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Establishing Key Performance Indicators [KPIs] and Their Importance for the Surgical Management of Inflammatory Bowel Disease–Results From a Pan-European, Delphi Consensus Study

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Abstract

Background and Aims: Key performance indicators [KPIs] exist across a range of areas in medicine. They help to monitor outcomes, reduce variation, and drive up standards across services. KPIs exist for inflammatory bowel disease [IBD] care, but none specifically cover inflammatory bowel disease [IBD] surgical service provision.

Methods: This was a consensus-based study using a panel of expert IBD clinicians from across Europe. Items were developed and fed through a Delphi process to achieve consensus. Items were ranked on a Likert scale from 1 [not important] to 5 [very important]. Consensus was defined when the inter quartile range was ≤ 1, and items with a median score > 3 were considered for inclusion.

Results: A panel of 21 experts [14 surgeons and 7 gastroenterologists] was recruited. Consensus was achieved on procedure-specific KPIs for ileocaecal and perianal surgery for Crohn's disease, [*N* = 10] with themes relating to morbidity [*N* = 7], multidisciplinary input [*N* = 2], and quality of life [*N* = 1]; and for subtotal colectomy, proctocolectomy and ileoanal pouch surgery for ulcerative colitis [*N* = 11], with themes relating to mortality [*N* = 2], morbidity [*N* = 8], and service provision [*N* = 1]. Consensus was also achieved for measures of the quality of IBD surgical service provision and quality assurance in IBD surgery.

Conclusions: This study has provided measurable KPIs for the provision of surgical services in IBD. These indicators cover IBD surgery in general, the governance and structures of the surgical

services, and separate indicators for specific subareas of surgery. Monitoring of IBD services with these KPIs may reduce variation across services and improve quality.

Key Words: Delphi; IBD surgery; inflammatory bowel disease

1. Introduction

Inflammatory bowel disease [IBD] service provision and care are being reviewed in the UK as part of a general drive to reduce variation in standards of health care and to improve the quality of services that patients receive.[1] Significant variation in quality exists between units in colorectal surgery, including IBD services.[2,3] Focused monitoring of services can help steer health care provision and guide commissioning of clinical services to generate greater efficiency, productivity, and economy—ultimately improving service at a patient level by initiating targeted change.[4]

Various quality measurement techniques used in the manufacturing industry and commerce have been adopted by health care services with the aim of improving standards. One such approach is the development of key performance indicators [KPIs] or metrics. KPIs are specific and measurable metrics used within health care to measure performance by acting as 'flags' or 'alerts' to identify good practice, provide comparability, and identify areas for improvement within a service provision.[5] KPIs are being developed through defined methodologies and used to monitor standards across a wide range of health care services.[6–8] These indicators act as 'flags' to highlight areas where standards excel or are substandard, thereby facilitating targeted quality improvement where indicated. They can also be used to monitor effectiveness of quality improvement initiatives and the progression towards organisational goals.

Existing quality and performance indicators have been developed to cover a range of areas of IBD practice.[9,10] Guidelines exist for the management of IBD as a whole, and for surgery in ulcerative colitis [UC] and Crohn's disease,[11–16] but key performance indicators have not been identified to date in surgery. The identification of KPIs for surgical IBD services will provide consensus-derived standards, thereby delivering a tool for monitoring quality throughout providers of such services in the UK.

The primary aim of this study is to obtain expert consensus on KPIs appropriate for surgical IBD services. The secondary aim was to develop expert consensus-based recommendations for the structure and size of a unit within which patients undergo elective IBD surgery.

2. Methods

This was a prospective study using Delphi methodology. This methodology used a systematic process of consulting, collecting, evaluating, and tabulating expert opinion on a specific topic, without bringing experts together. Questions and statements are posed to panellists and answered anonymously within a round, the benefit being that this method can sample the opinion of a group of specialists without being altered by the opinions of influential persons. Exposure to the replies is provided, and members revise their opinions on consecutive rounds until convergence and consensus are reached.[17,18] The initial inclusion of items for consideration as performance indicators was based on evidence review,[19–22] review of existing guideline documents,[11–16,23] and semi-structured interviews [performed June to October 2013, across a multidisciplinary sample of 27 IBD experts including nine consultant colorectal surgeons, five consultant gastroenterologists, four service managers, four IBD nurse specialists, and five IBD patients]. These items were incorporated into a Delphi survey and were sent to each participant using freely available software [Qualtrics], and participants were asked to return Likert rankings or categorical responses on each statement. Space for free-text responses was also provided to participants.

After each round of the process, the results of the Likert scales were collated, and free text responses anonymised. Successive rounds of this process were carried out with group-level aggregated, anonymised results from the previous round provided to all participants in order to drive consensus.

2.1. Data analysis

Data analysis was carried out in Statistical Package for the Social Sciences [SPSS] v23. Participants were asked to rate each individual item on a 5-point Likert scale [1 = not important as a key performance indicator, 5 = very important as a key performance indicator]. Consensus was considered to be achieved when the interquartile range [IQR] was ≤ 1. Items with a median score of > 3 [important or very important] were considered to be useful KPIs in IBD surgery. For categorical responses, consensus was defined by an agreement rate across participants of 70% or higher.[24]

2.2. Expert panel selection

Surgeons and gastroenterologists from 19 institutions across Europe were recruited to the expert panel for the Delphi process. Specific eligibility criteria were used [Box 1] in order to ensure an appropriate level of expertise on the panel and thus the validity and credibility of the subsequent consensus.[24] An invitation was sent to members of the European Crohn's and Colitis Organisation to recruit Delphi consensus panelists, and there were a total of 25 respondents.

3. Results

3.1. Expert panel

Of the 25 respondents, 21 were clinicians who met the eligibility criteria set out in Box 1, and were subsequently recruited to the expert panel. Fourteen of the panel members were consultant colorectal surgeons, and seven were consultant gastroenterologists. The median number of years' experience in consultant post across the group was 10 years. Participants were recruited across 19 institutions spanning 10 European countries. Consensus was reached following two iterations of the Delphi process [Table 1].

3.2. Crohn's disease

Table 2 demonstrates the median and IQR for each iteration regarding outcome measures following small bowel or ileocolonic surgery, and peri-anal Crohn's surgery.

3.2.1. Crohn's small bowel or ileocolonic surgery

A consensus on key performance indicators [median; IQR] that were considered very important [Likert rating 5] in Crohn's small bowel or ileocolonic surgery included: the proportion of patients who require re-operations within 30 days secondary to intra-abdominal septic complications; the proportion of patients who develop

Box 1. Eligibility criteria.

1. Peer-reviewed publications in IBD [5 papers minimum] OR Accredited Academic Appointment

OR

2. Active or recent role [within past 5 years] on any one of the following committees on IBD management
   - ➢ National standards group
   - ➢ National Audit
   - ➢ Registry Group
   - ➢ IBDQIP [Inflammatory Bowel Disease Quality Improvement Programme]
   - ➢ Groups dealing with guidelines or commissioning member of BSG [British Society of Gastroenterology] IBD Section
   - ➢ NICE [National Institute for Health and Care Excellence] guidance working groups on IBD-related drugs or disease-specific, eg the recent CD and UC NICE appraisal groups
   - ➢ ECCO [European Crohn's and Colitis Organisation] Guidelines European working groups
   - ➢ National pharmacological advisories

OR

3. IBD clinical leads for each NHS trust OR national IBD audit lead or medical advisor to local NACC [National Association for Colitis and Crohn's Disease] group

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis.

Table 1. Expert consensus panelists [ECPs] detailing years in post, institution, and country. Seven consultant gastroenterologists [CG] and 14 consultant colorectal surgeons [CS] were recruited as ECP members. Participants were recruited across 19 institutions spanning 10 European countries.

Specialty	Years in post	City, country
CG	12	Ankara, Turkey
CG	4	Bern, Switzerland
CG	7	Heraklion, Crete
CG	5	Abergavenny, UK
CG	21	Cardiff, UK
CG	21	Sheffield, UK
CG	30	Angera, Italy
CS	16	Amsterdam, The Netherlands
CS	6	Athens, Greece
CS	18	Oporto, Portugal
CS	6	Linköping, Sweden
CS	3	Muenster, Germany
CS	10	Harrow, UK
CS	16	Plymouth, UK
CS	3	Birmingham, UK
CS	6	London, UK
CS	12	London, UK
CS	2	Chelmsford, UK
CS	13	Sheffield, UK
CS	15	London, UK
CS	1	Rozzano Milano, Italy

enterocutaneous fistulae within 90 days; and the proportion of patients who develop subsequent short bowel. A consensus on items that were considered important [Likert rating 4] were: the proportion of patients who receive preoperative nutritional optimisation where indicated; quality of life measures at 6 months postoperatively using the Crohn's Life Impact Questionnaire [CLIQ]; and the proportion of patients who develop clinical recurrence within 12 months.

3.2.2. Crohn's perianal fistula surgery

A consensus on key performance indicators that were considered important [Likert rating 4] in Crohn's perianal fistula surgery included: the proportion of patients who develop recurrent perianal abscesses within 12 months following surgery; the proportion of patients who go on to require proctectomy; and the proportion of patients who require perineal diversion with a defunctioning stoma.

3.3. Colitis

Table 3 demonstrates the median and IQR for each iteration regarding outcome measures following subtotal colectomy with end ileostomy formation, proctocolectomy, and ileoanal pouch formation.

A consensus on key performance indicators that were considered very important [Likert rating 5] in subtotal colectomy with end ileostomy included: 30-day mortality rates in patients aged over 70; the proportion of patients who undergo re-operation within 30 days after surgery; and 90-day mortality rates in patients aged over 70. There was consensus that the proportion of patients who develop rectal stump blowouts was important [Likert rating 4] as a performance indicator.

3.3.1. Proctocolectomy

A consensus on a key performance indicatornthat was considered very important [Likert rating 5] in proctocolectomy was the proportion of patients who develop sexual dysfunction. A consensus on indicators that were considered important [Likert rating 4] were: the proportion that develop perineal sinus formation; and the proportion of patients who have restorative ileoanal pouch formation, out of the total number of proctocolectomies.

3.3.2. Ileoanal pouch formation

A consensus on key performance indicators that were considered very important [Likert rating 5] in ileoanal pouch formation included: the proportion of patients who undergo re-operation within 30 days secondary to intra-abdominal septic complications; the proportion of patients who develop pelvic septic complications within 30 days following surgery; and the proportion of patients who require permanent faecal diversion with an ileostomy for long-term pouch-related complications [including pouchitis, fistulae, or pouch failure].

A consensus on an indicator that was considered important [Likert rating 4] was the proportion of patients who require pouch salvage surgery in the long term for pouch failure.

3.4. Outcomes measures for overall quality

3.4.1. Overall quality of the surgical service

A consensus on the key performance indicator [median; IQR] that was considered very important [Likert rating 5] in overall quality of the surgical service was overall mortality rates within 90 days after surgery [5; 1] [Supplementary Table 1, available as Supplementary data at *ECCO-JCC* online]. A consensus on indicators that were considered important [Likert rating 4] were: the proportion of readmissions within the 6-month postoperative period [4; 1]; the proportion of patients who return to work within a 6-month postoperative period [4; 1]; distribution of patient satisfaction surveys [through IBD-specific patient panels, departmental open days, or patient opinion websites] [4; 1]; overall 30-day postoperative morbidity [as graded by the

Table 2. Outcome measures specific to small bowel, ileocolonic and peri-anal Crohn's disease surgery [shaded areas indicate items that reached consensus following two iterations].

	Likert ratings	
Outcome measures specific to Crohn's small bowel or ileocolonic surgery include:-	**Round 1**	**Round 2**
The proportion of patients who require re-operation within 30 days secondary to intra-abdominal septic complications	5; 1	5; 0
The proportion of patients who develop enterocutaneous fistulae within 90 days	4; 1	5; 1
The proportion of patients who develop subsequent short bowel	5; 1	5; 1
The proportion of patients who receive preoperative nutritional optimisation where indicated	4; 1	4; 1
The proportion of patients who develop clinical recurrence within 12 months	4; 1	4;1
The proportion of patients who are started on prophylactic immunomodulatory therapy within 6 months after surgery	4; 1	4; 1
Quality of life measures at 6 months postoperatively using the Crohn's Life Impact Questionnaire [CLIQ]	4; 2	4; 1
The proportion of patients who are stoma free after 12 months	4; 1	4; 2
The proportion of cases performed laparoscopically without conversion to open surgery	3; 0	3; 0
The proportion of patients who develop surgical recurrence within 36 months	3; 1	3; 1
Outcome measures specific to Crohn's perianal fistulae surgery:		
The proportion of patients who develop recurrent perianal abscesses within 12 months following surgery	4; 1	4; 1
The proportion of patients who go on to require proctectomy	4; 1	4; 1
The proportion of patients who require perineal diversion with a defunctioning stoma	4; 1	4; 1

Table 3. Outcome measures specific to subtotal colectomy, proctocolectomy and ileoanal pouch colitis-related surgery [shaded areas indicate items that reached consensus following two iterations].

	Likert ratings	
Outcome measures specific to subtotal colectomy with end ileostomy:-	**Round 1**	**Round 2**
30-day mortality rates in patients aged over 70	5; 1	5; 0
90-day mortality rates in patients aged over 70	5; 1	5; 0
The proportion of patients who undergo re-operation within 30 days after surgery		5; 1
The proportion of patients who develop rectal stump blowouts	4.5; 2	4; 1
The proportion of cases performed laparoscopically without conversion to open sugery	3; 1	3; 1
Outcome measures specific to proctocolectomy include:-		
The proportion of patients who develop sexual dysfunction	5; 1	5; 1
The proportion who develop perineal sinus formation	4; 2	4; 0
The proportion of patients who have restorative ileoanal pouch formation out of the total number of proctocolectomies	4; 2	4; 1
The proportion of cases that are performed laparoscopically without conversion to open surgery	3; 1	3; 1
Outcome measures specific to ileoanal pouch formation include:-		
The proportion of patients who undergo re-operation within 30 days secondary to intra-abdominal septic complications	5; 1	5; 0
The proportion of patients who develop pelvic septic complications within 30 days following surgery	5; 1	5; 0
The proportion of patients who require permanent faecal diversion with an ileostomy for long term pouch-related complications [including pouchitis, fistulae, or pouch failure]	5; 1	5; 1
The proportion of patients who require pouch salvage surgery in the long term for pouch failure	4; 2	4; 1

Clavien-Dindo classification] [4; 1]; and quality of life measures 12 months postoperatively by use of the Inflammatory Bowel Disease Questionnaire [IBDQ] [4; 1].

3.4.2. Quality assurance

A consensus on key performance indicators [median; IQR] that were considered very important [Likert rating 5] in quality assurance [Supplementary Table 2, available as Supplementary data at *ECCO-JCC* online] included: an IBD team meeting discussion for all IBD deaths within 12 months of surgery, with the outcome of the discussion recorded and submitted to national data collection databases [5; 0]; an IBD team meeting discussion in the event of significant postoperative morbidity [Clavien-Dindo grade ≥ 3] [5; 1]; discussion in the surgical morbidity and mortality meeting in the event of surgical deaths within 30 days of surgery [5; 0]; submission of surgical outcome data into national IBD audits or registries [including the IBD audit, ileal pouch registry, IBD registry] [5; 1]; and a local registry of surgical IBD patients [5; 1]. A consensus on indicators that were considered important [Likert rating 4] were: open publication or registry reporting for overall morbidity and mortality [4; 0]; a process of granting credentials by a national or international governing body for the IBD unit to deliver surgical services [4; 1]; an IBD team meeting discussion in the event of all IBD-related postoperative readmissions [4; 0]; and an IBD team meeting discussion considering the length of postoperative inpatient stay when this is greater than 14 days [4; 1].

3.5. Clinical care processes

3.5.1. Preoperative care

A consensus on the key performance indicator [median; IQR] that was considered very important [Likert rating 5] in preoperative care was an outpatient gastroenterology review with a view to optimise the patient's medication status [5; 1] [Supplementary Table 3a, available as Supplementary data at *ECCO-JCC* online]. A consensus on indicators that were considered important [Likert rating 4] were: the presence of an IBD nurse specialist during surgical consultations to address social and psychological concerns and manage expectations [4; 1]; and a referral to a dietician for optimisation of the patient's nutritional status where indicated [4; 1].

3.5.2. Postoperative care

A consensus on key performance indicators [median; IQR] that were considered important [Likert rating 4] in postoperative care [Supplementary Table 3b] included: the use of a shared care IBD bundle/booklet [4; 1]; a discussion of all postoperative inpatients in the IBD team meeting [4; 1]; and a gastroenterology inpatient review to assess the need for medical prophylaxis after surgery [4; 1].

3.6. Structure and organisation of IBD surgical services

3.6.1. IBD team

A consensus on the members [median; IQR] that were considered very important [Likert rating 5] to be core members of the IBD team [Supplementary Table 4, available as Supplementary data at *ECCO-JCC* online] included: a consultant colorectal surgeon who is trained and experienced in laparoscopic surgery [5; 0]; a consultant radiologist [5; 1]; a consultant gastroenterologist [5; 0]; and a clinical nurse specialist with a special interest and competency in stoma therapy and ileoanal pouch surgery [5; 1]. It was considered important [Likert rating 4] for the team to include a consultant histopathologist [4; 1] as core member of the team.

3.6.2. Facilities

There was a consensus [median; IQR] that is was very important [Likert rating 5] for an institution delivering a high quality IBD surgical service [Supplementary Table 5, available as Supplementary data at *ECCO-JCC* online] to a defined population of 250 000 to have two full-time equivalent consultant surgeons [dedicated IBD time] minimum [5; 0]; one dedicated laparoscopic operating facility [5; 0]; one IBD-specific endoscopy facility with dye spray and double-balloon enteroscopic and dilatation capabilities [5; 0]; one dedicated gastroenterology ward [5; 0]; once a month minimum parallel or joint gastroenterology and surgical IBD clinics [5; 0]; two full-time equivalent consultant gastroenterologists [5; 0]; 1.5 full-time equivalent clinical nurse specialists with competency in stoma therapy and ileoanal pouch surgery [5; 1]; an IBD advice line manned during working hours [5; 1]; and a interventional radiology service [for percutaneous intra-abdominal abscess drainage] [5; 1].

There was a consensus that it was important [Likert rating 4] for: the institution to have an emergency 24-h joint surgery and gastroenterology IBD on-call service [4; 1]; and an urgent referral pathway for new IBD patients [new referrals to be seen within 2 weeks] [4; 1].

3.6.3. Surgical volume

There was consensus [ie over 70% agreement across the panel]: that an individual consultant colorectal surgeon should be performing > 15 major IBD resections per year [including proctocolectomy, subtotal colectomy, ileoanal pouch formation, and ileocolonic/small bowel Crohn's surgery] [85%] [Figure 1]; and that an institution delivering a high quality surgical service should be performing > 20 major IBD resections per year [95%] [Figure 2].

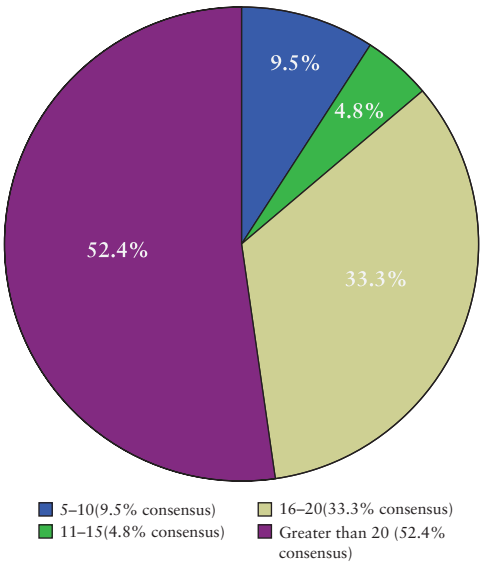

Figure 1. Pie chart demonstrating consensus on the number of major inflammatory bowel disease [IBD] resections (including proctocolectomy, subtotal colectomy, ileoanal pouch formation & ileocolonic/small bowel Crohn's surgery) performed per year by individual consultant colorectal surgeons, to ensure a high quality service provision. Following the second iteration, there was a 9.5% consensus on 5 to 10 major resections, 4.8% consensus on 11 to 15 major resections, 33.3% consensus on 16 to 20 major resections, and 52.4% consensus on more than 20 major resections performed per year by individual consultant colorectal surgeons.

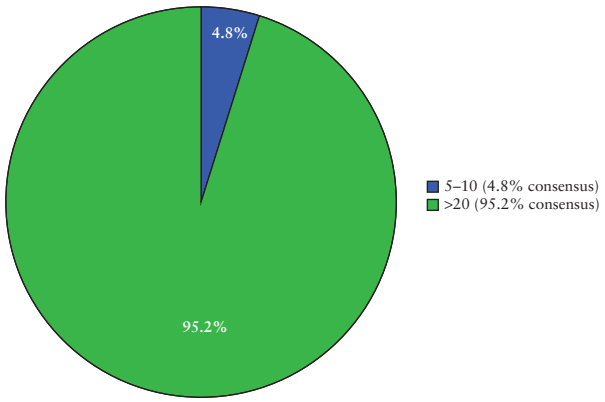

Figure 2. Pie chart demonstrating consensus on the number of major inflammatory bowel disease [IBD] resections (including proctocolectomy, subtotal colectomy, ileoanal pouch formation & ileocolonic/small bowel Crohn's surgery) performed per year by institutions to ensure a high quality service provision; 95.2% of Delphi participants agreed that following two iterations, more than 20 major resections should be performed per institution per year; and 4.8% of Delphi participants agreed that 5 to 10 major resections should be performed per institution per year.

4. Discussion

This study has provided, for the first time to our knowledge, a consensus-driven set of metrics that will make effective KPIs for the delivery of IBD surgery. Measuring performance on an individual measure may fail to appreciate the complexity of a health care system, and of risks failing to assess performance appropriately for a number of reasons.[25] The process of measuring an individual outcome variable and using it as an indicator of quality may alter behaviour in order to improve just that single outcome, without improving overall care.[26] This is especially the case where there are trade-offs, for example between length of postoperative stay and readmission rates, or pouch formation rates and pouch failures. Measuring variables from both sides of the trade-off may reduce the risk of this effect.[26]

The KPIs for overall provision of an IBD surgery service include: having a local registry of patients undergoing surgery for IBD; and submitting data to national databases or registries. Participation in national data collection and having robust collection locally have proved important as indicators of quality in their own right, with examples including the Bowel Cancer Audit[27] and the Inflammatory

Bowel Disease Audit,[28] but also produce the data required to monitor performance in other areas.[3,22]

Ninety-day mortality is increasingly being used instead of 30-day mortality as it captures more deaths and makes a more sensitive indicator of performance,[29] and it is the mortality measure suggested by consensus in this study. Mortality, however, remains a comparatively rare event in IBD surgery, especially in the elective setting.[1] Although monitoring mortality is a vital indicator of quality, the low risks will result in significant statistical fluctuation in the short term, especially in low volume units, and by the time a unit has proven itself to be a statistical outlier, many patients may have been exposed to poor quality care.

A number of more frequently occurring adverse outcomes have been suggested as key performance indicators by this expert panel. Re-operation within 30 days was considered an important indicator for all the intra-abdominal and pelvic operations. Development of short bowel syndrome and enterocutaneous fistulae are fortunately relatively rare complications of Crohn's disease, but the severity of impact on a patient's quality of life warrants their inclusion here.[30] Sexual dysfunction after rectal resection also has potential for a significant quality of life impact, and although often thought to be uncommon, is poorly monitored and under-reported and treated.[31]

The involvement of other members of the multidisciplinary team [MDT] [eg specialist IBD nursing staff] was recommended as important rather than very important indicators. This may in part represent the intentional decision not to include these core and extended members of the MDT on the expert consensus panel in order to focus the key performance indicators on the surgery itself.[32,33] Involvement of the full range of members of the MDT is vital in the quality of an IBD service as a whole,[4] is recognised in other guidelines,[12,34] and will be picked up in audits of a unit's overall IBD performance; but for specifically assessing the quality of the surgical service, there are other indicators which are more useful.

Some of the initial statements were rejected as useful performance indicators by the Delphi panel. In particular, rates of laparoscopic surgery, conversion rates, and the use of enhanced recovery programmes divided opinion across the panel, with no consensus being reached as to their usefulness as performance indicators. All panel members felt it was important for laparoscopic surgery to be available within the core IBD team, and the lack of consensus therefore relates to either whether a laparoscopic approach is correct for all patients, or whether measuring rates of laparoscopic surgery is a useful measure of surgical quality. There are substantial benefits with laparoscopic surgery in both Crohn's disease and ulcerative colitis. There is improved cosmesis and faster recovery than with open surgery in the short-term. Furthermore, long-term benefits have been demonstrated, with reduced adhesiolysis and incisional hernia surgery.[35–37] Current guidance suggests it should be the treatment of choice in ileocolonic resection for Crohn's disease, and is suitable for patients with colitis.[12,34] There are often valid clinical reasons why a case requires open rather than laparoscopic surgery, and measuring laparoscopic and conversion rates may therefore have been felt to be an inadequate measure of performance.

Institutional and surgeon volumes have been shown to correlate with outcomes for a range of surgical procedures, including ileoanal pouch surgery, yet pouch surgery volumes are low in many units, with 30% carrying out fewer than two pouches per year.[38] There is, however, no evidence of a relationship between surgical volume and outcomes in other areas of inflammatory bowel disease surgery. High volume does correlate to high quality performance. The technical expertise required to operate on complex Crohn's disease and UC, and the peri-operative decision making of when to operate and whether to fashion an anastomosis or to create a stoma, require highly trained surgeons. The consensus of the panel was that an IBD unit should be carrying out more than 20 major intra-abdominal IBD operations each year, and that an individual surgeon should be carrying out more than 15. Although there is no UK national consensus on what defines high volume, currently European consensus states high volume centres should perform at least 10 pouch formations per year. This would leave the remaining 10 to include the other major IBD surgical procedures.[23,39] This low number should be considered an initial threshold for the process of centralisation, supported by the necessary organisational structure and processes to support this. From the standpoint of the individual surgeon, colorectal surgeons carrying out cancer resections in the UK are required to carry out at least 20 cancer resections each year.[40] Depending on other clinical commitments it may not be realistic for a surgeon to achieve both of these targets, driving centralisation and the development of IBD surgery as a separate subspecialty interest within colorectal surgery.

Limitations do need to be considered within this study. First, those outcome measures that achieved consensus as either very important or important represent metrics in the ideal IBD surgical service provision. Many of these are undefined proportions and, unlike the clinical process, KPIs may be difficult to measure. Consideration should be given to defining proportions and whether the creation of a minimum set should be implemented into practice. These could be achieved through implementation of these KPIs into national audit datasets to provide a benchmark on proportions and volumes. Second, the study was limited by selection bias as there were only 20 respondents to a survey invitation sent to all ECCO members. Furthermore, coverage bias may exist considering representation from only 10 European countries, and skewing of opinion if some countries are represented more across panellists then others.

In conclusion, this study has identified a range of consensus-derived key performance indicators covering all aspects of inflammatory bowel disease surgery. These have the potential to complement institutions in monitoring and enhancing the standard of care within an IBD surgical service. Further work is required to determine proportions before producing deliverable metrics.

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Conflict of Interest

NS is the Director of London Safety and Training Solutions Ltd, which provides quality and safety training and advisory services on a consultancy basis to health care organisations globally.

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Supplementary Data

Supplementary data are available at *ECCO-JCC* online.

References

1. National audit of inflammatory bowel disease [IBD] service provision. The Royal College of Physicians. September 2014.
2. Kappelman MD, Palmer L, Boyle BM, Rubin DT. Quality of care in inflammatory bowel disease: a review and discussion. *Inflamm Bowel Dis* 2010;**16**:125–33.
3. Burns EM, Bottle A, Aylin P, Darzi A, Nicholls RJ, Faiz O. Variation in reoperation after colorectal surgery in England as an indicator of surgical performance: retrospective analysis of Hospital Episode Statistics. *BMJ* 2011;**343**:d4836.
4. Bortoli A, Daperno M, Kohn A, *et al*.; Italian Group for the study of Inflammatory Bowel Disease [IG-IBD]. Patient and physician views on the quality of care in inflammatory bowel disease: results from SOLUTION-1, a prospective IG-IBD study. *J Crohns Colitis* 2014;**8**:1642–52.
5. Guidance on Developing Key Performance Indicators and Minimum Data Sets to Monitor Health Care Quality: Health Information and Quality Authority. February 2013. https://www.hiqa.ie/sites/default/files/2017-01/KPI-Guidance-Version1.1-2013.pdf. Accessed August 6, 2017.
6. Krimsky WS, Mroz IB, McIlwaine JK, *et al*. A model for increasing patient safety in the intensive care unit: increasing the implementation rates of proven safety measures. *Qual Saf Health Care* 2009;**18**:74–80.
7. Rutter MD, Chattree A, Barbour JA, *et al*. British Society of Gastroenterology/Association of Coloproctologists of Great Britain and Ireland guidelines for the management of large non-pedunculated colorectal polyps. *Gut* 2015;**64**:1847–73.
8. Wakai A, O'Sullivan R, Staunton P, Walsh C, Hickey F, Plunkett PK. Development of key performance indicators for emergency departments in Ireland using an electronic modified-Delphi consensus approach. *Eur J Emerg Med* 2013;**20**:109–14.
9. Melmed GY, Siegel CA, Spiegel BM, *et al*. Quality indicators for inflammatory bowel disease: development of process and outcome measures. *Inflamm Bowel Dis* 2013;**19**:662–8.
10. Nguyen GC, Devlin SM, Afif W, *et al*. Defining quality indicators for best-practice management of inflammatory bowel disease in Canada. *Can J Gastroenterol Hepatol* 2014;**28**:275–85.
11. Mowat C, Cole A, Windsor A, *et al*.; IBD Section of the British Society of Gastroenterology. Guidelines for the management of inflammatory bowel disease in adults. *Gut* 2011;**60**:571–607.
12. Øresland T, Bemelman WA, Sampietro GM, *et al*.; European Crohn's and Colitis Organisation [ECCO]. European evidence based consensus on surgery for ulcerative colitis. *J Crohns Colitis* 2015;**9**:4–25.
13. Pellino G, Selvaggi F, Ghezzi G, Corona D, Riegler G, Delaini GG. A think tank of the Italian Society of Colorectal Surgery [SICCR] on the surgical treatment of inflammatory bowel disease using the Delphi method: Crohn's disease. *Tech Coloproctol* 2015;**19**:639–51.
14. Selvaggi F, Pellino G, Ghezzi G, Corona D, Riegler G, Delaini GG. A think tank of the Italian Society of Colorectal Surgery [SICCR] on the surgical treatment of inflammatory bowel disease using the Delphi method: ulcerative colitis. *Tech Coloproctol* 2015;**19**:627–38.
15. Gionchetti P, Dignass A, Danese S, *et al*.; ECCO. Third European evidence-based consensus on the diagnosis and management of Crohn's disease 2016: part 2: surgical management and special situations. *J Crohns Colitis* 2017;**11**:135–49.
16. Gomollón F, Dignass A, Annese V, *et al*.; ECCO. Third European evidence-based consensus on the diagnosis and management of Crohn's disease 2016: part 1: diagnosis and medical management. *J Crohns Colitis* 2017;**11**:3–25.
17. Stefanidis D, Cochran A, Sevdalis N, *et al*.; Multi-Institutional Educational Research Group of the Association for Surgical Education. Research priorities for multi-institutional collaborative research in surgical education. *Am J Surg* 2015;**209**:52–8.
18. Dalkey NC. *The Delphi Method: An Experimental Study of Group Opinion*. Santa Monica, CA: RAND Corporation; 1969.
19. Morar PS, Hodgkinson JD, Thalayasingam S, *et al*. Determining predictors for intra-abdominal septic complications following ileocolonic resection for Crohn's disease - considerations in pre-operative and peri-operative optimisation techniques to improve outcome. *J Crohns Colitis* 2015;**9**:483–91.
20. Morar PS, Faiz O, Hodgkinson JD, *et al*. Concomitant colonic disease [Montreal L3] and re-resectional surgery are predictors of clinical recurrence following ileocolonic resection for Crohn's disease. *Colorectal Dis* 2015;**17**:O247–55.
21. Scoglio D, Ahmed Ali U, Fichera A. Surgical treatment of ulcerative colitis: ileorectal vs ileal pouch-anal anastomosis. *World J Gastroenterol* 2014;**20**:13211–8.
22. Burns EM, Bottle A, Aylin P, *et al*. Volume analysis of outcome following restorative proctocolectomy. *Br J Surg* 2011;**98**:408–17.
23. BSG.. *Quality Care: Service Standards for the Health Care of People who Have Inflammatory Bowel Disease [IBD]*. London: British Society of Gastroenterology,; 2009.
24. Fink A, Kosecoff J, Chassin M, Brook RH. Consensus methods: characteristics and guidelines for use. *Am J Public Health* 1984;**74**:979–83.
25. Almoudaris AM, Burns EM, Bottle A, *et al*. Single measures of performance do not reflect overall institutional quality in colorectal cancer surgery. *Gut* 2013;**62**:423–9.
26. Bevan G, Hood C. What's measured is what matters: targets and gaming in the English public health care system. *Public Administration* 2006;**84**:517–38.
27. Healthcare Quality Improvement Partnership Ltd (HQIP), National Bowel Cancer Audit Annual Report 2016. https://www.acpgbi.org.uk/content/uploads/2016/07/nati-clin-audi-bowe-canc-2016-rep-v2.pdf. Accessed August 6, 2017.
28. UK IBD Audit Steering Group. UK IBD Audit 2nd Round [2008] Report - Executive Summary of the National Results for the Organisation & Process of Adult IBD Care in the UK. March 2009.
29. Byrne BE, Mamidanna R, Vincent CA, Faiz O. Population-based cohort study comparing 30- and 90-day institutional mortality rates after colorectal surgery. *Br J Surg* 2013;**100**:1810–7.
30. Carlsson E, Bosaeus I, Nordgren S. Quality of life and concerns in patients with short bowel syndrome. *Clin Nutr* 2003;**22**:445–52.
31. Hendren SK, O'Connor BI, Liu M, *et al*. Prevalence of male and female sexual dysfunction is high following surgery for rectal cancer. *Ann Surg* 2005;**242**:212–23.
32. Morar P, Sevdalis N, Warusavitarne J, et al. P400. Setting standards for multi-disciplinary team driven care in inflammatory bowel disease service provision—an expert consensus on key specialists to be involved. *J Crohns Colitis* 2015;**9**[Suppl 1]:S279.
33. Morar P, Read J, Arora S, *et al*. Defining the optimal design of the inflammatory bowel disease multidisciplinary team: results from a multicentre qualitative expert-based study. *Frontline Gastroenterol* 2015;**6**:290–97.
34. Dignass A, Van Assche G, Lindsay JO, *et al*.; European Crohn's and Colitis Organisation [ECCO]. Second European evidence-based consensus on the diagnosis and management of Crohn's disease: current management. *J Crohns Colitis* 2010;**4**:28–62.
35. Eshuis EJ, Slors JF, Stokkers PC, *et al*. Long-term outcomes following laparoscopically assisted versus open ileocolic resection for Crohn's disease. *Br J Surg* 2010;**97**:563–8.
36. Spinelli A, Bazzi P, Sacchi M, *et al*. Short-term outcomes of laparoscopy combined with enhanced recovery pathway after ileocecal resection for Crohn's disease: a case-matched analysis. *J Gastrointest Surg* 2013;**17**:126–132; discussion p.132.
37. Hull TL, Joyce MR, Geisler DP, Coffey JC. Adhesions after laparoscopic and open ileal pouch-anal anastomosis surgery for ulcerative colitis. *Br J Surg* 2012;**99**:270–5.
38. Burns EM, Bottle A, Aylin P, *et al*. Volume analysis of outcome following restorative proctocolectomy. *Br J Surg* 2011;**98**:408–17.
39. Øresland T, Bemelman WA, Sampietro GM, *et al*.; European Crohn's and Colitis Organisation [ECCO]. European evidence-based consensus on surgery for ulcerative colitis. *J Crohns Colitis* 2015;**9**:4–25.
40. Association of Coloproctology of Great Britain and Ireland (ACPGBI). *Colorectal Cancer Surgery Standards ACPGBI Advisory*. 2012.