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### Quality measurement and assessment in gastrointestinal endoscopy

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**Publication date**  
2022

[Link to publication](#)

#### **Citation for published version (APA):**

Nass, K. J. (2022). *Quality measurement and assessment in gastrointestinal endoscopy*.

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# CHAPTER 1

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GENERAL INTRODUCTION  
AND OUTLINE THESIS

## GENERAL INTRODUCTION

Colonoscopy is the reference standard for the detection of colorectal disease. It might be performed for various indications, such as symptoms, as a primary test or after triage by e.g. fecal immunochemical test (FIT) in a colorectal cancer (CRC) screening program, for surveillance, for the assessment of disease activity in inflammatory bowel disease (IBD) patients, or to perform a therapeutic intervention. Colonoscopy provides an opportunity to detect and remove precursor lesions of CRC: adenomas and serrated lesions. Colonoscopy with polypectomy reduces mortality from CRC [1-3]. However, colonoscopy is not perfect and does not fully protect individuals from developing CRC in the future [3-5]. Some individuals are diagnosed with CRC after recent colonoscopy and before the next recommended surveillance colonoscopy. These CRCs are called post-colonoscopy CRCs (PCCRCs). The occurrence of PCCRCs is estimated between 6.1 - 9.1% of all CRCs [6-9]. The majority of PCCRCs are preventable, as lesions that were missed during colonoscopy seem to play an important role in the development of these CRCs [4]. This may be caused by an inadequate prior examination due to inadequate quality of bowel preparation, unsuccessful cecal intubation or insufficient skills of the endoscopist [10]. Inadequate withdrawal technique or inattention may lead to inadequate inspection and missed lesions during colonoscopy. The morphology of polyps may also play a role; miss rates for flat and sessile adenomas are higher than the miss rate for pedunculated adenomas [5]. Besides being missed, incomplete resection of lesions may also be the cause of PCCRC [10]. Therefore, optimization of colonoscopy procedures still deserves attention, and the rate of PCCRCs has been proposed as a performance measure for endoscopy services.

### Current performance measures in gastrointestinal endoscopy

The PCCRC rate reflects the outcome that matters most for patients undergoing diagnostic, screening and surveillance colonoscopies [10]. However, PCCRC rate is a less suitable measure for monitoring colonoscopy quality in daily practice. For an accurate assessment of PCCRC rates, a long follow-up period, large numbers of detected cancers, and an accurate cancer registration with the possibility of linkage to pathology and endoscopy data are required. Therefore, surrogate measures that are easier to capture are recommended to measure quality in daily endoscopy practice [11]. Of those, the adenoma detection rate (ADR) has been inversely associated with the risk of PCCRC [12,13]. The ADR is the percentage of colonoscopies in which at least one adenoma is identified [11]. Moreover, the cecal intubation rate and adequate bowel preparation rate are also clearly defined, well-validated and frequently reported performance measures for colonoscopy [11]. The cecal intubation rate reflects complete bowel examination, a prerequisite for a reliable inspection of the mucosa in search for lesions [11]. The

percentage of patients with an adequately prepared bowel, assessed with a validated scale, is assessed by the adequate bowel preparation rate [11]. Besides optimization of colonoscopy practice in terms of detection of (pre)malignant lesions, the risks and burden for patients need to be minimized. To assess colonoscopy-related harms for patients, the adverse event rate is used as a performance measure. However, its reported incidence differs widely in literature, which seems mainly the consequence of underreporting of adverse events and a lack of consensus on definitions [14,15]. Colonoscopy also plays an essential role in the care of patients with IBD. Colonoscopy aims to facilitate an accurate diagnosis, assess disease activity, monitor response to therapy, detect potential dysplastic lesions or perform therapeutic interventions (i.e. dilation of strictures) [16]. However, widely accepted and validated performance measures specifically relevant for colonoscopy in IBD patients are still lacking.

### Composite performance measures

Besides single performance measures, several composite performance measures have been proposed in the last decade [17,18]. Composite measures combine several components of high-quality colonoscopy, which might result in an "all-or-none measurement". All-or-none measures create a perspective on a chain of elements, instead of focusing on one element in a process. Therefore, all-or-none measures might provide a better and potentially more stable reflection of overall quality than a single outcome measure [19]. For single performance measures, more than 90% of compliance is often achieved, which leads to limited space for setting targets and observing progress and could temper the motivation for further improvement. When single performance measures are combined into one measure, there is likely more room for improvement, which will more likely incite quality improvement initiatives [19]. In the surgical field, "Textbook Outcome" has been proposed as a composite measure to describe the ideal outcome of surgery. It has proven to be a feasible and useful parameter in the surgical field for comparison of performance between hospitals [20-26].

### Principle of audit and feedback

Aiming to assess and improve performance in colonoscopy, established performance measures should be measured and evaluated in a structured way. The principle of audit and feedback is one of the strategies to optimize colonoscopy. In an audit and feedback process, performance is measured and then compared to professional standards or targets for those measures [27]. To address this first step in the audit and feedback cycle, clearly defined measures are essential. Feedback on the comparison of the performance with the standards or targets is given to the audited individual or hospital. This feedback might ultimately lead to improvement initiatives and encourage

compliance with professional standards. Clinical auditing has shown to improve clinical outcomes in several fields in healthcare [28,29]. In gastrointestinal endoscopy, feedback to the individual endoscopist is associated with improvements in performance measures, such as the ADR [30]. For the ADR, low and moderate performers seem the ones to benefit most from feedback [30].

Variation in the quality of colonoscopy is likely multifactorial and includes patient, endoscopist, equipment and system factors. To reliably compare performance between endoscopy services, adjustment for case-mix factors may be necessary. Case-mix factors are non-modifiable patient and endoscopy characteristics, and may influence the performance measures of an endoscopy center by a possible association between case-mix factors and clinical outcome [31,32].

### **Dutch Gastrointestinal Endoscopy Audit and Dutch Registration of Complications in Endoscopy**

Continuous monitoring of performance measures is a method to acquire up-to-date information on endoscopy performance. In the Netherlands, in 2016 two registries for continuous monitoring of performance measures were initiated: the Dutch Gastrointestinal Endoscopy Audit (DGEA) and the Dutch Registration of Complications in Endoscopy (DRCE). Both registries are facilitated by the Dutch Institute for Clinical Auditing (DICA). DICA was founded to facilitate and organize initiation of nationwide audits in a uniform format in the Netherlands [28]. The DGEA aims to assess the quality of all colonoscopies performed in our country. For all colonoscopies in participating endoscopy services, the data are automatically extracted from standardized endoscopy reports, causing no additional administrative burden [33]. All endoscopy services in the Netherlands were invited to participate in the DGEA voluntarily. Participation in the DGEA might become mandatory for national audit purposes in the future. The other registration, the DRCE, is a national web-based adverse event registry for all gastrointestinal endoscopies [34]. Participation in the DRCE is mandatory for all endoscopy services participating in the Dutch national CRC screening program. All adverse events occurring within 30 days after the procedure are manually recorded by endoscopists. Besides a limited set of patient and endoscopy characteristics, characteristics about the type and severity of the adverse event are recorded. Feedback on performance is provided to all participating endoscopy services in the DGEA and DRCE. This is facilitated by the development of interactive Codman dashboards, named after the founding father of clinical auditing: Ernest Amory Codman [28]. Besides feedback on performance measures, clinicians can select patient groups and compare their results with the national benchmark.

### **Aim of this thesis**

The aim of this thesis was to propose and evaluate performance measures and classifications in gastrointestinal endoscopy. Furthermore, we aimed to gain insight in the current quality of care in gastrointestinal endoscopy in the Netherlands.

## **OUTLINE OF THIS THESIS**

### **Part I – Performance measures and classifications in gastrointestinal endoscopy**

In **chapter two**, the achievement of an adequate Performance Indicator of Colonic Intubation (PICI) within the Dutch FIT-based CRC screening program was evaluated. A definition for a composite measure for the optimal process of a diagnostic colonoscopy: Textbook Process, was proposed in **chapter three**. Textbook Process includes multiple desirable components that, when achieved all, represent the ideal process of diagnostic colonoscopy. In this chapter, the achievement of Textbook Process was assessed in two endoscopy services, together with the variation among separate endoscopists.

**Chapter four** describes the proposal and validation of a novel classification for Adverse events in Gastrointestinal Endoscopy (AGREE). This novel classification aims to compare the performance between different endoscopy services, countries, and potentially between disciplines, such as gastrointestinal endoscopy and surgery or interventional radiology.

Current performance measures for colonoscopy are mainly applicable for screening, surveillance or diagnostic colonoscopies. In **chapter five**, the European Society of Gastrointestinal Endoscopy (ESGE) presents a shortlist of performance measures for colonoscopy in IBD patients.

### **Part II – Evaluation of colonoscopy performance in the Netherlands**

**Chapter six** describes the feasibility of linking the DGEA and the DRCE at the level of the endoscopy service. Furthermore, the quality of colonoscopy within this large Dutch colonoscopy cohort was evaluated per indication by assessing the cecal intubation rate, the rate of adequate bowel preparation and adverse event rates. In **chapter seven**, the variation in case-mix factors between endoscopy services was explored with data from the DGEA. Furthermore, the importance of case-mix adjustment when comparing colonoscopy performance between endoscopy services was assessed.

## ABBREVIATIONS

ADR, Adenoma detection rate; AGREE, Adverse events in gastrointestinal endoscopy; CRC, colorectal cancer; DGEA, Dutch Gastrointestinal Endoscopy Audit; DICA, Dutch Institute for Clinical Auditing; DRCE, Dutch Registration for Complications in Endoscopy; ESGE, European Society of Gastrointestinal Endoscopy; FIT, fecal immunochemical test; IBD, inflammatory bowel disease; PCCRC, Post-colonoscopy colorectal cancer; PICI, Performance indicator for colonic intubation

## REFERENCES

1. Brenner H, Chang-Claude J, Jansen L et al. Reduced risk of colorectal cancer up to 10 years after screening, surveillance, or diagnostic colonoscopy. *Gastroenterology*. 2014;146(3):709-17.
2. Brenner H, Chang-Claude J, Seiler CM et al. Protection from colorectal cancer after colonoscopy: a population-based, case-control study. *Ann Intern Med*. 2011;154(1):22-30.
3. Zauber AG, Winawer SJ, O'Brien MJ et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med*. 2012;366(8):687-96.
4. le Clercq CM, Bouwens MW, Rondagh EJ et al. Postcolonoscopy colorectal cancers are preventable: a population-based study. *Gut*. 2014;63(6):957-63.
5. Zhao S, Wang S, Pan P et al. Magnitude, Risk Factors, and Factors Associated With Adenoma Miss Rate of Tandem Colonoscopy: A Systematic Review and Meta-analysis. *Gastroenterology*. 2019;156(6):1661-74.e11.
6. Beaton D, Beintaris I, Rutter MD. Utilization and reproducibility of World Endoscopy Organization post-colonoscopy colorectal cancer algorithms: retrospective analysis. *Endoscopy*. 2022;54(3):270-7.
7. Burr NE, Derbyshire E, Taylor J et al. Variation in post-colonoscopy colorectal cancer across colonoscopy providers in English National Health Service: population based cohort study. *BMJ*. 2019;367:l6090.
8. Forsberg A, Widman L, Bottai M et al. Postcolonoscopy Colorectal Cancer in Sweden From 2003 to 2012: Survival, Tumor Characteristics, and Risk Factors. *Clin Gastroenterol Hepatol*. 2020;18(12):2724-33 e3.
9. Morris EJ, Rutter MD, Finan PJ et al. Post-colonoscopy colorectal cancer (PCCRC) rates vary considerably depending on the method used to calculate them: a retrospective observational population-based study of PCCRC in the English National Health Service. *Gut*. 2015;64(8):1248-56.
10. Rutter MD, Beintaris I, Valori R et al. World Endoscopy Organization Consensus Statements on Post-Colonoscopy and Post-Imaging Colorectal Cancer. *Gastroenterology*. 2018;155(3):909-25.e3.
11. Kaminski MF, Thomas-Gibson S, Bugajski M et al. Performance measures for lower gastrointestinal endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. *Endoscopy*. 2017;49(4):378-97.
12. Corley DA, Jensen CD, Marks AR et al. Adenoma detection rate and risk of colorectal cancer and death. *N Engl J Med*. 2014;370(14):1298-306.
13. Kaminski MF, Regula J, Kraszewska E et al. Quality indicators for colonoscopy and the risk of interval cancer. *N Engl J Med*. 2010;362(19):1795-803.
14. Kim SY, Kim HS, Park HJ. Adverse events related to colonoscopy: Global trends and future challenges. *World J Gastroenterol*. 2019;25(2):190-204.
15. Reumkens A, Rondagh EJ, Bakker CM et al. Post-Colonoscopy Complications: A Systematic Review, Time Trends, and Meta-Analysis of Population-Based Studies. *Am J Gastroenterol*. 2016;111(8):1092-101.

16. American Society for Gastrointestinal Endoscopy Standards of Practice C, Shergill AK, Lightdale JR et al. The role of endoscopy in inflammatory bowel disease. *Gastrointest Endosc.* 2015;81(5):1101-21 e1-13.
17. Salet N, Bremmer RH, Verhagen M et al. Is Textbook Outcome a valuable composite measure for short-term outcomes of gastrointestinal treatments in the Netherlands using hospital information system data? A retrospective cohort study. *BMJ Open.* 2018;8(2):e019405.
18. Valori RM, Damery S, Gavin DR et al. A new composite measure of colonoscopy: the Performance Indicator of Colonic Intubation (PICI). *Endoscopy.* 2018;50(1):40-51.
19. Nolan T, Berwick DM. All-or-none measurement raises the bar on performance. *JAMA.* 2006;295(10):1168-70.
20. Karthaus EG, Lijftogt N, Busweiler LAD et al. Textbook Outcome: A Composite Measure for Quality of Elective Aneurysm Surgery. *Ann Surg.* 2017;266(5):898-904.
21. Kolfshoten NE, Kievit J, Gooiker GA et al. Focusing on desired outcomes of care after colon cancer resections; hospital variations in 'textbook outcome'. *Eur J Surg Oncol.* 2013;39(2):156-63.
22. Kuhrij LS, Karthaus EG, Vahl AC et al. A Composite Measure for Quality of Care in Patients with Symptomatic Carotid Stenosis Using Textbook Outcome. *Eur J Vasc Endovasc Surg.* 2020;60(4):502-8.
23. Merath K, Chen Q, Bagante F et al. A Multi-institutional International Analysis of Textbook Outcomes Among Patients Undergoing Curative-Intent Resection of Intrahepatic Cholangiocarcinoma. *JAMA Surg.* 2019;154(6):e190571.
24. Poelmeijer YQM, Marang-van de Mheen PJ, Wouters M et al. Textbook Outcome: an Ordered Composite Measure for Quality of Bariatric Surgery. *Obes Surg.* 2019;29(4):1287-94.
25. Ten Berge MG, Beck N, Steup WH et al. Textbook outcome as a composite outcome measure in non-small-cell lung cancer surgery. *Eur J Cardiothorac Surg.* 2021;59(1):92-9.
26. van Roessel S, Mackay TM, van Dieren S et al. Textbook Outcome: Nationwide Analysis of a Novel Quality Measure in Pancreatic Surgery. *Ann Surg.* 2019.
27. Ivers N, Jamtvedt G, Flottorp S et al. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev.* 2012(6):Cd000259.
28. Beck N, van Bommel AC, Eddes EH et al. The Dutch Institute for Clinical Auditing: Achieving Codman's Dream on a Nationwide Basis. *Ann Surg.* 2020;271(4):627-31.
29. de Neree tot Babberich MPM, Detering R, Dekker JWT et al. Achievements in colorectal cancer care during 8 years of auditing in The Netherlands. *European Journal of Surgical Oncology.* 2018;44(9):1361-70.
30. Bishay K, Causada-Calo N, Scaffidi MA et al. Associations between endoscopist feedback and improvements in colonoscopy quality indicators: a systematic review and meta-analysis. *Gastrointest Endosc.* 2020;92(5):1030-40.e9.
31. Elfrink AKE, van Zwet EW, Swijnenburg RJ et al. Case-mix adjustment to compare nationwide hospital performances after resection of colorectal liver metastases. *Eur J Surg Oncol.* 2021;47(3 Pt B):649-59.

32. Kolfshoten NE, Marang van de Mheen PJ, Gooiker GA et al. Variation in case-mix between hospitals treating colorectal cancer patients in the Netherlands. *Eur J Surg Oncol.* 2011;37(11):956-63.
33. de Neree Tot Babberich MPM, Ledebuer M, van Leerdam ME et al. Dutch Gastrointestinal Endoscopy Audit: automated extraction of colonoscopy data for quality assessment and improvement. *Gastrointest Endosc.* 2020;92(1):154-62 e1.
34. Nass KJ, van der Schaar PJ, van der Vlugt M et al. Continuous monitoring of colonoscopy performance in the Netherlands: first results of a nationwide registry. *Endoscopy.* 2021.