0–6) | |
| | **Endoscopic activity: Mild** | 14% | 11% | | 4% | |
| | **Moderate** | 29% | 44% | | 56% | |
| | **Severe** | 57% | 44% | | 40% | |
| | **Biopsies taken** | 100% | 89% | | 100% | |
| | **Latency to histology (days; median, range)** | 4 | 5 (0–14) | | 4 (2–18) | |
| **Post-admission monitoring** | Prophylactic heparin | 81% | 95% | | 19% | 0.000 |
| | **Pulse monitoring: 4 or more times/day** | 44% | 100% | | 8% | |
| | **1 to 3 times per day** | 50% | – | | 92% | |
| | **<once per day** | – | – | | – | |
| | **not monitored** | 6% | – | | – | |
| | **Tachycardia (>90 bpm)** | – | 7% | | – | |
| | **Temperature monitoring:** | 31% | 100% | 0.0000 | – | |

<div align="right"><em>(continued on next page)</em></div>

| Table 2 (continued) | | Oxford 2006 | Oxford 2008 | P Oxford 2006 vs 2008 | Milan | P Milan vs Oxford 2008 |
|---|---|---|---|---|---|---|
| Question | | | | | | |
| Post-admission monitoring | 4 or more times/day | 63% | – | | 100% | |
| | 1 to 3 times per day | – | – | | – | |
| | <once per day | | | | | |
| | Fever>37.5 °C | 7% | 14% | | 4% | |
| | Stool frequency monitoring: Daily | 63% | 100% | 0.008 | 92% | |
| | Every 2 to 3 days | – | – | | 8% | |
| | Every 4 to 6 days | – | – | | – | |
| | Once | – | – | | – | |
| | Not monitored | 38% | – | | – | |
| | CRP monitoring: Daily | 31% | 36% | | 8% | |
| | Every 2 to 3 days | 56% | 57% | | 62% | |
| | Every 4 to 6 days | 6% | – | | 19% | |
| | Once | – | 7% | | 12% | |
| | Not documented | 6% | – | | – | |
| | ESR monitoring: Daily | – | – | | 11% | 0.003 |
| | Every 2 to 3 days | 6% | – | | 8% | |
| | Every 4 to 6 days | – | – | | 4% | |
| | Once | 44% | 29% | | 77% | |
| | Not documented | 50% | 71% | | – | |
| | Plain abdominal x-ray | 88% | 86% | | 23% | 0.001 |
| Discharge arrangements | Appointments to: Gastroenterologist | 71% | 65% | | 100% | 0.001 |
| | Colorectal surgeon | 43% | 60% | | 12% | 0.000 |
| | Oral steroids on discharge | 71% | 45% | | 15% | 0.027 |
| | Steroid reduction programme started | 100% | 100% | | 100% | |
| | Bone protection agents | 7% | 56% | 0.000 | 50% | |

although some were planned for later elective admissions. A limitation of the audit tool is that no data could be entered about the outcomes of patients not requiring steroids, such as the introduction of immunomodulators after disease re-evaluation, which was a common indication for admission in Milan.

### 3.2.6. Discharge arrangements
All patients at both sites received an appointment for follow up in the gastroenterological or surgical outpatient clinic; 65% received an appointment to gastroenterology and 60% to colorectal surgical clinics in Oxford, vs 100% (p=0.001) and 12% (p<0.001), respectively, in Milan. Follow up appointments to both a gastroenterologist and a surgeon was given to 25% of Oxford patients and to 11% of Milan patients (p=NS), reflecting the different types of admission. A steroid reduction programme was started on discharge in all patients, but bone protection agents were prescribed in only 56% of cases in Oxford (vs 7% in 2006; p=0.000) and in 50% in Milan (p=NS).

### 3.3. Crohn's disease inpatients

All data on the audit of inpatients with a primary diagnosis of CD are summarised in Table 3. Significant differences between centres are reported with p values.

### 3.3.1. Reason for, route of admission and outcome
Twenty-one (24% male, median age 37 (range 18–68) years) and 20 (40% male, median age 48 (range 18–70) years) patients with CD were admitted in Oxford and Milan, respectively. Most admissions (70%) in Milan were medical elective (vs 24% in Oxford; p=0.003), mainly from the OPD (75% vs 42%; p=0.003), with a similar rate of emergency admissions and no tertiary referrals during the audit period.

There was a longer duration of symptoms (new or relapse) precipitating admission for Milan, with 40% of patients admitted after 8 weeks of symptoms onset (vs 17% in Oxford; p=0.036). A higher proportion of audited patients were being admitted for elective surgery in Oxford (43% vs 0%; p<0.001). All patients in Oxford were also seen by an IBD specialist nurse, which was not the case in Milan (p=0.000). No patient died and the median duration of hospitalization was similar at both centres.

A higher proportion of patients in Oxford were taking AZA on admission (52% vs 20%; p=0.031) and more were on dietary therapy (14% vs 0%; p=0.079, NS) than in Milan. Use of other therapies (mesalazine, antibiotics, corticosteroids and anti-TNF agents) was similar. Disease extent was similar between centres, as well as the rate of current smokers, even if too high (29% vs 30%).

### 3.3.2. Assessing the severity of Crohn's disease
Symptoms and signs of active CD were similar, except for a trend towards fewer patients reporting diarrhoea in Milan

**Table 3** Crohn's disease audit questions and results.

| Question | | Oxford 2006 | Oxford 2008 | P Oxford 2006 vs 2008 | Milan | P Milan vs Oxford 2008 |
|---|---|---|---|---|---|---|
| **Reason for, route of admission and outcome** | Primary reason for admission: | 52% | 29% | | 30% | 0.003 |
| | Emergency, active CD | 9% | 24% | | 70% | 0.000 |
| | Planned, active CD | 30% | 43% | | – | |
| | Elective for surgery | 9% | 4% | | – | |
| | New diagnosis of CD | | | | | |
| | **Source of admission:** | 19% | 17% | | – | 0.003 |
| | **General Practitioner** | 19% | 33% | | 25% | |
| | **Accident & Emergency** | 31% | 42% | | 75% | |
| | **Outpatients Department** | – | 8% | | – | |
| | **Other hospital** | 31% | – | | – | |
| | **Not documented** | | | | | |
| | **Speciality responsible for** | 6% | 8% | | 5% | 0.000 |
| | **the initial patients care** | 50% | 25% | | 80% | 0.033 |
| | **Acute medicine** | 38% | 50% | | 10% | |
| | **Gastroenterology** | 6% | 17% | | 5% | |
| | **Surgeons (Colorectal + General)** | | | | | |
| | **General medicine** | | | | | |
| | **IBD specialist nurse's visit** | 6% | 100% | 0.000 | – | 0.000 |
| | **Deaths** | 0 | 0 | | 0 | |
| | **Duration of hospitalization (days; median, range)** | 7 | 8 (3–28) | | 9 (5–19) | |
| | **Treatment on admission:** | 22% | 19% | | 25% | 0.031 |
| | **5-ASA** | 43% | 52% | | 20% | |
| | **AZA** | 4% | – | | – | |
| | **MP** | 9% | 10% | | – | |
| | **MTX** | – | 10% | | 5% | |
| | **Antibiotics** | 30% | 10% | | 5% | |
| | **Corticosteroids** | – | 14% | | – | |
| | **Dietary therapy** | – | 10% | | 10% | |
| | **Anti-TNF** | 30% | 24% | | 45% | |
| | **None** | | | | | |
| | **Current smokers** | 43% | 29% | | 30% | |
| | **nd = not documented** | 9% | 24% | | 10% | |
| **Assessing the severity of Crohn's disease** | Diarrhoea | 63% | 67% | | 35% | 0.033 |
| | Stool No. (median, range) | 4 | 6 (1–15) | | 5 (3–7) | |
| | Pulse rate (median, range) | 91 | 87 (62–110) | | 79 (60–92) | |
| | Temperature (˚C, median, range) | 36.9 | 37 (36.5–38.6) | | 37 (36.4–37.5) | |
| | Fever > 37.5 ˚C | 6% | 17% | | 20% | |
| | CRP > 5 mg/L | 81% | 83% | | 65% | |
| | | (median 35) | (median 68) | | (median 21) | |
| | Hb (g/dl; median, range) | 12.8 | 11 (9.1–14.3) | | 12 (6.1–14.5) | |
| | ESR (median, range) | 19 | 44 (7–80) | | 18 (10–10) | 0.025 |
| | nd = Not Documented | | nd = 50% | | nd = 14% | |
| | Stool sample for Standard Stool and CDT Culture | 30% | 75% | 0.009 | 57% | |
| | Latency to stool sample (days; median, range) | 0–2 | 1 (0–2) | | 1 (0–7) | |
| | Abdominal Ultrasound Scan | 30% | 5% | | 85% | 0.000 |
| | Abdominal CT Scan | 17% | 29% | | 5% | 0.045 |
| | Patient's weight measured | 50% | 100% | | 100% | |
| | BMI measured | 25% | 100% | | 75% | |
| | Dietitian's visit | 44% | 91% | | 15% | 0.000 |
| | Dietary treatment | 31% | 100% | | 25% | 0.000 |
| | Prophylactic herapin | 74% | 100% | | 10% | 0.000 |

*(continued on next page)*

**Table 3** (*continued*)

| Question | | Oxford 2006 | Oxford 2008 | P Oxford 2006 vs 2008 | Milan | P Milan vs Oxford 2008 |
|---|---|---|---|---|---|---|
| **Medical interventions** | Corticosteroids: Intravenous | 81% | 58% | | 5% | 0.000 |
| | Oral | – | – | | 5% | 0.000 |
| | None | 19% | 42% | | 90% | |
| | **Type of steroids: Prednisolone** | – | – | | 100% | |
| | **Budesonide** | – | – | | – | |
| | **Hydrocortisone** | 100% | 100% | | – | |
| | **Latency to steroids (days; median, range)** | | 0 (0–5) | | 4 (0–7) | |
| | **Blood transfusion** | 17% | 5% | | 5% | |
| | **Anti-TNFα therapy** | 14% | 5% | | – | |
| | **Surgery** | Not available | 67% | | 5% | 0.000 |
| **Discharge arrangements** | Appointments to: | 74% | 90% | | 100% | 0.008 |
| | Gastroenterologist | 48% | 76% | | 35% | |
| | Colorectal Surgeon | | | | | |
| | **Oral steroids on discharge** | 61% | 33% | | 5% | 0.022 |
| | **Steroid reduction programme started on discharge** | 79% | 100% | | 100% | |
| | **Bone protection agents** | 14% | 29% | | – | |

(35% *vs* 67%; *p* = 0.033, likely reflecting a higher prevalence of obstructive symptoms. On the other hand, Oxford cases included sicker patients, as reflected by higher temperature, median CRP and ESR levels, although ESR was less used in Oxford (50% *vs* 86%; *p* = 0.025). Stool was sent for standard culture and CDT assay in 75% of cases in Oxford (*vs* 30% in 2006; *p* = 0.009) and 57% in Milan (*p* = NS), with a latency of up 2 and 7 days, respectively (median 1 day). Abdominal ultrasound was the initial imaging method of choice in Milan (85% *vs* 5%; *p* < 0.001), compared with CT in Oxford (29% *vs* 5%; *p* = 0.045).

All patients had their weight measured, but Oxford paid more attention to nutritional assessment, with BMI measured in 100% (*vs* 75%; *p* = 0.059, NS) and dietitian visits in 91% (*vs* 15%; *p* < 0.001).

Prophylactic use of heparin was reported in 100% of Oxford inpatients with CD, but only in 10% of Milan cases (*p* < 0.001).

### 3.3.3. Medical interventions
Oxford used corticosteroids more often, consistent with higher disease activity (58% *vs* 10%; *p* < 0.001), given after a median latency of 0 (range 0–5) days (*vs* 4, range 0–7). Anti-TNF agents were used in only 5% of inpatients in Oxford and in no patients in Milan (*p* = NS), but that reflects their normal use in the outpatient setting. The audit tool did not allow data collection on planned post-admission infliximab.

### 3.3.4. Surgical interventions
More Oxford patients had surgery (67% *vs* 5%; *p* < 0.001) during the admission, but this reflects elective admissions as well as sicker patients, while not allowing for the practice of deferring surgery to elective readmission after initial discharge. Indications for surgery and the type of intervention were more widely represented in Oxford; laparoscopic procedures were performed in 21% of Oxford, but 5% in Milan.

ASA status was reported in 43% of patients in Oxford and in no cases in Milan. Written reports by a stoma nurse were made in 93% of cases in Oxford (*vs* 0%; *p* = 0.008).

### 3.3.5. Discharge arrangements
On post-operative discharge, AZA was introduced in 36% of cases in Oxford, but 50% of patients did not receive any drug. All patients received a follow up appointment with a gastroenterologist (90% *vs* 100%; *p* = NS) or a colorectal surgeon (76% *vs* 35%; *p* = 0.008), with 67% of patients in Oxford receiving appointments to both a gastroenterologist and a surgeon (*vs* 35%, *p* = 0.042). All steroid users received a steroid reduction programme, but only 29% of cases in Oxford and no patients in Milan received bone protection agents (*p* = NS, also *vs* Oxford 2006).

## 4. Discussion

Clinical audit is the process formally introduced in 1993 into the United Kingdom's National Heatlh Service (NHS) as a quality improvement process that seeks to improve patient care and outcomes, through systematic review of care against explicit criteria and the implementation of change.

The key component of clinical audit is that performance is reviewed (or audited) to ensure that what *should be* done *is being* done and (if not) it provides a framework to enable improvements to be made. The component parts of a clinical audit are: setting standards, measuring current practice, comparing results with standards (criteria), changing practice, and then re-auditing to make sure practice has improved. This process is known as the audit cycle. As might be expected, re-auditing is the phase of the cycle that most commonly lapses.

The UK IBD audit tool is a collaborative partnership between gastroenterologists (the British Society of

Gastroenterology), colorectal surgeons (the Association of Coloproctology of Great Britain and Ireland), patients (the National Association for Colitis and Crohn's Disease) and physicians (the Royal College of Physicians of London). After the first audit cycle in 2006, a list of IBD standards were reported (Appendix 1), which we have used to complete the cycle by re-auditing Oxford IBD practice in 2008 and to compare it with IBD management in Milan. This has allowed us to make some interesting observations.

Concerning the organisation of IBD care, Oxford has improved its standards since the initial audit in 2006, by introducing IBD specialist nurses. In contrast, Milan should be encouraged to create this important position and to organise multidisciplinary and nutritional teams. Both ensured immediate access for outpatients to specialist medical or surgical opinions, but in different ways: Oxford runs parallel clinics so that one specialist can walk down the corridor to ask a colleague to see a patient there and then, while Milan runs joint clinics in dedicated sessions of the week, with both specialists in the same consultation. Neither centre met the standard that psychologists should be attached to the gastroenterology service.

It is however, outcomes, rather than the organisation of care, that matters most. Some differences between the two centres reflect the different types of patients admitted more than the clinical approach. The duration of hospital stay was similar between centres, but patients with either UC or CD appeared somewhat sicker on admission to Oxford, although the number of patients is small. For disease activity assessment and monitoring, CRP is the preferred bioparameter,[11] although measurement of the ESR is still embedded in some objective activity indices and therefore included in guidelines.[9,10]

In UC a significant difference between the 2 centres is the endoscopic approach to disease assessment. In Milan procedures always consist of full colonoscopy, in order to (re)assess disease activity, extent and exclude unexpected pathology.[12] These data are considered fundamental before starting treatment, which in turn causes a longer latency before starting steroid therapy. In contrast, Oxford generally only uses flexible sigmoidoscopy, partly because they admit sicker patients with UC rather than elective admissions for treatment-refractory disease and partly because of easier access. Furthermore, treatment often started empirically on the day of admission, pending endoscopic assessment and endoscopy was not repeated if disease activity had recently been confirmed in outpatients. This is a matter of debate between the 2 clinical groups.

According to the 2006 standards for UC, both stool cultures and CDT assay should be performed in all patients admitted with active UC. This remains to be reached at both sites, but there has been a significant increase in the proportion of assays in Oxford since the previous audit. Milan rarely uses prophylactic heparin and uncommonly performs a plain abdominal X-ray on admission; although this may reflect lower disease severity, the benefits of such procedures have been reported.[13,14] Imaging in CD inpatients was initially exclusively performed through bowel ultrasound in Milan, reflecting local expertise,[15] while CT scan was the routine method in Oxford. This needs to be debated, since excessive radiation exposure has been reported,[16] and expert abdominal US may be sufficient to exclude complications. Both centres revealed a high rate of active smokers among patients with CD, although smoking status was frequently missing in the clinical case notes, reflecting insufficient attention to the detrimental effects of smoking on disease prognosis,[17] and the unequivocal benefits of smoking cessation in CD.[18]

The numbers of patients and multiple comparisons mean that care should be taken not to over-interpret differences, but this was primarily a feasibility study and to determine whether the established UK audit tool could be used across national boundaries. It can. The web-based tool was accessible and offers the potential for wider application in Europe, especially since audit analysis is almost unknown in some countries, including Italy. It demonstrates the value of periodic re-audit, since there were measurable changes in practice in Oxford to meet national standards in the 2 years since the first analysis. Audit makes physicians critically aware of their clinical practice, in order to change or improve disease management. Moreover, the validation of the audit tool in different countries could improve the tool itself, refining the questions to allow for local organisation and practice. This is an opportunity for ECCO and improvements on clinical guidelines might be based on audit results.

## Statement of authorship

AC collected and interpreted the data, and drafted the manuscript. SK helped to collect and interpret the data. SA helped to collect and interpret the data. NM provided surgical data and helped to interpret the data. GS provided the surgical data. PF provided the histological data. PD performed the statistical analysis. BG provided the surgical data. ML provided the clinical data. GM provided the endoscopic data. BW provided the histological data. DF helped to interpret the data. GV helped to interpret the data. GBP was the coordinator of the study in Italy. ST conceived the study, interpreted the data, drafted the manuscript and was the coordinator of the study in UK.

## Conflict of interests

All authors declare they do not have any financial and personal relationships with other people or organisations that could inappropriately influence this work.

## Appendix 1. UK IBD Audit 2006 National Report — List of IBD Standards

### 1) Organisation & Structure of IBD services

General Hospital Demographics: Hospitals where surgery is performed for IBD should have ITU beds with 24 hr care by anaesthetists/intensivists on site.

Inpatient Activity: Patients undergoing surgery for UC should have the opportunity to have ileo-anal pouch surgery either locally, if available, or at a regional centre.

Gastroenterology Services: Specialty triage of emergency admitted IBD patients to appropriate medical or surgical gastroenterology. No more than 3 patients per lavatory. At least 2 WTE Medical Gastroenterologists. At least 1 IBD specialist nurse with at least 5 sessions dedicated to IBD.

Colorectal Services: At least 2 FTE Colorectal surgeons. At least 1 stoma-care nurse specialist with at least 5 sessions dedicated to stoma care.

Multidisciplinary Working: Sites should have a searchable database to allow adequate audit. A weekly multidisciplinary meeting should take place between gastroenterologists, colorectal surgeons and radiologists. There should be regular histopathology conferences (at least 1 per month). Each hospital should have a radiologist and pathologist with a special interest in gastroenterology.

Dietetics and Nutritional Services: Each site should have a multidisciplinary nutrition team. This team should conduct ward rounds at least twice a week. At least 5 dietetic sessions per week should be dedicated to gastroenterological diseases (includes inpatients and outpatients).

Outpatient Services: A clear process for telephone access for ill patients should be established that allows review within one week. Written information for patients with IBD should be readily available in clinic areas. Joint or parallel clinics should exist to discuss and refer patients between medical and surgical teams.

Patient Information: Written information on IBD should be provided to each patient with IBD.

Monitoring of established immunosuppresive therapy: Should be a written policy for the mechanism of monitoring immunosuppressive therapy.

IBD Support Services: There should be regular (usually 1 or 2 per year) transition clinics involving paediatricians and adult gastroenterologists for hand over of patients to adult services. These can be done on a regional basis.

Management of Ulcerative Colitis: Written Trust guidelines should exist for the management of acute or severe colitis.

Interactions between your hospital and patients and patient groups: There should be regular meetings (at least once a year and usually on a regional basis) between groups of patients with IBD (and their relatives or carers) and hospital staff, this should involve medical, surgical and nursing staff.

**2) Ulcerative Colitis (inpatient)**

Admission: Patients should be transferred to the care of a medical gastroenterologist or colorectal surgeon within 24 hours of admission. Patients should be seen by a consultant gastroenterologist or colorectal surgeon within 3 days of admission. Patients should be seen by an IBD specialist nurse during admission. Patients should be transferred to a specialist gastroenterology ward.

Severity of Disease: Patients should have stool frequency documented in first 24 hours of admission. Pulse rate and temperature to be taken at least 4 times in first 24 hours of admission. Patients should have haemoglobin, albumin and CRP (or ESR) performed. Patients with diarrhoea should have a standard stool culture and CDT performed within 48 hours of admission.

Endoscopic Assessment: New cases of suspected UC admitted to hospital should have endoscopic sigmoidoscopy confirmation within 3 days of admission. Endoscopy report should contain an assessment of severity. New cases of UC admitted to hospital should have biopsies taken for histology and these should be reported within 5 days.

Monitoring of Colitis: Patients should have prophylactic heparin. Pulse rate and temperature monitored at least 4 times a day. Stool frequency should be monitored daily. ESR, or CRP should be monitored every 24–48 hours in severely active ulcerative colitis. Patients should have a plain abdominal X-ray with 24 hours of admission. If toxic mega-colon is present the abdominal X-ray should be repeated the next day if emergency surgery is not undertaken.

Steroid therapy: Appropriate intravenous steroid therapy (400 mg hydrocortisone or 60 mg methylprednisolone) should be initiated within 24 hours of admission in a suspected severe attack of UC. If the attack of colitis is not settling within 72 hours of appropriate steroid therapy the risk of colectomy is high. If there is no response to appropriate corticosteroids within 3 days, rescue therapeutic options need to be discussed with the patient (either surgery, ciclosporin or anti-TNFα therapy). A consultant colorectal surgeon should discuss the surgical options with the patient.

Ciclosporin Therapy: Creatinine should be measured within the 48 hours prior to initiation of ciclosporin. Magnesium and cholesterol should be measured within the 48 hours prior to initiation of intravenous ciclosporin. Creatinine and FBC should be monitored daily. Ciclosporin levels should be checked daily after 3 days of IV therapy.

Surgical Interventions: Consultant colorectal surgeons should be involved with the discussion with the patient regarding the decision to operate. Patients having resectional surgery for UC should see a stoma nurse prior to the operation. Operations should be performed or assisted by a consultant colorectal surgeon. ASA status should be recorded pre-operatively.

Discharge Arrangements: Patients should be followed up by a gastroenterologist or colorectal surgeon. Patients discharged on oral steroids should have a steroid reduction programme stated on discharge. Patients on oral steroids should be co-prescribed bone protection agents (such as calcium and vitamin D or bisphosphonates).

**3) Crohn's Disease (inpatient)**

Admitting Speciality: Patients admitted with CD should be under the care of medical gastroenterologists or colorectal surgeon within 24 hours of admission. Patients should be transferred to a specialist gastroenterology ward. All patients should be seen by a consultant gastroenterologist or colorectal surgeon within 3 days of admission. All patients should be seen by an IBD specialist nurse during admission.

Smoking Status: Smoking status should be documented and smoking cessation support should be offered.

Severity of Disease: Patients should have stool frequency documented in the first 24 hours following admission. Patients should have haemoglobin, albumin and CRP (or ESR) performed in the first 24 hours following admission.

Exclusion of Infection: Patients with diarrhoea should have a standard stool culture and CDT performed within 48 hours of admission. Patients with fever (>37.5 °C on two occasions) should have blood cultures performed.

Imaging: For suspected abdominal sepsis, imaging should be performed within 48 hours of request and reported within 24 hours of being done.

Weight Assessment and Dietetic Support: Patients should be weighed and BMI calculated. Non-elective admissions should be seen by a dietician. Nutritional support should be provided for malnourished patients.

Use of anti-thrombotic therapies: Patients should have prophylactic heparin.

Blood Transfusion: Patients with a haemoglobin level of less than 10 g/dL should be considered for blood transfusion or iron infusion.

Initiation of Treatment with anti-TNF- during admission: All patients given anti-TNF-α for the first time should have a chest X-ray within the previous 3 months.

Surgical Interventions: Consultant colorectal surgeons should be involved with the discussion with the patient regarding the decision to operate. Patients having resectional surgery for CD should see a stoma nurse prior to operation. Operation should be performed or assisted by a consultant colorectal surgeon. Patients should have ASA status documented prior to surgery.

Post-Operative Prophylactic Therapy: Prophylactic therapy to try to reduce recurrence should be discussed with CD patients having resectional surgery with anastomosis.

## References

1. Hanauer SB. Review article: evolving concepts in treatment and disease modification in ulcerative colitis. *Aliment Pharmacol Ther* 2008;**27**(Suppl 1):15−21.
2. Cummings JFR, Keshav S, Travis SPL. The management of Crohn's disease. *Br Med J* 2008;**336**:1062−6.
3. Shivananda S, Lennard-Jones J, Logan R, Fear N, Price A, Carpenter L, et al. Incidence of inflammatory bowel disease across Europe: is there a difference between north and south? Results of the European Collaborative Study on Inflammatory Bowel Disease (EC-IBD). *Gut* 1996;**39**:690−7.
4. Trallori G, Palli D, Sapeva C, Bardazzi G, Bonanomi AG, d'Albasio G, et al. A population-based study of inflammatory bowel disease in Florence over 15 years (1978−92). *Scand J Gastroenterol* 1996;**31**:892−9.
5. Rogala L, Miller N, Graff LA, Rawsthorne P, Clara I, Walker JR, et al. Population-based controlled study of social support, self-perceived stress, activity and work issues, and access to health care in inflammatory bowel disease. *Inflamm Bowel Dis* 2008;**14**:526−35.
6. Andres PG, Friedman LS. Epidemiology and the natural course of inflammatory bowel disease. *Gastroenterol Clin North Am* 1999;**28**:255−81.
7. Roberts SE, Williams JG, Yeates D, Goldrake MJ. Mortality in patients with and without colectomy admitted to hospital for ulcerative colitis and Crohn's disease: record linkage studies. *Br Med J* 2007;**335**:1033.
8. Carter MJ, Lobo AJ, Travis SP. IBD Section, British Society of Gastroenterology. Guidelines for the management of inflammatory bowel disease in adults. *Gut* 2004;**53**:S1−S16.
9. Travis SP, Stange EF, Lemann M, Oresland T, Chowers Y, Forbes A, et al. European Crohn's and Colitis Organisation. European evidence-based consensus on the diagnosis and management of Crohn's disease: current management. *Gut* 2006;**55**(Suppl 1):i16−35.
10. Stange EF, Travis SP, Vermeire S, Beglinger C, Kupcinkas L, Geboes K, et al. European Crohn's and Colitis Organisation. European Consensus on the diagnosis and management of ulcerative colitis: definitions and diagnosis. *J Crohn's Colitis* 2008;**2**:1−23.
11. Vermeire S, Van Assche G, Rutgeerts P. The role of C/reactive protein as an inflammatory marker in gastrointestinal diseases. *Nat Clin Pract Gastroenterol Hepatol* 2005;**2**:580−6.
12. Manes G, Imbesi V, Ardizzone S, Cassinotti A, Bosani M, Massari A, et al. Appropriateness and diagnostic yield of colonoscopy in the management of patients with ulcerative colitis: a prospective study in an open access endoscopy service. *Inflamm Bowel Dis* 2008;**14**:1133−8.
13. Koutroubakis IE. Venous thromboembolism in hospitalized inflammatory bowel disease patients: the magnitude of the problem is staggering. *Am J Gastroenterol* 2008;**103**:2281−3.
14. Gan S. I, Beck P L. A new look at toxic megacolon: an update and review of incidence, etiology, pathogenesis, and management. *Am J Gastroenterol* 2003;**98**:2363−71.
15. Maconi G, Radice E, Greco S, Bianchi Porro G. Bowel ultrasound in Crohn's disease. *Best Pract Res Clin Gastroenterol* 2006;**20**:93−112.
16. Newnham E, Hawkes E, Surender A. L, Gearry R, Gibson P R. Quantifying exposure to diagnostic medical radiation in patients with inflammatory bowel disease: are we contributing to malignancy? *Aliment Pharmacol Ther* 2007;**26**:1019−24.
17. Birrenbach T, Böcker U. Inflammatory bowel disease and smoking: a review of epidemiology, pathophysiology and therapeutic implications. *Inflamm Bowel Dis* 2004;**10**:848−59.
18. Johnson GJ, Cosnes J, Mansfield JC. Review article: smoking cessation as primary therapy to modifiy the course of Crohn's disease. *Aliment Pharmacol Ther* 2005;**21**:921−31.