ORIGINAL ARTICLE

Assessment of the value of gastroenterologists' activity in the outpatient setting: applying the "Moneyball" approach to clinical care

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Abstract

Background With the emergence of alternative payment systems replacing the traditional funding models, the value of physician activity is scrutinized more closely. Attempts have been made to quantify the value of endoscopists' activity; there is little in the medical literature describing gastroenterologists' value in the outpatient setting.

Aims To characterize the value of clinical activity of gastroenterologists in the outpatient setting.

Methods The value of clinical activity of ten gastroenterologists in an academic medical center was estimated. Value was defined as Q (quality of clinical care) divided by T_A (duration of outpatient visit adjusted for complexity level); T_A served as a surrogate measure of the cost of the clinician's services. Medical records of each patient's clinical visit were reviewed and graded independently by three staff gastroenterologists; each reviewer was blinded to the identity of the physician and to other reviewers' scores.

Results Over consecutive weeks, the clinical records of 307 patients who were seen by ten gastroenterologists were reviewed and graded for quality (Q) and complexity (C); the duration of each visit (T) was recorded. Each physician saw a mean of 31 patients; mean physician value varied from 0.28 to 0.87. More senior physicians demonstrated higher levels of value.

Conclusion Measurement of the value of clinical activity represents an important component of gastroenterologists' performance. There was a threefold variation among physician levels of value with more experienced clinicians demonstrating higher value levels. Further studies will be required to more clearly define valid metrics for physician value.

Keywords Gastroenterology · Outpatient practice · Quality of care · Value

Introduction

Spiraling healthcare costs have necessitated changes in healthcare funding models. In the USA, the traditional fee-for-service model of payment is being replaced with alternative payment models for physicians [1]. Activity-based funding is being introduced in Ireland, transitioning from traditional block grant funding model. The National Health Service England has introduced value-based healthcare funding for a variety of clinical conditions. With the emergence of alternative payment systems in place of the traditional models, the value of physician activity is being scrutinized more closely.

In 2003, Michael Lewis described the analytic, evidence-based approach taken by Billy Beane and the Oakland Athletics baseball organization as he attempted to define the true value of baseball players in *Moneyball* [2]. Proponents of a value-based approach to healthcare have advocated a similar use of information analysis to value clinicians' activity [3]. Conventionally, value in healthcare has been defined as quality of care, or healthcare outcomes, divided by cost of care [4, 5]. In the field of gastroenterology, some attempts have been made to quantify the value of endoscopists' activity [6]. Although metrics of quality in endoscopy are well accepted—adenoma detection rate, cecal intubation rate, colorectal cancer detection rate—there is little in the medical literature describing gastroenterologists' value in the outpatient setting. In the outpatient clinic, measures of quality are more nuanced, encompassing a broader range and depending upon the patient's presenting complaint and underlying medical diagnoses. This study aimed to characterize the value of gastroenterologists' clinical activity in the outpatient clinic setting.

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Methods

Over the course of three weeks in June 2016, all patients attending the gastroenterology/hepatology outpatients' clinics in an academic medical center were reviewed. Ethical approval was obtained for the study from the hospital Institutional Review Board.

Clinics were held on three mornings each week and were of approximately three and half to four hours in duration. All clinics comprised of one (occasionally two) consultant/ attending gastroenterologists along with three or four gastroenterology fellows. Fellows were sufficiently experienced to function autonomously in most of their clinical decision-making although, if they had any uncertainty, they reviewed their patient with the consultant gastroenterologist to ensure appropriate care. Patients attended clinics for management of the full spectrum of adult gastroenterology and hepatology illnesses, with the exception of viral hepatitis. All patients were over 16 years of age and had been referred by their primary care physician; the hospital catchment population is approximately 800,000 patients. In general, patients attended clinic for the following:

- Their initial visit
- Follow-up visit—to review results of tests ordered on their initial visit
- Ongoing management of long-standing gastroenterological illnesses (usually chronic inflammatory bowel disease [IBD] or chronic non-viral liver disease)

Calculation of value

By convention, value in healthcare has been defined as quality of care (or outcome of care) divided by cost of care [4]. For the purposes of this study, we chose to use key performance indicators (KPIs) for specific conditions as endorsed by professional societies to measure quality (Q). The duration of the clinic visit (T) was used as a surrogate measure of cost; duration of visit (in minutes) was the time from the patient's entry into the consultation to their exit. All consultation times were recorded prospectively during the clinic by one of three co-investigators (LAV, AWB, MC) who used a stopwatch to record the interval between arrival and departure of each patient from the doctor's office. To take account of the varying complexity level of each individual patient, visit duration was divided by complexity level (T/C) to yield an adjusted duration for each patient ($T_A = T/C$). Therefore, the value equation was $V = Q / T_A$ or $Q / (T/C)$.

Measurement of quality

Medical records for each patient visit were reviewed and independently graded for quality by three staff gastroenterologists (GCH, AOT, KH) for each patient visit. All 312 patient records were reviewed by all three reviewers. Reviewers were blinded to both the identity of the physician being graded and other reviewers' scores. In the event of discrepancy in scores, the mean of the three scores was used.

The quality grade was based on the overall appropriateness of management according to published evidence-based guidelines for the relevant patient condition. Guidelines for management of chronic liver disease were based on quality indicators developed using a modified Delphi panel process that combined existing evidence with consensus judgment of hepatology experts [7]; these KPIs incorporate position statements from the American College of Gastroenterology (ACG), the American Gastroenterological Association (AGA), and the American Association for the Study of Liver Diseases (AASLD) [8–10] and address six domains of clinical care: (a) ascites, (b) variceal bleeding, (c) hepatic encephalopathy, (d) hepatocellular cancer, (e) liver transplantation, and (f) general cirrhosis care (e.g., hepatitis A, B vaccination if not already immune). Similarly, guidelines for the management of inflammatory bowel disease were based on those endorsed by the major gastroenterology professional organizations [11–16]. Relevant KPIs for the outpatient management of IBD are illustrated in Table 1. General best practice guidelines, where available, were used to guide the reviewers' scoring for management of other gastroenterological conditions [17, 18]; the AGA "Choosing Wisely" initiative was also utilized for assessing appropriateness of management. Quality was graded on a four-point Likert scale as follows:

1. Inadequate Quality: inappropriate management plan
2. Adequate Quality: appropriate management but few relevant KPIs documented for patient's condition

Table 1 Key performance indicators used to assess quality of management of inflammatory bowel disease

Chronic inflammatory bowel disease key performance indicators
• Consideration of immunosuppressive medication in patients requiring two or more courses of steroids (prednisolone) in prior year
• No IBD patient should receive steroid dose > 20 mg/day for more than 6 months
• Patients with steroid refractory Crohn's disease should receive an anti-TNF agent
• Appropriate colorectal cancer surveillance
• Addressing bone health
• Addressing smoking cessation (for Crohn's patients)
• Appropriate use of corticosteroid-sparing therapy
• Appropriate testing for latent infections (e.g., tuberculosis, prior hepatitis B virus) prior to commencing anti-TNF treatment
• Discussing skin cancer/lymphoma risks in patients starting immunosuppressants
• Monitoring leukocyte count (patients on azathioprine)
• Monitoring serum levels of biologic therapy and presence of antibodies if relevant

3. Good Quality: appropriate management along with several relevant KPIs documented
4. Excellent Quality: appropriate management along with most/all relevant KPIs documented

Measurement of complexity

The level of complexity of the patient visit was also graded on a four-point Likert scale as follows:

1. Routine follow-up of straightforward patient, not requiring change in treatment (e.g., IBD patient on aminosalicylate medication only)
2. Initial visit for straightforward complaint; follow-up of moderate complexity (e.g., IBD patient on biologic therapy, IBD patient on aminosalicylate medication requiring change in treatment)
3. Initial visit of moderate complexity; follow-up visit requiring significant change in treatment; significant test results requiring detailed discussion (e.g., new diagnosis of IBD)
4. Patient requiring hospital admission; detection of malignancy on test results requiring very detailed discussion with patient, family

Statistical analysis

Estimates of value were described for each physician as mean and standard deviation (SD); mean estimates for quality, complexity level, visit duration, and adjusted visit duration were also presented for each physician (Table 3). Value estimates were illustrated graphically for physicians based on their levels of seniority (attending/consultant, senior fellows, junior fellows), Fig. 1. Pearson's correlation coefficient (r) was used to describe the level of agreement among the reviewers for grading of quality and complexity (Table 2).

Results

Overall, 312 patient visits seen by 11 gastroenterologists were reviewed; one physician saw only 5 patients and was therefore excluded leaving 307 patient visits (seen by ten gastroenterologists) for analysis. Of the ten physicians, there were four consultant gastroenterologists, three senior gastroenterology fellows (at least four years of subspecialty training), and three junior fellows (less than four years of subspecialty training). Each physician saw at least 16 patients (mean 30.7 patients). There were high levels of correlation for scoring among the three reviewers as illustrated in Table 2 (quality, $r = 0.87$–0.93; complexity, $r = 0.86$–0.92).

Table 3 illustrates the baseline performance characteristics of the ten gastroenterologists. As shown, there was a threefold variation in mean value estimates for physicians, from 0.28 to 0.87. Similarly, there were 2.3-fold variations in both mean quality (from 1.68 to 3.94) and mean adjusted time duration (from 4.40 to 10.23) for physicians. Table 4 illustrates the patient case mix of each physician; as is apparent from the table, consultants D had a specialty interest in IBD and these patients comprised the majority (88%) of their cohort; otherwise, patient subtypes were fairly randomly distributed among all physicians.

Figure 1 illustrates the quality (y-axis) and adjusted time (x-axis) measurements for each physician, with high-value physicians in the upper left quadrant (high quality, short visit duration) and low-value physicians in the lower right quadrant. As shown graphically, there was a wide inter-physician variation in value measurements. Overall, the high-value quadrant comprised two of the four consultants and one of the three senior fellows; the low-value quadrant comprised all three junior fellows.

Interestingly, there was no correlation between overall quality of care and adjusted time duration, $r = 0.01$. When stratified based on physician experience level, the lack of correlation still held, $r = -0.04$ (for consultants), $r = -0.03$ (senior fellows), and $r = 0.25$ (junior fellows).

Discussion

This is one of the first studies to attempt to characterize the value of gastroenterologists' activity in the outpatient clinic setting. The concept of value in healthcare is relatively recent; with the disappearance of the traditional fee-for-service model of care and other traditional funding models, value of care delivered is assuming greater importance. Novel approaches to reimbursement such as bundled payments and episode-based payments aim to link reimbursement to patient outcomes, thereby incentivizing physicians to provide value rather than volume of care. Indeed, the Department of Health and Human Services has outlined their goal of linking 30% of Medicare payments to newer payment models by the year-end (2016) and progressing to 50% linkage by 2018. In Ireland, the *Sláintecare* report on the future of healthcare emphasizes value of care delivered. A report from *The Economist* Intelligence Unit identified Sweden and the UK healthcare systems as having very high and high alignment, respectively, with value-based healthcare [19]. With this paradigm shift in funding, accurate measurement of the value of gastroenterologists' clinical activity—especially outside the endoscopy suite—represents a key challenge. The findings of this study provide some important insights into gastroenterologists' value in the outpatient clinic setting.

Fig. 1 Quality and adjusted time for ten gastroenterologists in an outpatient setting
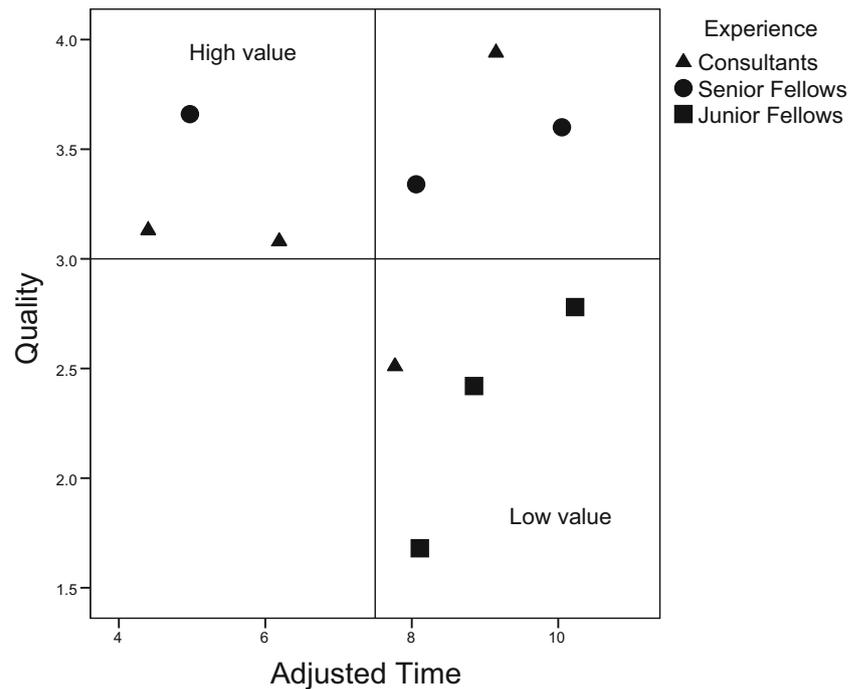
Perhaps the most challenging aspect of a study like this relates to the measurement of the quality of a physician's work. How does one quantify the quality of the non-procedural component of a gastroenterologist's work? Philosophically, is it a measure of the improvement in a patient's contentment following the consultation, i.e., patient satisfaction? Is it the degree to which the patient's life has been prolonged due to the visit? Is it both and, if so, what is the relative contribution of either? In his novel *A Fortunate Man*, John Berger chronicles the life of a country doctor in England, Dr. John Sassall, over a three-month period in 1966 [20]. The author grapples with this dilemma of quantifying the quality of a doctor's work: "What is the social value of a pain eased? What is the value of a life saved?.....Should a doctor be judged professionally – by the consistent level of his professional skill?.......You cannot expect to evaluate a man's life's work as though it were stock in a warehouse. There is no scale of measurement possible. ……..We in our society do not know how to acknowledge, to measure the contribution of an ordinary working doctor." In more recent times, professional gastroenterology societies have published best practice guidelines for management of various conditions. Although these

guidelines do not capture some of the more nuanced aspects of the doctor-patient interaction, they represent the most objective measures of quality available. In this study, we chose to grade quality as objectively as possible based on these guidelines. Similar subjectivity exists in the grading of patient complexity levels; does a moderately complex IBD patient equate to a moderately complex patient with chronic liver disease? We accept that there is inherent subjectivity in the assessment of the quality and complexity of a clinician's activity; nonetheless, it is reassuring that there were exceptionally high levels of agreement among grades of the three blinded reviewers in both of these domains.

One of the noteworthy findings of this study is the high level of variability that exists among gastroenterologists with respect to clinical metrics such as quality of care provided, duration of consultation visits, and overall value measurements. This inter-physician variability is not surprising; we observed a threefold variation in value levels among physicians. There is ample evidence in the endoscopy literature to attest to the variation in quality that exists in provision of colonoscopic services to patients, variation of adenoma detection, cecal intubation rates [21] and, most importantly, in colon cancer detection rates [22]. There is also evidence to support differing levels of efficiency among primary care physicians in the outpatient setting [23]. One of the few papers in the literature on this topic reported on the quality of consultations of 85 primary care physicians (PCPs) in general practice in the Lothian region of Scotland [23]. The authors reported that quality was superior for "slower" physicians, i.e., those taking longer for their consultations. In contrast, our findings did not support any relationship between quality and duration

Table 2 Agreement levels (*r*) among three staff gastroenterologists reviewing quality and complexity levels of consultation visits

	Reviewer 1	Reviewer 2	Reviewer 3
Reviewer 1	–	0.87 (complexity)	0.91 (complexity)
Reviewer 2	0.87 (quality)	–	0.93 (complexity)
Reviewer 3	0.86 (quality)	0.92 (quality)	–

Table 3 Performance characteristics of ten gastroenterologists in outpatient clinic setting

	No. pts	Experience	C, mean (SD)	Q, mean (SD)	T, mean	T_A, mean (SD)	V, mean (SD)
A	30	1	1.68 (0.49)	2.51 (0.61)	12.00	7.77 (4.49)	0.39 (0.17)
B	16	1	1.75 (0.58)	3.08 (0.73)	9.81	6.19 (2.93)	0.60 (0.28)
C	31	1	1.63 (0.74)	3.13 (0.83)	7.39	4.40 (1.84)	0.84 (0.46)
D	18	1	2.06 (0.62)	3.94 (0.13)	18.17	9.15 (4.22)	0.58 (0.42)
E	29	2	2.01 (0.73)	3.34 (0.76)	16.52	8.06 (2.63)	0.45 (0.18)
F	34	2	1.97 (0.68)	3.66 (0.58)	9.59	4.97 (2.03)	0.85 (0.36)
G	46	2	1.96 (0.61)	3.60 (0.73)	19.46	10.05 (3.85)	0.42 (0.19)
H	20	3	1.93 (0.49)	2.78 (0.95)	19.10	10.23 (4.98)	0.33 (0.20)
I	49	3	1.75 (0.50)	2.42 (0.95)	14.53	8.85 (4.96)	0.36 (0.25)
J	34	3	1.74 (0.57)	1.68 (0.66)	12.65	8.11 (4.14)	0.28 (0.20)

Experience: 1, consultants; 2, senior fellow; 3, junior fellow; C, complexity; Q, quality (both graded on 1 to 4 Likert scale); T, time, in minutes; T_A, adjusted time, in minutes; V, value; SD, standard deviation

of clinic visit. An important difference between the two studies related to measurement of quality; quality among the Scottish PCPs was defined as addressing psychosocial issues, addressing long-term health issues, carrying out health promotion, and general patient satisfaction levels. In contrast, our metrics were more specialty-specific, evidence-based where possible, and did not incorporate patient satisfaction scores. These contrary findings illustrate the importance of the definition of "quality" in influencing the conclusions of such studies. Future work will be helpful in clarifying and validating the most appropriate specialty-specific quality measures in clinical practice.

Our findings provide evidence that physician experience level is of some importance. Staff gastroenterologists demonstrated higher levels of value than trainees, while senior fellows exhibited superior value to junior fellows. Quality measures were actually slightly superior for senior fellows (3.53) compared to consultants (3.17); both were higher than junior

Table 4 Patient case mix of ten gastroenterologists in outpatient clinic setting

	No. pts	1st visit	IBD	CLD	Miscellaneous
A	30	6 (20%)	16 (53%)	2 (7%)	6 (20%)
B	16	5 (31%)	4 (25%)	4 (25%)	3 (19%)
C	31	3 (10%)	7 (23%)	13 (42%)	8 (26%)
D	18	1 (6%)	16 (88%)	0	1 (6%)
E	29	3 (10%)	15 (52%)	5 (17%)	6 (21%)
F	34	6 (18%)	11 (32%)	8 (24%)	9 (26%)
G	46	14 (30%)	17 (37%)	7 (15%)	8 (17%)
H	20	3 (15%)	7 (35%)	9 (45%)	1 (5%)
I	49	11 (22%)	14 (29%)	13 (27%)	11 (22%)
J	34	3 (9%)	13 (38%)	9 (26%)	9 (26%)

1st visit, initial patient visit; IBD, return visit for patient with inflammatory bowel disease; CLD, return visit for patient with chronic liver disease; miscellaneous, return visit for all other patients

fellows (2.93). Most of the difference in value reflects the difference in adjusted time measurements between consultants (6.88), senior fellows (7.69), and junior fellows (9.06). This time difference is to be expected in a supervised clinical setting where consultants ensure adequate quality levels of care for all patients regardless of the clinician's level of experience; however, occasionally, trainees are required to review a complex patient with the consultant, thereby prolonging the trainee's consultation time. In general, only a minority of trainees' patient consultations (< 20%) involved a review by the consultant and, if so, the wait time until the consultant was available was minimal (2 to 4 min).

This study has several limitations. Our attempt to quantify value is predicated on the validity of the measures of quality and time (as a surrogate measure of cost) that we used. Grading quality, as mentioned above, is inherently subjective and difficult. For this reason, we used existing evidence-based guidelines, where available, to guide our measurement. Despite this, there was still imprecision in our grading of quality. For example, it would be possible for a physician to score poorly in quality while still managing a patient safely, e.g., safe immediate management of a cirrhotic patient but without addressing hepatoma screening or esophageal variceal screening would only yield a score of 2/4. Indeed, there were very few episodes of suboptimal management (score of 1/4)—only 16 of 307 patient visits (5%)—and each represented a relatively non-serious oversight, usually inappropriate surveillance endoscopy interval (most commonly, inappropriately early surveillance). Furthermore, although our Likert quality scale was agreed upon by the senior clinicians in the study, it has not been previously validated in other settings. Nonetheless, despite the subjective nature of assessing quality, the high level of agreement among our three blinded reviewers was reassuring. Secondly, the validity of adjusted duration of consultation visit as a proxy for cost of care is open to debate. We hypothesized that cost of care was directly proportional to the time interval between patient arrival and departure from the

doctor's office. This time interval does not take account of time taken for ancillary activities such as pre-consultation preview of patient test results in advance of patient entry, post-consultation dictation of note for patient's medical record. All physicians in our study tended to perform these tasks outside of the patient entry/exit time, e.g., none of the study physicians dictated the patient note while the patient was present in the room. In our outpatient setting, physicians are frequently required to respond to phone calls relating to other patients and to address a variety of miscellaneous clinical issues between patient visits; therefore, the interval between patient entry/exit was considered the most accurate measure of time taken solely for that patient. It is true that cost of care also encompasses appropriate ordering of investigations. Excessive ordering of inappropriate tests increases cost of care; however, over-ordering would be reflected in the quality numerator of our value equation in this study. Thirdly, our healthcare system does not rely on the patient's medical record for billing purposes. Realizing that a "checklist" of billable activities is not required to generate revenue, physicians occasionally use the medical record as a medium to convey only the necessary relevant clinical details while not documenting (even though addressing) other issues. For example, a physician may have counseled a patient with Crohn's disease regarding the importance of smoking cessation while neglecting to mention it in the medical record. This may have been responsible for the slightly inferior quality level among consultants compared to senior fellows, as consultants were more likely to adopt a "minimalist" approach in their dictated clinical note, documenting essential clinical issues while omitting less pertinent information.

In summary, there is a shift occurring from traditional to alternative payment models for gastroenterologists. Measurement of the value of clinical activity, not only in endoscopic practice, will be an important component of the ongoing assessment of gastroenterologists' performance. This study represents an initial attempt to characterize gastroenterologists' value in the outpatient setting. Notwithstanding the variations observed in value measurements among physicians, the clinician's experience level appears to influence overall value. Moreover, the quality of care did not correlate with duration of consultations, reinforcing the unpredictability of the nature of medicine. Future studies will be required to further assess the value of physician activity. Moreover, measures of quality for grading clinician activity will likely be refined in years to come to more accurately reflect patient outcomes and to facilitate such studies.

Compliance with ethical standards

References

1. Patel K, Presser E, George M, McClellan M (2016) Shifting away from fee-for-service: alternative approaches to payment in gastroenterology. Clin Gastro Hepatol 14:497–506
2. Lewis M (2003) Moneyball: the art of winning an unfair game. W. W. Norton, New York
3. Phillips CJ, Greene JA (2012) Moneyball and medicine. N Engl J Med 367:1581–1583
4. Porter ME (2010) What is value in healthcare? N Engl J Med 363: 2477–2481
5. Kosinski L (2014) How does a gastroenterologist demonstrate value? Gastroenterology 147:927–929
6. Harewood GC (2015) Measuring the value of colonoscopists' performance. Clin Gastroenterol Hepatol 13:1377
7. Kanwal F, Kramer J, Asch SM, el–Serag H, Spiegel BMR, Edmundowicz S, Sanyal AJ, Dominitz JA, McQuaid KR, Martin P, Keeffe EB, Friedman LS, Ho SB, Durazo F, Bacon BR (2010) An explicit quality indicator set for measurement of quality of care in patients with cirrhosis. Clin Gastroenterol Hepatol 8:709–717
8. Chalasani N, Younossi Z, Lavine JE et al (2012) The diagnosis and management of non-alcoholic fatty liver disease: practice guideline by the American Gastroenterological Association, American Association for the Study of Liver Diseases and American College of Gastroenterology. Gastroenterology 142(7):1592–1609
9. O'Shea RS, Dasarathy S, McCullough AJ (2010) Alcoholic liver disease. Practice guideline of the Committee of the American Association for the Study of Liver Diseases. Hepatology 51(1): 307–328
10. Bacon BR, Adams PC, Kowdley KV, Powell LW, Tavill AS, American Association for the Study of Liver Diseases (2011) Diagnosis and management of hemochromatosis: 2011 practice guideline by the American Association for the Study of Liver Diseases. Hepatology 54(1):328–343
11. Dassopoulos T, Cohen RD, Scherl EJ, Schwartz RM, Kosinski L, Regueiro MD (2015) Ulcerative colitis care pathway. Gastroenterology 149(1):238–245
12. Dassopoulos T, Sultan S, Falck-Ytter YT et al (2013) American Gastroenterological Association Institute technical review on the use of thiopurines, methotrexate, and anti-TNF alpha biologic drugs for the induction and maintenance of remission in inflammatory Crohn's disease. Gastroenterology 145(6):1464–1478
13. Dignass A, Eliakim R, Magro F, Maaser C, Chowers Y, Geboes K, Mantzaris G, Reinisch W, Colombel JF, Vermeire S, Travis S, Lindsay JO, van Assche G (2012) Second European evidence-based consensus on the diagnosis and management of ulcerative colitis part 1: definitions and diagnosis. J Crohns Colitis 6:965–990
14. Dignass A, Lindsay JO, Sturm A, Windsor A, Colombel JF, Allez M, D'Haens G, D'Hoore A, Mantzaris G, Novacek G, Öresland T, Reinisch W, Sans M, Stange E, Vermeire S, Travis S, van Assche G (2012) Second European evidence-based consensus on the diagnosis and management of ulcerative colitis part 2: current management. J Crohns Colitis 6:991–1030
15. Van Asche G, Dignass A, Panes J et al (2010) The second European evidence-based consensus on the diagnosis and management of Crohn's disease: definitions and diagnosis. J Crohns Colitis 4:7–27
16. Dignass A, Van Asche G, Lindsay JO et al (2010) The second European evidence-based consensus on the diagnosis and management of Crohn's disease: current management. J Crohns Colitis 4:28–62

17. Drossman DA, Camilleri M, Mayer EA, Whitehead WE (2002) AGA technical review on irritable bowel syndrome. Gastroenterology 123(6):2108–2131

18. Kahrilas PJ, Shaheen NJ, Vaezi MFAGA (2008) Institute technical review on the management of gastroesophageal reflux disease. Gastroenterology 135(4):1392–1413

19. The Economist Intelligence Unit. www.vbhcglobalassessment.eiu.com

20. Berger J, Mohr J (1967) A fortunate man: the story of a country doctor. Edinburgh, Canongate

21. Shaukat A, Oancea C, Bond JH, Church TR, Allen JI (2009) Variation in detection of adenomas and polyps by colonoscopy and change over time with a performance improvement program. Clin Gastroenterol Hepatol 7:1335–1340

22. Shaukat A, Rector TS, Church TR, Lederle FA, Kim AS, Rank JM, Allen JI (2015) Longer withdrawal time is associated with a reduced incidence of interval cancer after screening colonoscopy. Gastroenterology 149:952–957

23. Howie JG, Porter AM, Heaney DJ, Hopton JL (1991) Long to short consultation ratio: a proxy measure of quality of care for general practice. Br J Gen Pract 41:48–54