Using Audit and Feedback to Improve Colonic Polyp Detection, Qualitative Studies within the National Endoscopy Database Automated Performance Reports to Improve Quality Outcomes Trial (NED APRIQOT).

Dr Jamie Catlow

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Abstract

Colorectal cancer (CRC) arises from polyps, and polyp detection and resection at colonoscopy is pivotal in preventing CRC. Colonoscopists with a low polyp detection rate have a higher rate of CRC after colonoscopy. The National Endoscopy Database Automated Performance Reports to Improve Quality Outcomes Trial (NED-APRIQOT) is a randomised cluster control trial of electronic audit and feedback (A&F) in English endoscopy centres. This MD aimed to (1) assess the acceptability of colonoscopy key performance indicators (KPIs); (2) develop an evidence-based and theoretically informed behaviour change intervention (BCI), an A&F endoscopist performance report, for implementation in the trial; and (3) explore pre-trial experiences of endoscopy A&F.

A narrative review of A&F and KPIs in the colonoscopy literature was undertaken. This informed selection of KPIs for a Delphi consensus, to determine the clinical acceptability of KPIs available through the NED. A panel of UK experts in colonoscopy, reflecting the varied professional backgrounds performing endoscopy, undertook three rounds rating statements and provided free-text comments. A case-mix adjusted mean number of polyps (MNP) was chosen for the trial.

An A&F behavioural theory review informed the design of a draft BCI. Interviews were undertaken with 19 endoscopists from six English NHS endoscopy centres, purposively sampled for clinical background and professional experience. The BCI was iteratively refined through rounds of cognitive interviews in which participants interacted with and 'talked aloud' about the BCI. The finalised BCI was implemented in the NED-APRIQOT.

These participants also undertook semi-structured interviews exploring current colonoscopy A&F practices. A framework thematic analysis mapped themes to Feedback Intervention Theory (FIT) and the Theory of Planned Behaviour. A FIT-based model described A&F's intended and paradoxical effects on endoscopist behaviour. Detection and patient safety were dependent on coaching, team behaviours and unit-leads managing underperformance. Future endoscopy A&F interventions should consider targeting behaviours using theoretical models.

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Finally, I dedicate this to my husband, Owain. Words (apart from the following five chapters) fail me, thank you.

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Presentations and publications

Below is a list of presentations and publications outputs from this MD work.

Papers

Catlow J, Sharp L, Kasim A, Lu L, Brookes M, Lee T, et al. The National Endoscopy Database (NED) Automated Performance Reports to Improve Quality Outcomes Trial (APRIQOT) randomized controlled trial design. Endosc Int Open [Internet]. Georg Thieme Verlag KG; 2020 [cited 2020 Dec 23];08:E1545–52.

Pre-print paper

Catlow J, Bhardwaj-Gosling R, Sharp L, Rutter MD, Sniehotta F. Using a dark logic model to explore adverse effects in audit and feedback: a qualitative study of gaming in colonoscopy 2021. https://doi.org/10.21203/rs.3.rs-353206/v1. –awaiting decision after reviewers' comments with BMJ Quality and Safety

National oral presentations

Catlow J, Sharp L, Rogers P, Sniehotta F, Bhardwaj-Gosling R, et al. P18 Developing a theory informed behaviour change intervention to improve colonic polyp detection. Gut [Internet]. BMJ; 2021 [cited 2021 Feb 26]. p. A50.2-A51.

Poster presentations

Catlow J, Sharp L, Rutter M. ACCEPTABILITY OF KEY PERFORMANCE INDICATORS (KPI) IN THE NATIONAL ENDOSCOPY DATABASE (NED) AUTOMATED PERFORMANCE REPORTS TO IMPROVE QUALITY OUTCOMES TRIAL (APRIQOT), A DELPHI PROCESS. ESGE Days [Internet]; 2020 [cited 2020 Jun 11]. p. ePP228.

Catlow J, Sharp L, Rutter M. P16 Acceptability of key performance indicators (KPI) in the national endoscopy database (NED), a Delphi process. Gut [Internet]. BMJ; 2021 [cited 2021 Feb 26]. p. A49.2-A50.

Regional and local oral presentations

Catlow, J. Qualitative work and behaviour change intervention. NED-APRIQOT Trialists National Meeting, May 2019.

Catlow, J. Using the National Endoscopy Database to evaluate endoscopy performance and reduce unwarranted variation in quality. Implementation Science Subtheme Meeting, Newcastle University, March 2019.

Catlow, J. How to reduce unwarranted variation in colonoscopy quality. Introducing NED-APRIQOT. Northern Region Endoscopy Group (NREG), October 2018

Chapter 1 An Introduction to Colonoscopy and Quality Improvement in Endoscopy

Colorectal cancer (CRC) is diagnosed in half a million people each year in Europe, and is the fourth most common cancer in the UK.[1,2] CRCs arise from polyps, and polyp detection and resection at colonoscopy is pivotal in preventing CRC. The diagnosis of CRC between six and 36 months after a cancer-negative colonoscopy is called post-colonoscopy colorectal cancer (PCCRC). The patients of colonoscopists who detect fewer polyps have higher rates of PCCRC incidence and mortality, therefore people die from unwarranted variation in colonoscopy quality.[3–5] This thesis explores audit and feedback (A&F) in colonoscopy and interventions attempting to reduce this unwarranted variation in colonoscopy quality.

This chapter describes current UK colonoscopy practice and the organisations involved in UK endoscopy quality improvement. This includes how this work is nested within the National Endoscopy Database Automated Performance Reports to Improve Quality Outcomes Trial (NED-APRIQOT), a randomised cluster control trial of electronic audit and feedback (A&F) across English endoscopy centres.[6] Detection key performance indicators (KPIs) used in colonoscopy and considered in the NED-APRIQOT are reviewed. Finally, healthcare A&F current practices are narratively reviewed including theories of behaviour change used in, and applicable to, colonoscopy quality.

After, this thesis aims to (1) assess the acceptability of key performance indicators (KPI) for colonoscopy; (2) develop an evidence based and theoretically informed behaviour change intervention (BCI), an A&F report on endoscopist performance, for implementation in the trial; and (3) explore current (pre-trial) views and experiences of A&F in endoscopy.

1.1 Current UK colonoscopy practice

1.1.1 Colonoscopy and colorectal cancer prevention

Colonoscopy is a medical procedure that involves an endoscopist inserting a camera into the large bowel (intubation) then withdrawing the camera and inspecting for pathology (withdrawal), beforehand the bowel is cleansed (bowel preparation) to allow visualisation.[7] In the United Kingdom (UK) 99.6% of colonoscopy is performed without

general anaesthetic, using conscious sedation, nitrous oxide or no pre-medication.[8] During a colonoscopy procedure in the UK there are usually at least three members of staff in the endoscopy room:

- an endoscopist performing the procedure of intubation and withdrawal,

- an endoscopy nurse attending to the needs of the patient and monitoring clinical observations, effects of sedation and comfort and

- an endoscopy nurse or technician assisting the endoscopist with equipment.[9]

Patient comfort is currently assessed using a nurse-reported comfort level, verbally provided by the endoscopy nurse and documented by the endoscopist. Patient comfort is documented as an ordinal score from 1 (no discomfort) to 5 (severe discomfort).[10,11]

The location of pathology in the colon can be grossly divided into proximal (right) and distal (left) to the splenic flexure (Figure 1.1), as polyps and colorectal cancers (CRCs) that arise from the proximal colon have different clinical, pathological, molecular and genetic features to their distal counterparts.[12]

Colorectal cancers (CRCs) arise from polyps through a variety of pathogenic pathways, including the traditional adenoma pathway and the serrated pathway.[13] Detection and resection of pre-malignant polyps at colonoscopy has been demonstrated to prevent death from colorectal cancer.[14] However, detecting polyps is a complex behaviour, and consecutive colonoscopy studies demonstrate an adenoma miss rate (AMR) of around 25%.[15] This miss rate may be higher for pre-malignant serrated polyps; these are more prevalent in the proximal colon and their endoscopic appearance can be subtle, being flatter, paler and with an indistinct border; potentially resembling 'normal' colonic folds.[13] This is supported by epidemiological studies showing proximal CRCs are overrepresented in patients with PCCRC.[4]
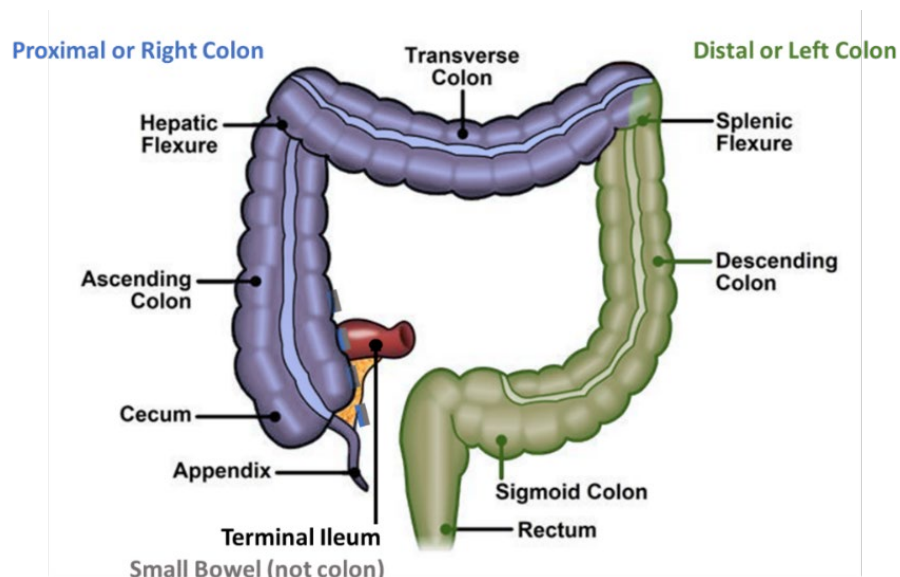
Figure.1.1 Diagrammatic representation of colon anatomy

1.1.2 The Joint Advisory Groups for gastrointestinal endoscopy (JAG) and Bowel Cancer Screening Programme

Over the last 25 years the UK government has funded, and supported implementation of, a quality improvement programme overseen by the Joint Advisory Group for gastrointestinal endoscopy (JAG), a branch of the Royal College of Physicians.

The JAG has established roles in UK endoscopy training, accreditation of endoscopy services and endoscopists.[16] Through service accreditation the JAG provides independent and impartial recognition that endoscopy services demonstrate high levels of quality.[16] In England and Wales 228 of 433 National Health Service (NHS) and independent sector endoscopy services are JAG accredited.[17] Endoscopy centres seeking accreditation are graded against a Global Rating Scale (GRS) through site-visit evaluation and providing substantiating evidence. Centres must demonstrate competence to deliver endoscopy services against domains of clinical quality, patient experience, workforce and training.[9,18]

The JAG provides training and certification for all endoscopists to perform colonoscopy independently, and has developed an online logbook of procedures, standardised procedure assessments and formal certification requirements. The JAG has developed focused courses including a colonoscopy basic skills course required for colonoscopy certification and a train the colonoscopy trainer (TCT) courses required for endoscopists to train others.[16] At the time of writing courses are provided in small groups in person by regional training centres.

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The English NHS Bowel Cancer Screening Programme (BCSP) began in 2006 with the aim to improve CRC outcomes and mortality. The English BCSP offers all adults aged between 60 and 74 faecal blood testing biennially and invites those with a positive result for a screening colonoscopy.[19] All BCSP endoscopy is undertaken in JAG-accredited screening centres. The JAG provides further accreditation for endoscopists undertaking BCSP work, with assessments including a written examination, observed colonoscopy procedures and observed polypectomies.[19] BCSP endoscopists are reported to have higher quality colonoscopy regarding caecal intubation rate and detection KPIs compared to non-BCSP accredited endoscopists.[16,20] From 2013 to 2020 NHS England offered Bowel Scope Screening (BoSS), one-off flexible sigmoidoscopy screening to all individuals aged 55 years. BoSS endoscopist accreditation involved a similar process, however focussed only on the distal colon.[21]

1.1.3 UK colonoscopy A&F standards prior to the NED-APRIQOT

The JAG, the British Society of Gastroenterology (BSG) and the Association of Coloproctology of Great Britain and Ireland commissioned a working group in 2013 to define quality assurance measures and KPIs in colonoscopy.[11] Further guidance recommended by the JAG and the BSG has been published regarding the management of endoscopist underperformance in relation to these KPIs.[22] These guidelines and recommendations define A&F endoscopy practice in the UK prior to the NED-APRIQOT project, and are described and have been mapped to Colquhoun et al's 17 modifiable design elements to A&F interventions in Appendix A Table A1.[23]

The working group guidelines recommend colonoscopy KPIs with 'standard' and 'aspirational' targets. These are based on process and patient outcomes (Table 1.1). JAG recommends these outcomes are available in departments, and clinical leads should give all endoscopists "*feedback on their procedure KPIs*" at least twice a year.[9] Similarly, individual endoscopists should be given feedback on patient outcomes (Table 1.1) at least once a year. Prior to NED these were collated through local ERSs and sent out by clinical leads to endoscopists, anecdotally this is usually done by email.

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Colonoscopy KPI	Target
Six monthly process outcomes	
Caecal intubation rate	Standard 90% Aspirational 95%
Adenoma detection rate (ADR) in general population	Standard 15% Aspirational 20%
Bowel preparation sufficient not to warrant repeat test	Standard 90% Aspirational 95%
Rectal retroversion rate	Standard 90%
Colonoscopy withdrawal time	Standard mean ≥6mins Aspirational mean ≥10mins
Sedation level	Patients <70 years median total doses: ≤ 50mg Pethidine, ≤100mcg Fentanyl, ≤ 5mg Midazolam. Patients ≥70 years median total doses: ≤ 25mg Pethidine, ≤50mcg Fentanyl, ≤ 2mg Midazolam.
Number of colonoscopies undertaken per year	Standard 100 per annum Aspirational 150 per annum
Polyp retrieval rate	Standard >90%
Tattooing all lesions ≥2cm/cancers outside rectum and caecum	Standard 100%
Annual patient outcome	
All post colonoscopy colorectal cancers (PCCRC)	No target
Patient comfort level	Standard <10% moderate or severe discomfort
Colonoscopy perforation rate	Overall: standard <1/1000, aspirational <1/3000 Diagnostic: standard <1/2000, aspirational <1/4000 Polypectomy performed: standard <1/500, aspirational <1/1500
Post polypectomy bleeding rate of intermediate severity or higher	Standard <1/200 Aspirational <1/1000

Table 1.1 Summary of endoscopy working group recommended colonoscopy key performance indicators (KPI) and targets[11]

1.1.4 The National Endoscopy Database and the NED-APRIQOT

International studies show a significant variation in quality markers of colonoscopy between endoscopists including polyp detection.[24,25] In the UK previously assessing national endoscopy quality was dependent on local data collection by hand, which limited the size and scope of previous national audits of colonoscopy quality.[8,26] Similarly small local ad-hoc audits and larger scale audits using BCSP data have been published,[27,28] however these varied in their data collection methods and did not represent wider colonoscopy practice.

The UK is the first country to develop a National Endoscopy Database (NED), a novel registry that captures patient-level data automatically and from each hospital's endoscopy reporting system (ERS) at the time of the procedure[29]. Since the NED project commenced in 2013, the NED has enrolled over 400 UK endoscopy centres. The data-field types captured from ERSs are summarised in Appendix A Table A2, these exclude histological data, but include:

- Identifiable endoscopist data: endoscopist name, date and time of the procedure,

- Non-identifiable patient data: age and sex,

- Procedural data: indication, the number of polyps detected, details of any polypectomies performed and location of polypectomies in the bowel.

For the first time the NED allows assessment of polyp detection KPI and variation in KPI nationally and in real-time. The NED-APRIQOT project is an English multi-centre cluster-controlled trial aiming to improve colonoscopy quality through an automated A&F processes using the NED.[6] The study sought to develop an electronic A&F behaviour change intervention (BCI) with the primary objective of improving polyp detection KPIs at the endoscopist and endoscopy centre level. This MD project was conducted alongside NED-APRIQOT.

1.1.5 Developments in endoscopy A&F since NED-APRIQOT

Since the commencement of the NED-APRIQOT project and undertaking the described fieldwork, UK endoscopy A&F practice has had two major developments.

Firstly, the BSG and JAG published a framework for the management of underperformance, utilising self-efficacy theory and using an attribution model to explore causality of

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underperformance.[30] This describes a step-wise approach for verifying underperforming using KPI and the NED, identifying causative factors, providing support and reassessing through governance and appraisal processes.

Secondly, a subgroup of the BSG, the endoscopy committee, identified a gap in endoscopy quality between BCSP and wider UK endoscopy services, and established the Endoscopy Quality Improvement Programme (EQIP), focussed on reducing variation in endoscopy quality.[31] This aims to improve the evidence base for quality KPI and associated behaviours, and provide support for managing performance through training, promoting mentorship and implementation of evidence-based bundles. This is being developed at the regional level by local EQIP leads, and at a national level though developing performance management within JAG accreditation criteria and further implementing the NED for A&F data provision.

The remainder of this chapter is organised as follows:

- A narrative review of KPIs in colonoscopy follows; this informed the first piece of work in the MD, a Delphi process exploring which KPIs are acceptable to endoscopists. This work was intended to inform the selection of a KPI which would form the outcome measure for the NED-APRIQOT.
- A narrative review of A&F theories followed by their application to colonoscopy and the colonoscopy A&F literature is then described; this provides a foundation for the second element of the MD, the design and development (though rounds of cognitive interviews with endoscopy staff) of the A&F BCI which would be tested within NED-APRIQOT. These behavioural theories were also used to create a logic-model for current A&F practices in endoscopy explored in semi-structured qualitative interviews in the final piece of work, used to guide implementation and evaluate the BCI's effectiveness in the trial.

1.2 Narrative literature review of key performance indicators in endoscopy.

As part of the NED-APRIQOT project, it was necessary to select a polyp detection KPI, that could be calculated using NED data, and which would form the outcome for the trial. The

European Society for Gastroenterology (ESGE) assess endoscopy KPIs against four major criteria of: importance, scientific acceptability, feasibility and usability (see Appendix A Box A1).[32] Below the main potential detection KPIs are described, and their strengths and limitations are narratively reviewed.

1.2.1 Adenoma detection rate

Adenoma detection rate (ADR), the percentage of procedures in which at least one adenoma is detected, is the current gold standard KPI for polyp detection in the UK and Europe.[11,33] Most colorectal cancers arise from adenomatous polyps and their removal prevents colorectal cancer.[13,14] Studies have assessed ADR and interval cancers, defined as colorectal adenocarcinoma diagnosed between the time of screening colonoscopy and scheduled time of surveillance. Corley et al demonstrated an inverse association between endoscopist ADR and the risks of interval cancers. The hazard ratio for interval cancers in patients of endoscopists with the highest quintile ADR versus the lowest quintile was 0.52 (95% confidence interval (CI) 0.39-0.69).[3] Kaminski et al similarly demonstrated that ADR is an independent predictor of the risk of interval cancers in screening colonoscopy,[5] and that improving ADR lowered the risk of interval cancer (hazard ratio 0.63, 95% CI 0.45-0.88).[34]

ADR is scientifically acceptable as it is a clearly defined and validated KPI.[33] However, ADR has three major limitations. Firstly, ADR has significant variation with patient factors such as age, gender and procedure indication.[35] Secondly, ADR is a binary measure at the procedure level which incentivises detecting at least one polyp but not necessarily all polyps in the colon, risking a 'one-and-done' phenomenon.[36] Finally, ADR does not include significant non-adenomatous polyps, particularly serrated polyps, thought to account for between 15% and 30% of colorectal cancers.[13,37] It is hypothesised that histopathological assessment may become less relevant as endoscopists move towards 'optical diagnosis', where the endoscopist uses higher definition and magnified colonoscopes to determine the polyp type from its macroscopic appearance.[38] The main feasibility limitation of ADR is its dependence on a link to a pathological dataset; pathology is not recorded on NED.

In the UK ADR has clear targets of a minimum detection rate of 15% and an aspirational detection rate of 20% across all procedure and irrespective of case-mix.[11] The ESGE

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recommends a higher minimum standard of 25% but only across outpatient and screening colonoscopies in patients over 50 years,[33] and the ASGE recommends targets of 25% overall, 30% in males and 20% in females across colonoscopy in asymptomatic average risk individuals at screening.[39]

1.2.2 Polyp detection rate

Polyp detection rate (PDR), the percentage of procedures in which at least one polyp is detected, is an accepted surrogate for ADR in UK and European guidance, when a ratio between an endoscopist's PDR and ADR has been developed or there is limited access to histopathology.[11,33] PDR and ADR correlate with coefficients of 0.83 and 0.85 in large English and French screening cohorts respectively,[40,41] however the correlation is weaker in the distal colon and may relate to detection of diminutive hyperplastic polyps in the rectum and sigmoid.[42] Retrospective work involving 124,000 screening procedures and 154 interval cancers identified that screening endoscopists in the highest two quintiles of PDR had lower odds of their patients developing interval cancer than endoscopists in the lowest PDR quintile.[43]

PDR is described in screening and general colonoscopy cohorts, however has a wider standard deviation and range than ADR.[42,44] PDR is more convenient to calculate using endoscopy report data alone and is available through the NED.[29] The ESGE hypothesise the inclusion of non-neoplastic polyps in PDR risks 'gaming', with quality improvement programmes pressurising endoscopists to detect and remove these non-neoplastic polyps.[33] The ESGE suggests a minimum standard for PDR of 40% across all procedures,[33] however as described in ADR literature, average PDR values differ in screening and symptomatic patient populations.[44,45]

1.2.3 Polypectomy rate

Polypectomy rate, the percentage of colonoscopies in which at least one polyp is removed, strongly correlates with ADR in general colonoscopy (corelation coefficient (r)=0.85, p<0.001)[46] and screening cohorts (r=0.91, p<0.0001), although correlation weakens in the distal colon.[47] Patients of endoscopists with a higher polypectomy rate (>30% versus <10%) have lower odds of developing a proximal PCCRC (odds ratio 0.61, 95% CI 0.42-

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0.89).[4] Work assessing the UK polyp surveillance guidelines demonstrates patients have a lower risk of colorectal cancer following polypectomy than the general population.[48]

Although there is a discrepancy between ADR and polypectomy rate in the distal colon,[49,50] polypectomy is potentially less gameable as it requires both detection and removal of the polyp and is more easily audited against ADR.[47]

Polypectomy data are available through NED, including polyp location.[29] UK and ESGE guidance does not recommend polypectomy rate and has no recommended minimum standards.[11,33] As described above endoscopists with a polypectomy rate >30% had reduced odds of PCCRC.[4] A polypectomy rate of 37% has been calculated to be equivalent to an ADR of 25% in a retrospective study of 60 endoscopists undertaking screening colonoscopies in the United States.[47]

1.2.4 Proximal polypectomy rate

Proximal polypectomy rate (PPR), the percentage of colonoscopies in which at least one polyp is removed proximal to the splenic flexure, correlates strongly with proximal ADR in a screening colonoscopy cohort (r=0.92, p<0.001).[49] As described above, in a Canadian study proximal CRCs were over represented in patients with PCCRC.[4] This finding was reproduced in a Korean screening setting with a larger proportion of interval cancers found in the proximal colon.[51] This may be explained by the potentially higher miss rate for pre-malignant serrated polyps which are more prevalent in the proximal colon.[13] Proximal serrated polyp detection rates do not correlate with ADR and only weakly correlate with proximal ADR (r=0.55, p<0.002).[52] A PPR incorporating such serrated lesions may add information to an overall detection KPI such as ADR, however would not provide any data on distal detection.

PPR is calculable through NED,[29] however is dependent on the endoscopist accurately identifying the splenic flexure. PPR is not described in current UK and ESGE guidance and there are no current recommended minimum standards.[11,33]

1.2.6 Mean adenomas per procedure

Mean adenomas per procedure (MAP), the total number of adenomas detected divided by the number of colonoscopies performed, correlated with ADR in large UK (r=0.85,

p<0.001)[27] and French (r=0.84, p<0.0001)[41] screening cohorts. Other data on MAP in the literature are limited. In a Dutch population-based cohort study of 1031 PCCRC patients, patients with multiple adenomas in one segment of colon did not have an increased risk of developing a PCCRC.[53] In small scale consecutive colonoscopy studies in Thailand and the United States MAP did not significantly correlate with AMR.[54,55]

There is limited literature for the use of MAP outside of the screening colonoscopy population potentially reducing its acceptability in symptomatic colonoscopy. MAP reduces the 'one-and-done' phenomenon, through promoting inspection of the whole colon.[41] MAP is dependent on histological data unavailable through the NED.[29] MAP is recommended for use in the English BCSP to monitor quality of detection, in conjunction with ADR, however a minimum standard is not recommended.[27] In the large French cohort of screening colonoscopies, a benchmark MAP of 80 polyps per 100 procedures was suggested as equivalent to an ADR of 35%.[41]

1.2.5 Mean number of polyps and mean polypectomy rate

Mean number of polyps (MNP), the total number of polyps detected divided by the number of colonoscopies performed, has been demonstrated to correlate strongly with ADR in an Iranian screening cohort (r=0.88, p<0.05),[56] and with MAP in a French screening cohort (r=0.9, p<0.0001).[41]

There is no clear descriptive data in the literature around the use of a mean polypectomy rate (MPR), the total number of polyps removed divided by the number of colonoscopies performed.

The limited descriptive literature for MNP and MPR in the general colonoscopy population reduces their scientific acceptability. Both are calculable through the NED data fields, and overcome the 'one-and-done' phenomenon. As with other polyp detection and polypectomy KPI it is likely that correlation with ADR and MAP will diverge in the distal colon.[47] MNP and MPR are not recommended in UK or European guidance and have no set minimum standards.[11,33]

1.2.6 Adenomas per positive participant and polyps per positive participant

Adenomas per positive participant (APP) is the number of adenomas detected in patients with at least one adenoma. APP was devised in a small consecutive colonoscopy study to improve prediction of AMR and reduce the 'one-and-done' phenomenon in conjunction with ADR; APP was demonstrated to inversely correlate with AMR (r=-0.99, p<0.01).[54] As APP excludes procedures not detecting any pathology it does not correlate with ADR, and is not recommended for use as a sole detection KPI.[57,58]

APP is dependent on histological data, which is unavailable through the NED. Recent assessment on APP in an Austrian screening programme did not recommend its use as a KPI.[57] There are no published recommended minimum targets for APP.

There is no published data regarding a polyps per positive participant (PPP) KPI, which would be calculable through NED. However, PPP would also exclude negative procedures.

1.3 A&F developments in clinical practice, current A&F colonoscopy trials and behavioural theories of change

1.3.1 A&F development in clinical practice

A&F is defined as a summary of performance data about aspects of clinical practice over a specific period (audit), provided to practitioners, teams, or organisations (feedback).[59,60] A&F is commonly used as a behaviour change intervention to improve healthcare quality across many settings.[61] A 2012 Cochrane Library review of healthcare professional A&F showed interventions with dichotomous measures of compliance with desired practice yielded modest and heterogeneous improvements in clinical performance (overall 4.3% increase in compliance, interquartile range 0.5% - 16%). An assessment of this variability suggested significant improvements in subgroups where feedback was provided: both verbally and in written format; from a supervisor or colleague; delivered at least monthly; with both an explicit measurable target and an action plan; with the intention to reduce a current behaviour; and where baseline performance was low.[62,63] A&F has been similarly tested and found heterogenous improvement in endoscopy, the endoscopy evidence base is critiqued using the following review of A&F literature in section 1.3.6 (page (pg.) 19).

The Cochrane review's subgroup analysis did not fully explain the high variance in A&F improvements.[63] To address this, international leaders in A&F and health professional behaviour change published best practice guidance for A&F interventions, including identifying A&F components, describing the nature of behaviour change required and setting targets, goals and an action plan.[62] Identifying these active and effective components in complex A&F interventions presents a challenge. The Behaviour Change Techniques Taxonomy (BCTT) is a hierarchical structure designed to systematically identify and categorise "active ingredients" of BCIs to improve clarity in designing and interpretating findings of trials of BCIs.[64] Trials in endoscopy A&F poorly describe their interventions in terms of specific components they contain, despite such tools being available since 2013 (see section 1.3.6, pg. 19).

The importance of applying relevant theory to improve A&F design and contribute to A&F literature was also highlighted in the Cochrane review.[62] In 2013 a systematic review of A&F interventions described explicit use of theory in A&F studies was rare, and the field required attention to understanding theoretical mechanisms of change to address this heterogeneity.[61] To facilitate implementation of theory, clinical publications recommended theory informed practical steps for design of electronic A&F interventions.[65] These included considering goals, actions, the frequency of feedback, providing individualised data, choosing comparators to reinforce behaviour change, the use of visual displays, and minimising cognitive load. Although useful clinical tools, the paper recognised changing behaviour remains a complex intervention, requiring theoretical models for considering the causal mechanisms of feedback.

1.3.2 Choice of mid-range theories

Recent work by Braun and Clarke [66] on thematic analysis in qualitative studies suggests A&F studies' theoretical paradigm, epistemological and ontological setting should be clear to theoretically inform analysis of empirical data and guide when to stop data collection. The grand overarching theoretical perspectives used in behaviour change are interpretivism and constructivism. Knowledge is generated through individuals' interaction with the environment in the course of experience; understanding motives and actions of individuals require attention to interpretation, social context and local circumstance.[67]

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Behaviour change theories derive and integrate theoretical insights from a number of social science disciplines, including psychology, sociology and organisation studies.[60] A recent editorial in Implementation Science called for a shift in focus to these 'mid-range theories'. A&F interventions and qualitative study are recommended to use mid-range theories to inform analysis of empirical data and develop "*programme*" or intervention theories and logic models for the nature of dynamic relationships between interventions, participants and the environment. These should broaden current mid-range theoretical models, and help identity differences and variations in the programme's context.[68]

1.3.3 Feedback intervention theory

Feedback intervention theory (FIT)[1], a psychological motivation theory, has tenets drawn from a wide range of motivational and cognitive theories, including control theory.[69,70] FIT can be applied to behaviours in colonoscopy and has previously been identified as an appropriate theory for the development of A&F interventions in endoscopy.[71] In the wider healthcare setting FIT has been used in the development of clinical BCIs in catheter associated urinary tract infections and improving primary care physician anti-hypertensive prescribing.[59] FIT covers key behaviour change concepts of capability (through task dominance), motivation, and opportunity (situation and personality variable) for behaviours.[72] A meta-analysis of A&F in various healthcare setting successfully applied FIT to explain variations in intervention effectiveness.[73]

A logic model of the tenets of FIT are shown in Figure 1.2. FIT describes goals in a hierarchy:

- High level 'meta-tasks' - around the implications on one's self identity, personal characteristics and guiding principles. Taking the example of an endoscopist performing colonoscopy, they could have the self-identity goal of being a good endoscopist and the guiding principle goal of doing no harm to their patients by finding polyps.

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[1] Now, I apologise that throughout this thesis 'FIT' has nothing to do with faecal immunochemical testing.

- 'Task-motivation' processes - these are focal tasks or behaviours to achieve higher goals. For example, the endoscopist might have the goal of turning the patient when withdrawing the colonoscope to get better views of the colon.

- Lower level 'task-learning' processes - these are controls of specific focal tasks, such as sensation and intensity control. For example, when turning the patient, the endoscopist will plan to gently grip and apply insertional pressure on the colonoscope to prevent falling back.
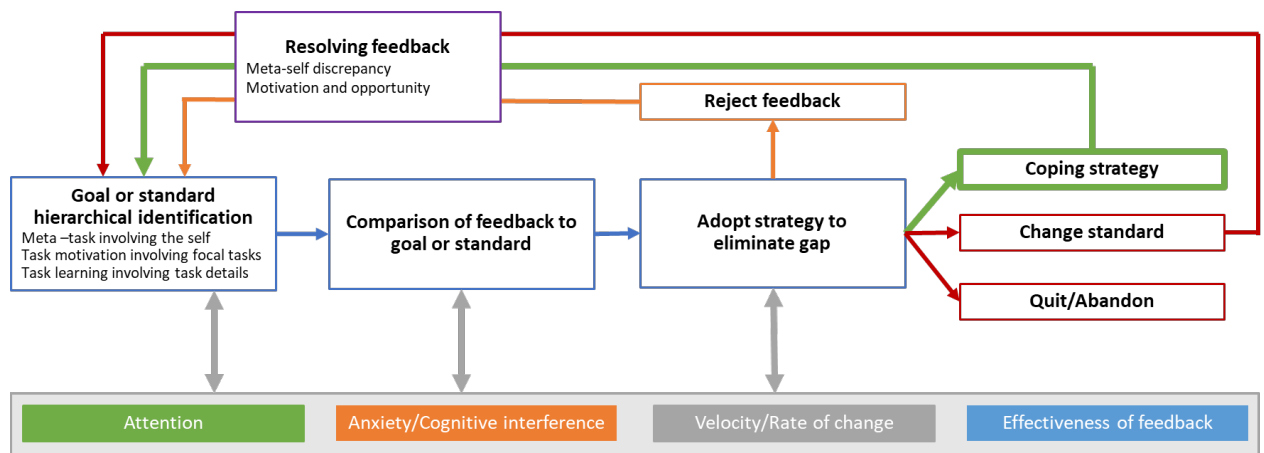
Figure 1.2: Feedback intervention theory (FIT) logic model for Audit and Feedback in endoscopy.
Legend: Blue demonstrates concepts from fit of identification of A&F. Adopting strategies to eliminate a gap in performance are divided into: rejecting the feedback gap (orange), changing the standard or quitting (red) and coping mechanisms to achieve the goals (green). Purple shows resolving the feedback and undertaking the task. The grey box shows task modifiers according to FIT: locus of attention (green), anxiety and cognitive interference (orange), the velocity or rate of change of improvement (grey) and the effectiveness of the intervention including cues, situation and personality variables (blue).

Task-learning processes are usually automatic behaviours away from the focus of attention, often bundled together to form a programme or script, and activated when a task-motivation process is started. High-level meta-tasks are also infrequently re-evaluated, as individuals rarely re-address their self-identity. FIT assumes most attention is directed at the task-motivation level of the hierarchy, and that feedback interventions change the locus of attention to a certain process, and therefore change behaviours.[69,70] The effectiveness of a feedback intervention may be dependent on: (a) the cues given to guide which standard will receive attention, (b) the nature of the task and it's susceptibility to attentional shifts,

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and (c) situation or personality variables determining how a recipient chooses to approach the standard brought to their attention.[69]

Kluger and DeNisi describe feedback characteristics which improved A&F effectiveness.[69] These included providing set goals, velocity information (the amount of change), correct solution information (how to improve performance) and delivering feedback via computer.[69,73] A meta-analysis assessed healthcare A&F interventions for these features, and identified that these features strengthened intervention effectiveness.[73]

FIT also allows exploration of the heterogeneity of effect of A&F interventions, through concepts of rejecting feedback gaps, quitting and cognitive interference from meta-tasks. Kluger and DeNisi describe discouragement, praise and verbally delivered feedback directed attention away from the focal task and decreased performance, and the Cochrane review confirmed feedback focussed on discouragement or praise reduced its effectiveness.[63,69] Interventions aimed at meta-tasks risk an attack on the self and an emotional response, this diminishes resources on the focal task, and interferes with performance.[69] Similar responses have been described when providing clinicians with negative feedback;[74] these include rejecting the feedback and emphasising a lack of credibility of the source, and ignoring feedback which was perceived as being intentionally maleficent. FIT's tenets provide a framework to map these responses.

1.3.4 The theory of planned behaviour

Clinical adoption of a behaviour is an individual's professional decision, and changes in intention partly predict behaviours; a meta-analysis of experimental behaviour change interventions lead to medium-to-large changes in intention and small-to-medium changes in behaviour.[75] Godin et al undertook a systemic review of studies assessing healthcare professionals' intentions, behaviours and their underlying social cognitive theories. This concluded using the Theory of Planned Behaviour (TPB) was moderately effective at predicting intention and behaviour[76].

The TPB can be used to explore beliefs around behaviours, describing:

- Behavioural beliefs – attitudes towards the behaviour and effects of the behaviour

- Control beliefs – the perceived control of the behaviour by participants

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- Normative beliefs – perceived social pressures around behaviours.[77]

The Cochrane review of A&F suggested that TPB is particularly useful to explore normative comparisons.[63] Anecdotally social norm comparisons are commonly used in colonoscopy A&F, comparing endoscopists to others in their centre. The Mindspace project reviewed social norms influencing behaviour at a societal level and offers insights.[78] Social norms which target an audience specifically may be more effective, as demonstrated in the hotel industry encouraging recycling of towels. The message "recycle your towels" was associated with a recycle rate of 35%, whereas the most specific message "most previous occupants of the room have reused towels at some point during their stay" was associated with a 49% recycle rate. Social norms may create undesirable norms and a regression to the mean, for example letters aiming to reduce energy usage sent to homes with below average consumption increased their usage. This effect was eliminated by an injunctive message, which conveyed social approval or disapproval using an emoticon.[79]

1.3.5 The theoretical domains framework

FIT and the TPB were selected to be the foundation of our model of A&F in endoscopy. Such psychological and social cognitive theories, although helpful in describing task-motivation and intention in healthcare, do not capture wider theoretical aspects. Considering theories from a broader range of relevant theoretical traditions may advance A&F interventions further. The theoretical domains framework (TDF) was developed by a collaboration of behavioural scientists and implementation science researchers to provide a comprehensive, theory informed approach to identity theoretical determinants of behaviour in influencing health professional behaviour. TDF version 1 is a synthesis of 33 theories of behaviour and behaviour change clustered into 12 domains; although there is a subsequent 14 domain version, this original validated version provides better coverage of influences on behaviour.[80,81]. This framework provides a guide to explore additional cognitive, affective, social, and environmental influences on behaviour that may not be fully explained in FIT and the TPB.

1.3.6 Critique of current recommendations for A&F in colonoscopy prior to NED-APRIQOT

UK endoscopy A&F guidance sets out a dichotomous minimum targets for KPIs; these are clear set goals from a credible organisation.[11] The Cochrane A&F review demonstrated

improvement in desired practice when presenting compliance as a dichotomous outcome,[63] suggesting such comparisons to a reasonable standard may be effective.[60] However, these recommendations have no *a priori* theorisation for the mechanism of changing behaviour or empirical qualitative study, which may increase the effectiveness of current A&F.[82]

Current UK guidance suggests providing endoscopists with multiple process and patient outcomes about a complex behaviour without recommending a behaviour change intervention or plan; multifaceted complex interventions are suggested to increase effectiveness of complex feedback.[63] The current use of several comparators may create mixed messages for recipients, allowing them to 'justify' poor performance in one area with good performance in another. The comparator's role is to reinforce a desired behaviour change, focussing attention on a feedback-standard gap, which unstructured multiple comparators may not achieve.[65]

UK guidance does not recommend providing educational information with KPIs or correct solution information for desired behaviours.[69] However, FIT and the Cochrane review demonstrate A&F with educational outreach and information on how target performance can be attained in a plan is more effective than feedback alone.[63,83]

Current UK guidance includes 6 monthly and annual feedback on care process and patient outcomes. There is expert consensus that using recent performance data to provide feedback is most effective.[62] More frequent A&F uses data from fewer procedures, potentially reducing the feedback's credibility and risking rejection of the feedback-standard gap.[69] This is a risk in the UK, as the Quality Improvement in Colonoscopy study in northern England described endoscopists performed a median of 30 colonoscopies per quarter, an average of 10 colonoscopies per month.[84] However, repeated cycles of feedback on smaller numbers of procedures may allow effective reflection on individual behaviours when planning behaviour change. As described in FIT, repeated feedback cycles have greater improvements in performance than once only feedback,[85] and feedback presented with the degree of change in performance observed is more effective.[83]

1.3.7 Current colonoscopy A&F trials

A recent systematic review [86] and narrative review [71] identified 19 A&F trials in colonoscopy since 2006. The trial design, A&F intervention and outcomes are summarised in Table 1.2. A meta-analysis using data from 12 of these trials demonstrated a modest pooled improvement in ADR from 30.5% to 36.0% with colonoscopy A&F interventions, with a pooled rate ratio of 1.21 (95% CI 1.09-1.34). However, as expected there was variability in effectiveness of A&F intervention across all studies, with 7 of the 19 trials not reporting a significant improvement in detection KPIs.

Most trial design was quasi-experimental, with 16 of the 19 trials using a single group with assessment before and after an A&F intervention. 16 of the 19 trials were undertaken in a single centre, and no trials documented including non-medical endoscopists who undertake a large proportion of endoscopies in the UK.[87] Descriptions of the intervention were poor; no studies considered behaviour change theory in the development of the A&F interventions and poorly described the behaviours that the interventions sought to change. Withdrawal time was provided in A&F intervention in six studies, only three trials showed significantly longer withdrawal times.[88–93] No other process outcomes associated with detection behaviours were used in interventions. Six studies provided further educational meetings as part of the intervention, these trials had similarly variable effectiveness with only three trials demonstrating improvement in detection KPIs.[91,94–98]

In summary, previous trials of A&F interventions in colonoscopy have been of poor quality, with no theory informed design and demonstrated modest improvement in detection KPIs.

In the UK, in a before and after study, the Quality Improvement in Colonoscopy study provided endoscopy centre level bundle of interventions, which targeted detection behaviours. This found significant increase in the targeted detection behaviour of hyoscine butylbromide (Buscopan) prescription (54.4% intervention vs. 15.8% control, P < 0.001), and modest improvements in ADR (18.1% intervention vs. 16.0% control, p=0.002). The study did not provide individual feedback to endoscopists and was therefore not included in the above reviews.[84]

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1.4 Content of thesis

The remainder of the thesis is organised as follows:

- Chapter 2 describes the Delphi process used to assess acceptability of various detection KPIs, before use in the NED-APRIQOT trial.
- Chapter 3 describes the theory informed design and development of a BCI through cognitive interviews and ethnographic exploration of endoscopy centres, and mapping of the BCI to the BCTT for use in the NED-APRIQOT.
- Chapter 4 describes semi-structured qualitative interviews and a thematic analysis to develop a FIT model to analyse and understand a thick description of the A&F processes in colonoscopy currently in England, including analysis of intended and potential adverse effects of future A&F interventions using a logic model.
- Chapter 5 summarises the overall findings of this thesis. The implications for future clinical research are considered in the fields of KPIs, development of behavioural theories, together with implications for future colonoscopy A&F interventions.

The development of the BCI and its analysis (Chapter 3) is presented before the wider analysis of A&F processes in colonoscopy (Chapter 4). Although the interviews were undertaken at the same time, and aspects of the findings from Chapter 4 were considered in the trial implementation, the analysis related to the BCI development was undertaken first (and, indeed, was ongoing during the interviews as the BCI development was iterative), in order to meet deadlines for trial planning and implementation. For that reason, it seemed logical to present the BCI analysis first in this thesis.

Author, year	Design, centres, country	Endoscopists and Procedures	Professional backgrounds	Primary outcome*	Intervention description	Theory informed	Outcome (* p<0.05)
Coe, 2013[94]	RCT 1 centre USA	15 endoscopists 2400 procedures	All endoscopists	Case-mix adjusted ADR	1 x Written A&F data (ADR and WT), 2 x in person training sessions.	No	ADR: Intervention 36% to 47%, control 36% to 35%.*
Fraser, 2013[88]	Pre- and post-intervention (1 group) 1 centre New Zealand	Unknown endoscopists, 67,570 procedures	Gastroenterology and surgery	CIR Insertion time WT PDR	Annual A&F meetings.	No	CIR: 96.3% to 99.0%* Insertion time: 7.5 min to 8.9 min* PDR: 29% to 49%* WT: 5.6 min to 6.6 min*
Gurudu, 2018[99]	1 group 1 centre USA	16 endoscopists 1612 procedures	Academic gastroenterology	ADR	3-monthly and monthly written A&F with anonymised peer comparison (highest detector)	No	ADR: 30.5% to 37.7%*
Harewood, 2006[93]	1 group 1 centre USA	58 endoscopists Median 310 procedures each	Gastroenterology	CIR Insertion time WT	3-monthly written A&F email with anonymised peer comparison	No	CIR: 96.3% to 97.2% WT: 9.1 min to 8.9 min
Harewood, 2008[95]	RCT 1 centre Ireland	4 endoscopists 581 procedures	Gastroenterology fellows	CIR PDR	1 x written and graphical A&F with anonymised peer comparison once, 1 x meeting with supervisor	No	CIR: Intervention 73% to 83%, control 78% to 72%.* PDR: Intervention 12.9% to 18.0%, control 16.9% to 19.6%
Hewett, 2011[100]	1 group 1 centre Australia	Unknown endoscopists 4770 procedures	Not recorded	CIR ADR	Participants self-collected and recorded A&F data	No	CIR: 96.1% to 96.3% ADR: 27.6% to 43.1%*

Table 1.2 Studies of audit and feedback (A&F) for colonoscopy reviewed by Tinmouth et al[71] and Bishay et al[86]

ADR – adenoma detection rate. CIR – caecal intubation rate. PDR – polyp detection rate. RCT – randomised controlled trial. WT – withdrawal time.

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Author, year	Design, centres, country	Endoscopists and Procedures	Professional backgrounds	Primary outcome	Intervention description	Theory informed	Outcome (* p<0.05)
Imperiali, 2007[96]	1 group 1 centre Italy	8 endoscopists 10,705 procedures	Gastroenterology	CIR PDR	6-monthly charted A&F data. Departmental meetings discussed A&F and made action plans – anonymised.	No	CIR: 84.6% to 93.1%* PDR: 33.8% to 33%
Inra, 2017[89]	1 group 3 centres USA	28 endoscopists 1987 procedures	Gastroenterology	CIR WT ADR (male and female)	2 x written A&F (scorecard) with targets	No	CIR: 98.2% to 98.5% WT: 9.2 min to 9.8 min ADR: male 31.9% to 30%, female 21.6% to 18.4%
Kahi, 2013[101]	1 group 1 centre USA	6 endoscopists 928 procedures	Academic gastroenterology and surgery	Case-mix adjusted CIR Case mix adjusted ADR	Quarterly written A&F with anonymised peer comparison	No	CIR: 95.6% to 98.1%* ADR: 44.7% to 52.9%*
Kaminski, 2016 [97]	RCT 40 centres Poland	38 endoscopists 24,582 procedures	Endoscopy centre leaders	ADR	2 x written A&F email with anonymised peer comparison. 1 x 2-day leadership training programme	No	ADR: intervention 17.4% to 23.9%, Control 18.5% to 20.8%*
Keswani, 2015[102]	1 group 1 centre USA	20 endoscopists 12,894 procedures	Physicians	ADR	Annual written A&F with anonymised peer comparison (10th, median and 90th percentile)	No	ADR: 28% to 31%*
Lin, 2010[90]	1 group 1 centre USA	10 endoscopists 1391 procedures	Gastroenterology	WT PDR ADR Patient satisfaction score	3-6 monthly written A&F with anonymised peer comparison	No	WT: 6.57 min to 8.07min.* PDR: 33.1% to 38.1% ADR: 19.6% to 22.7%
Mellen, 2010[103]	1 group 1 centre USA	6 endoscopists 560 procedures	Gastroenterology	ADR	1 x written A&F with peer comparison	No	ADR: 34.6% to 42.6%

Table 1.2 continued: Studies of audit and feedback (A&F) for colonoscopy reviewed by Tinmouth et al[71] *and Bishay et al*[86]

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Author, year	Design, centres, country	Endoscopists and Procedures	Professional backgrounds	Primary outcome*	Intervention description	Theory informed	Outcome (* p<0.05)
Nayor, 2018[104]	1 group 1 centre USA	14 endoscopists 7046 procedures	Gastroenterology	ADR Sessile serrated detection rate	6 monthly written A&F with target and graphical anonymised peer comparison	No	ADR: 32.1% to 38.7%* Sessile serrated detection rate: 4.8% to 7.8%*
Nielson 2017[91]	1 group 1 centre Denmark	9 endoscopists 205 procedures	Gastroenterology	WT PDR	1 x written A&F with target. Nurse monitoring. 1 x educational meeting	No	WT: 6.8min to 7.2min PDR: 22% to 42%*
Rein, 2011[105]	1 group 1 centre USA	13 endoscopists 2206 procedures	Gastroenterology	CIR ADR	1 x written and graphical A&F with peer comparison	No	CIR: 98.9% to 98.3% ADR: 31.0% to 32.3%
Sey, 2017[106]	1 group 1 centre Canada	17 endoscopists 1946 procedures	Gastroenterology and surgery	ADR PDR	Annual written A&F with anonymised peer comparison	No	ADR: 34.5% to 41.2%* PDR: 45.0% to 51.8%*
Sawhney, 2008[92]	1 group 1 centre USA	42 endoscopists 23,910 procedures	Gastroenterology and surgery	WT PDR	Monthly written A&F	No	WT >7 minutes: 65% to 99%* PDR: 48% to 55%
Shaukat, 2009[98]	1 group 5 centres USA	43 endoscopists 47,253 procedures	Gastroenterology	Case-mix adjusted ADR	6 monthly written A&F with peer comparison and education literature. 1 x group anonymised ADR review. 1 x individual meeting. 1 x poor performers met.	No	No significant change, unspecified.

Table 1.2 continued: Studies of audit and feedback (A&F) for colonoscopy reviewed by Tinmouth et al[71] and Bishay et al[86]

Chapter 2 A Delphi Consensus of Acceptability of Key Performance Indicators in the National Endoscopy Database Automated Performance Reports to Improve Quality Outcomes Trial (NED-APRIQOT)

2.1 Introduction and Definitions

This chapter contains a Delphi process for the selection of a KPI for the NED-APRIQOT. The polyp detection KPIs and case-mix adjustments being considered for investigation in NED-APRIQOT are not all currently used in colonoscopy quality improvement practice.[11] Before choosing a KPI for the trial and implementing these new adjusted measures, I sought the opinion of experts in endoscopy, to gain consensus on which detection measures were clinically acceptable for UK colonoscopists.

2.1.1 National Endoscopy Database (NED) data and available KPIs

NED does not have access to local histopathological data therefore adenoma detection rate (ADR), the current gold-standard detection KPI for colonoscopy, is not available and has limitations outlined in Chapter 1. The detection KPIs which can be generated through NED are based on polyp detection or polypectomy rates (Appendix A Table A2), and Chapter 1 describes their evidence base. PPP was not considered as it excludes negative procedures. I presented potential detection KPIs calculable through the NED to the NED-APRIQOT trialists group. The group selected five KPIs as potential candidates for the NED-APRIQOT. All have the denominator of the number of colonoscopies performed and examples of their calculation are shown in Figure 2.1:

- Polyp detection rate (PDR): procedures where at least one polyp is detected, displayed as a percentage.

- Polypectomy rate (PR): procedures where at least one polyp is removed, displayed as a percentage.

- Proximal polypectomy rate (PPR): procedure where at least one polyp is removed proximal to the splenic flexure, displayed as a percentage.

- Mean number of polyps per colonoscopy (MNP): the number of polyps detected, displayed as a rate per 100 colonoscopies.

- Mean polypectomy rate (MPR): the number of polypectomies performed, displayed as a rate per 100 colonoscopies.

Colonoscopy	Total polyps found	Total proximal polyps found	Total polypectomies performed
A	0		
B	0		
C	0		
D	0		
E	1	1	0
F	1	0	1
G	1	0	1
H	1	1	1
I	2	0	2
J	3	1	3

Detection KPI	Definition	Example for 10 colonoscopies	Calculation	Result
Polyp detection rate (PDR)	Procedures where at least one polyp is detected, displayed as a percentage	They detect polyps in 6 procedures	6 / 10 x 100	PDR = 60%
Polypectomy rate (PR)	Procedures where at least one polyp is removed, displayed as a percentage	They perform a polypectomy in 5 procedures	5 / 10 x 100	PR = 50%
Proximal polypectomy rate (PPR)	Procedure where at least one polyp is removed proximal to the splenic flexure	They perform a polypectomy proximal to the splenic flexure in 2 procedures	2 / 10 x 100	PPR = 20%
Mean number of polyps per colonoscopy (MNP)	Number of polyps detected, displayed as a rate per 100 colonoscopies	They detect 9 polyps in total	9 / 10 x 100	MNP = 90 per 100 colonoscopies
Mean polypectomy rate (MPR)	Number of polypectomies performed, displayed as a rate per 100 colonoscopies	They perform 8 polypectomies in total	8 / 10 x 100	MPR = 80 per 100 colonoscopies

Figure 2.0.1 Example of an endoscopist performing 10 procedures (A - J, green table) and calculation of the detection KPIs for these procedures (blue table).

Case-mix factors of patient age, sex and procedure indication are recognised as influencing polyp detection.[45] These factors are not under the endoscopists' control, and expert opinion has suggested these factors should be considered when setting a detection

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standard.[107] Adjusting for case-mix does not remove inter-endoscopist variation in polyp detection or centre-level variation in PCCRC,[108,109] and therefore may improve identification of variation pertaining to colonoscopy quality. NED data provides ease of access to national endoscopy data, and the opportunity to use statistical analysis to calculate "*optimal procedure adjusted detection*" (OPAD) KPIs,[6] adjusting endoscopists' performance for their case-mix.

2.2 Method

2.2.1 Aim

The aim of this work was to identify which detection KPI that can be calculated within NED and are adjustable for patient and procedural factors, are acceptable to endoscopists before use in the NED-APRIQOT.

A modified Delphi approach was chosen in parallel with a statistical analysis undertaken by the NED-APIRQOT statistics team. Extracts from this statistical analysis were used to inform panellists about the KPIs.

2.2.2 Delphi Panel Selection

To gain consensus on acceptance of KPIs which may be generalisable to the UK endoscopy workforce, I aimed to recruit 20 expert panel members with a range of professional backgrounds. The term expert is described as difficult to define,[110] however to ensure the relevance of the panel's consensus to the wider endoscopy population social norm theory suggests identifying "*valued others*" in the field of endoscopy.[77] The NED-APRIQOT trialists group perceived regional leaders in areas of endoscopy quality improvement, training and the English BCSP were valued experts.

The Delphi panel inclusion criteria were independent colonoscopy practitioners, with leadership experience in colonoscopy quality improvement or training, or advanced colonoscopy accreditation through the BCSP. The panel were recruited to reflect the professional background and gender make-up of the workforce undertaking endoscopy in the UK as reported by JAG (Figure 2.2) and the Centre for Workforce Intelligence.[111–113] The panel therefore aimed to recruit 10 gastroenterologists, 3 colorectal surgeons, 5 clinical nurse endoscopists and 2 non-consultant grade doctors or trainees, of these aiming to

recruit at least 10 female members to the panel as 47% of endoscopy lists are undertaken by female endoscopists.[112][2]

Panel members were recommended by the JAG and NED-APRIQOT investigators based on clinical and academic network connections, and panellists were recruited until professional background and gender criteria were filled. Suggested panellists were invited by email and sent a participant information sheet. Those who agreed to be on the Delphi panel by email were sent a link to a Google Form to collect responses. Panellists confirmed their preferred email address, clinical background, and gender. All further responses were analysed anonymously.

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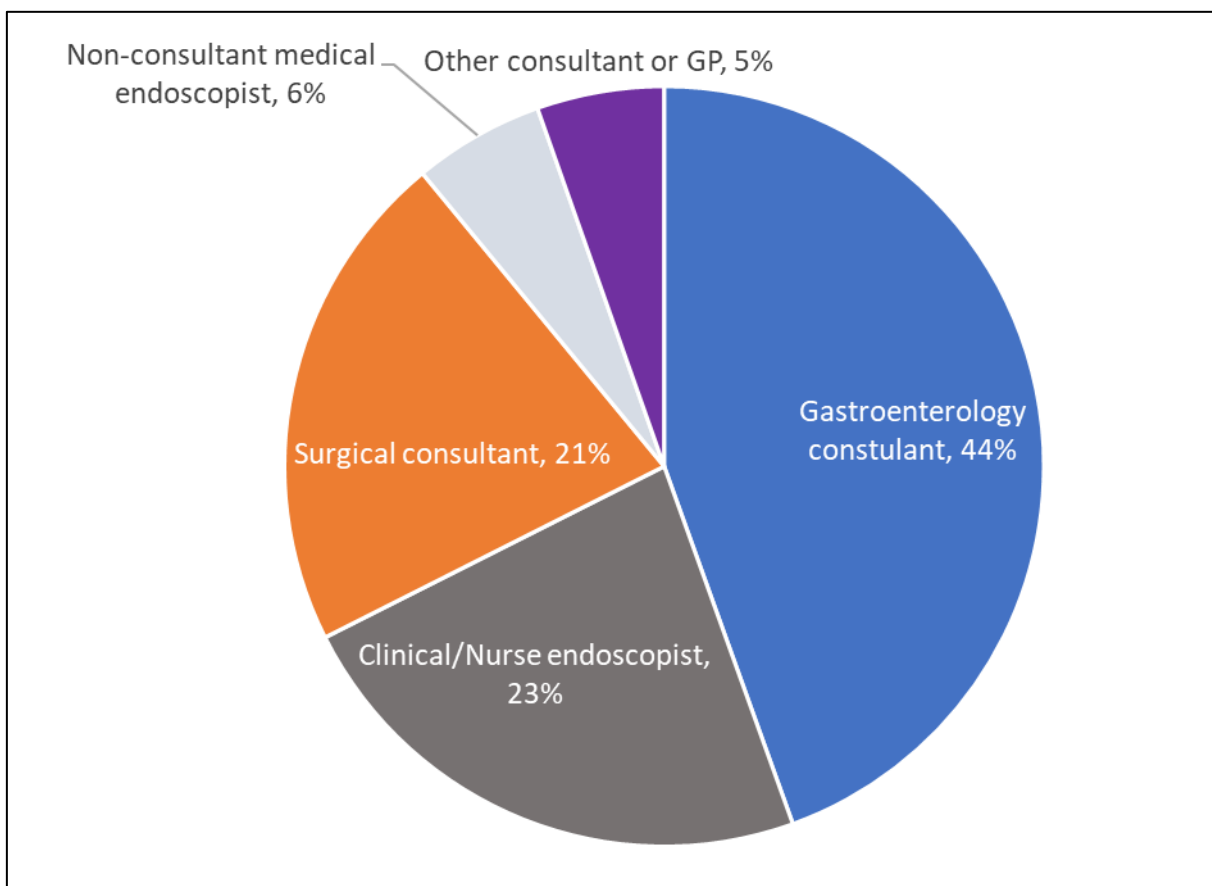
[2] These are calculations based on the Centre for Workforce Intelligence and the JAG survey of endoscopists. Sum of the proportion of lists per week by each profession multiplied by proportion of females in that profession.

Figure 2.2: Proportion of lists performed each week by endoscopist professional background in UK NHS endoscopy units.[111]

2.2.3 Delphi Method

A modified Delphi approach was used as described by Trevelyan et al [110]. A maximum of three rounds was set a priori.

Panellists were provided with statements about each KPI and asked to rate anonymously how much they agreed or disagreed using a five-point Likert scale and encouraged to provide free text comments for each statement (Figure 2.3).

In the first round, panellists were provided a summary of the pros and cons of each KPI based on a review of the literature and opinions from the NED-APRIQOT trialists group. Before subsequent round panellists received all anonymous data from the previous round including graded statements with all free text comments and redrafted statements to grade with a summary of previous comments and relevant literature.

Rounds were open for two weeks, with an invitation email on day one and a reminder email a week before closure. Once the collection period had closed responses were analysed anonymously. All participants who had completed the consent process were invited to all rounds.

I met with the NED-APRIQOT trialists group to agree a priori criteria for consensus.[110] After the first and second rounds statements with ≥80% agreement ('Agree' or 'Strongly agree' responses) were accepted. Statements with <80% agreement were redrafted incorporating comments and resubmitted to the group. After the third-round statements with ≥50% agreement with <20% 'Strongly disagree' and 'Disagree' responses were accepted. These criteria were in keeping with previous definitions of consensus, and results are displayed graphically over time to show stability and reliability of responses.[110,114]

Statement 3: A proximal polypectomy rate is an acceptable additional detection measure to improve awareness of proximal lesion detection. *

Pros

- Low proximal polyp detection and removal is associated with increased odds of post-colonoscopy colorectal cancer in a retrospective study (Baxter et al., 2011).
- Proximal polyp detection and removal has a better correlation to the adenoma detection rate than distal (descending and sigmoid colon) detection measures (Gohel et al., 2014).

Cons

- Polypectomy rate is less commonly used and may not be perceived as a detection measure by colonoscopists, as it is dependent on procedural intervention.
- Polypectomy rate would not include polyps detected but not removed due to contraindications to polypectomy at the time of colonoscopy.

○ Strongly agree

○ Agree

○ Neutral

○ Disagree

○ Strongly disagree

Statement 3: A proximal polypectomy rate is an acceptable additional detection measure to improve awareness of proximal lesion detection. Please comment on this statement below.

Long-answer text

Figure 2.3 Example of statement, literature summary and five-point Likert Scale used in the Delphi form.

2.2.4 Statistical analysis of KPIs

Statistical analyses of the investigated KPIs were undertaken by the NED-APRIQOT statistical team and will be reported elsewhere. In brief, during the Delphi process an analysis was undertaken of the each KPI using 100 000 colonoscopy procedures from NED. This provided descriptive statistics, assessed their correlation with traditional KPIs and was used to develop a model for case-mix adjustment that allowed differentiation of endoscopists' performance.

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This data was used in the third round of the modified Delphi to answer statistical queries and to illustrate suggested adjustments to KPIs using real world data.

The results of the Delphi process and statistical analysis were presented to the NED-APRIQOT trialists group together in May 2019, to aid selection of the trial KPI.

2.3 Results

2.3.1 Delphi Panel Make Up

In summary, 21 panellists completed at least one round, and 19 panellists completed all rounds. The Delphi panel met the purposive sampling criteria for professional background, 57% were female, and worked in seven regions across the UK (Figure 2.4).
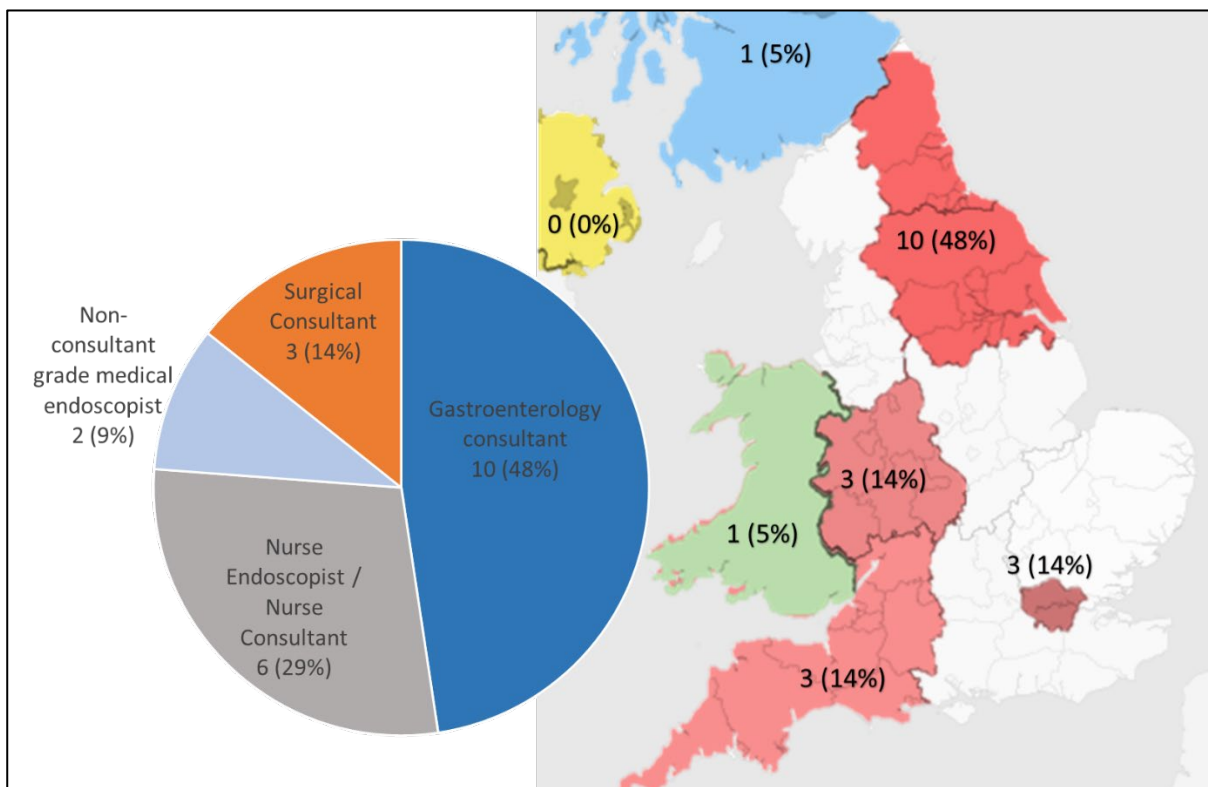
Figure 2.4 Delphi Panel professional roles and locations in the UK (n=21)

Seven of eight redrafted statements reached consensus criteria by round three, and these are described by KPI below, with a summary of panellists' comments with comment frequency. Round one ran from 18/1/2019 – 1/2/2019, round two ran from 15/2/2019 – 4/3/2019 and round three ran from 3/4/2019 – 27/4/2019, with an extension due to the Easter break.

Each subsequent section contains consensus statements and tables of agreement for each of the five KPIs and other statements regarding variations of KPIs and their display, with a summary of free text comments.

2.3.2 Polyp detection rate (PDR) statements and responses

The following polyp detection rate (PDR) statement was accepted by 95% of panellists:

> *"Statement: PDR is an acceptable detection measure in colonoscopy in the absence of a link to histological polyp data. Procedure adjusted PDR may be used to account for variables which may affect polyp detection, such as the procedure indication."*

Consensus was reached in round 2 (*Table 2.1*).

The initial PDR statement described the pros and cons of using PDR. In summary PDR is currently used in colonoscopy quality guidance and retrospective data from screening procedures shows a strong correlation to adenoma detection rate (ADR).[11,115] However, there is a discrepancy between the correlation of ADR and PDR in the distal colon,[42,116] As NED does not currently capture polyp location, this may risk gaming of PDR through increased diminutive distal colon polyp detection.[117]

In round one, 16 panellists commented on PDR. These described PDR as a *"pragmatic"* or *"practical"* choice (8 comments) with *"familiarity and ease of interpretation"* (3 comments), and benefited from encompassing non-adenomatous polyps as *"there are a vast range of polyps/lesions to be found in the colon"* (2 comments). The most common concern regarded the overreporting of *"diminutive hyperplastic polyps"*, and the risk of this having a gaming effect (6 comments); this was suggested to be reduced by combining with other measures, *"including proximal polypectomy rate"* (2 comments). One comment suggested excluding procedures *"with known polyps or those referred for resection"*.

The statement was amended for round two to highlight the lack of a histological link in NED and the ability to adjust PDR for case-mix (*Table 2.1*).

In round two, 12 panellists commented on PDR, again describing PDR as pragmatic (8 comments), suggesting that future iterations of NED should receive size and location data for all polyps (4 comments), and highlighted the need to adjust PDR for procedure indication (3 comments).

Round	1	2
Statement	*"PDR is an acceptable detection measure in colonoscopy."*	*"PDR is an acceptable detection measure in colonoscopy in the absence of a link to histological polyp data. Procedure adjusted PDR may be used to account for variables which may affect polyp detection, such as the procedure indication."*
Strongly Agree	0 (0%)	3 (15%)
Agree	14 (74%)	16 (80%)
Neutral	4 (21%)	0 (0%)
Disagree	1 (5%)	1 (5%)
Strongly Disagree	0 (0%)	0 (0%)
Total responses	19	20
Chart		

Table 2.1 Delphi responses to PDR statements, figures provided are number of responses (percentage of round responses).

2.3.3 Polypectomy rate (PR) statements and responses

The following polypectomy rate (PR) statement was accepted by 81% of panellists:

> *"Polypectomy rate is an acceptable detection measure in colonoscopy in the absence of a link to histological polyp data. Procedure adjusted polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure*

indication and patient demographics."

This reached consensus in round three (*Table 2.2*).

Round	1	2	3
Statement	*"Polypectomy rate is an acceptable detection measure in colonoscopy."*	*"Polypectomy rate is an acceptable detection measure in colonoscopy in the absence of a link to histological polyp data. Procedure adjusted polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure indication."*	*"Polypectomy rate is an acceptable detection measure in colonoscopy in the absence of a link to histological polyp data. Procedure adjusted polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."*
Strongly agree	2 (11%)	4 (20%)	4 (19%)
Agree	10 (53%)	11 (55%)	13 (62%)
Neutral	5 (26%)	2 (10%)	3 (14%)
Disagree	2 (11%)	3 (15%)	1 (5%)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)
Total responses	19	20	21
Chart			

Table 2.2 Delphi responses to PR statements, figures provided are number of responses (percentage of round responses).

The initial PR statement was provided with a literature summary describing the reduced odds of post-colonoscopy colorectal cancer when endoscopists have higher PR,[4] the correlation of PR with ADR [46,47,118] and the benefit of NED capturing polypectomy location data. The disadvantages of PR were described as similar to those for ADR, that is, its

dependence on procedural intervention, and therefore the exclusion of polyps detected but not removed for clinical reasons.[49]

In round one, 14 panellists commented on PR. Eight were positive, highlighting polypectomy reduced the risk of gaming as endoscopists are "*less able to manipulate data*" (5 comments), encompassing all "*clinically significant polyps*" not just adenomas (5 comments) and being easy to understand (1 comment). Comments highlighted concerns of "*clinical reasons*" preventing polypectomy (6 comments), including "*antiplatelets and anticoagulation*" (4 comments) and endoscopists' "*technical ability*" (3 comments).

The statement was amended for round two to highlight the lack of a histological link in NED and the ability to adjust PR for case-mix (Table 2.2).

In round two, 11 panellists commented on PR, seven comments were positive. Concerns that "*too many variables determin[e] whether polypectomy can be performed*" (3 comments). Others argued that the impact of these variables "*should apply to all diagnostic colonoscopies nationally at a similar rate*" and "*everyone would be equally affected*" therefore PR would still be a "*useful tool to determine colonoscopy quality*" (2 comments). There was concern that PR may "*increase the temptation for endoscopists to attempt removal*" of polyps "*beyond their skill level*" (2 comments). However, it was also noted that all independent colonoscopists "*should be able to remove polyps up to 1cm*" and having this as a KPI may "*encourage upskilling*" (2 comments).

In round three, panellists were provided with a preliminary analysis of NED data regarding PR:

> "*Analysis of preliminary NED data from 2311 endoscopists shows a strong correlation between polypectomy rate and polyp detection rate (correlation coefficient 0.83, p<0.0001). We will collect histological data for a period of the trial to correlate our selected primary KPI with adenoma detection rate (ADR).*"

There were nine comments regarding PR in this round. The correlation with PDR was "*reassuring*" to the panel (3 comments). The importance of the histological work was highlighted, as "*ultimately a correlation with ADR*" was important but "*in the absence of a histological confirmation [PR] seems a reasonable alternative*" (3 comments). Two comments reiterated the importance of "*adjustment by procedure indication*".

2.3.4 Mean number of polyps (MNP) statements and responses

The following Mean Number of Polyps (MNP) statement was accepted by 81% of panellists:

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"Using mean number of polyps detected is an acceptable detection measure in colonoscopy. Procedure adjusted rates may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."

This reached consensus in round three (Table 2.3).

The initial MNP statement was provided with a literature summary describing the benefits of MNP avoiding the "one-and-done" phenomenon [36], its alignment with the premise of colonoscopy – to detect all pathology,[115] the strong correlations between MNP and ADR and mean number of adenomas.[4,119] Disadvantages included NED not capturing polyp location and the risk of skew by procedures with large numbers of polyps, with data showing the correlation between the MNP and ADR plateaus after five polyps are detected [120].

In round one, 16 panellists commented on MNP. These described MNP as a "*better measure*" as it "*mitigates the 'one and done' approach*" (4 comments). There was criticism that detecting a high number of polyps would skew MNP (3 comments). Two solutions were discussed, a "cap" at five polyps (2 comments) or using median number of polyps to better represent this likely non-parametric data (2 comments).

The MNP statement was not amended in round 2. A literature summary regarding using median data was provided, describing the precedent for using a mean [56,115,119] that previously correlated with ADR.[56,115,120] Panellists were informed that a median number of polyps would be statistically assessed, however the median value, generating an integer, may lose the variation of a mean value and not differentiate endoscopists well.

In round two, 14 panellists commented on MNP. These suggested MNP should "*be supported by [other] indicators*" such as PDR or polypectomy rate (5 comments). Two comments reiterated MNP "*would need to be adjusted for case-mix*" (2 comments). There were statistical queries regarding providing a median and a mean value for endoscopists (4 comments), and a request for an impact assessment on the cap on KPI data (2 comments).

Round	1	2	3
Statement	*"Using mean number of polyps is an acceptable detection measure in colonoscopy."*	*"Using mean number of polyps is an acceptable detection measure in colonoscopy."*	*"Using mean number of polyps detected is an acceptable detection measure in colonoscopy. Procedure adjusted rates may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."*
Strongly agree	2 (11%)	4 (20%)	5 (24%)
Agree	7 (37%)	10 (50%)	12 (57%)
Neutral	5 (26%)	2 (10%)	3 (14%)
Disagree	5 (26%)	4 (20%)	1 (5%)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)
Total responses	19	20	21
Chart			

Table 2.3 Delphi responses to MNP statements, figures provided are number of responses (percentage of round responses).

The MNP statement was amended in round 3 suggesting a case-mix adjustment (Table 2.3).

To address statistical questions, panellists were provided with preliminary analysis of NED data regarding MNP and the use of a median or a cap of five polyps:

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"We have calculated the median and mean polyp detection rate using our preliminary NED data of 2311 endoscopists performing 62000 procedures.

- *The median number of polyps detected at a per endoscopist level was very skewed. Results of 0 polyps/colonoscopy for 1606 (83%) endoscopists and 1 polyp per colonoscopy for 271 (12%).*

- *The mean number of polyps was still positively skewed but had a much more normal distribution (median 0.46 polyps/colonoscopy, confidence interval 0.43-0.48 polyps/colonoscopy)*

Median number of polyps is unlikely to be a useful tool in providing feedback or reviewing performance. Mean number of polyps with a cap of five polyps had the strongest correlation to polyp detection rate (Spearman correlation coefficient 0.94 p<0.001) and reduced the positive skew of the distribution."

In round three, 10 panellists commented on MNP. The statistical analysis provided most with reassurance, "*mean is clearly better than median*" (7 comments), however it was suggested that MNP was "*especially helpful when used with other KPIs*" (3 comments). One comment was concerned that MNP was "*less easy to interpret … but could encourage endoscopists to keep looking*".

2.3.5 Mean polypectomy rate (MPR) statements and responses

The following MPR statement was accepted by 67% of panellists:

"*Using mean polypectomy rate is an acceptable detection measure in colonoscopy. Procedure adjusted rates may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."*

This reached the minimum requirement for consensus in round three (Table 2.4).

The initial MPR statement was provided with a similar literature summary to MNP, but also highlighting that MPR captures the location of colonic polyps.

In round one, 12 panellists commented on MPR. It was suggested MPR was more accurate than MNP as the requirement for polypectomy "*is likely to hint towards significant (i.e. adenomatous) polyps*" and that this enabled "*mean adenoma detection rate to be more accurately predicted*" (4 comments).

Round	1	2	3
Statement	*"Using mean polypectomies per procedure is an acceptable detection measure in colonoscopy."*	*"Using mean polypectomies per procedure is an acceptable detection measure in colonoscopy."*	*"Using mean polypectomy rate is an acceptable detection measure in colonoscopy. Procedure adjusted rates may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."*
Strongly agree	0 (0%)	1 (5%)	6 (29%)
Agree	11 (58%)	9 (45%)	8 (38%)
Neutral	6 (32%)	8 (40%)	5 (24%)
Disagree	2 (11%)	2 (10%)	2 (10%)
Strongly disagree	0 (0)	0 (0%)	0 (0%)
Total responses	19	20	21
Chart			

Table 2.4 Delphi responses to MPR statements, figures provided are number of responses (percentage of round responses).

In all rounds comments referred to "*as above*" concerns highlighting PR comments regarding clinical variables preventing polypectomy and the dependence on technical skills for "*newer endoscopists who are in the developmental stage of their scoping career*"(2 comments),

concerns highlighting MNP comments regarding statistical queries of "*accuracy/validity of*" mean numbers versus medians and the 'cap' of five polyps (2 comments), and the need to "*stratify*" or adjust for "*procedural indication*" (2 comments). The statement was amended in round 3 suggesting a case-mix adjustment (*Table 2.4*).

In round three, four panellists commented on MPR. These members were reassured by the statistical analysis and choice of mean value (2 comments), suggested that MPR would be a better adjunct to another headline KPI (1 comment). There was ongoing concern of the influence of endoscopist skill at polypectomy (1 comment) requiring a realistic minimum to prevent endoscopists performing "*out with their level of skill*" (1 comment).

2.3.6 Proximal polypectomy rate (PPR) statements and responses

The following PPR statement was accepted by 86% of panellists:

> "*Proximal polypectomy rate is an acceptable secondary measure to the primary KPI. Procedure adjusted proximal polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics.*"

This reached consensus in round three (Table 2.5).

The initial PPR statement was provided with a literature summary describing that proximal polyp detection and removal has a stronger correlation to ADR than distal detection measures, [49] and low proximal polyp detection and removal is associated with increased odds of post-colonoscopy colorectal cancer.[4]

In round one, 13 panellists commented on PPR. PPR was described as improving attention to proximal lesions which would "*drive improvement rather than [be] used for benchmarking*" and improve "*pick up rates of lesions in the right colon*" (4 comments). Comments positively identified the inclusion of significant non-adenomatous polyps, "*especially sessile serrated polyps*" (3 comments), and reduced risk of "*gaming by identification of hyperplastic polyps in the rectum*" (2 comments). As with other polypectomy measures comments highlighted interference from other variables preventing polypectomy such as antiplatelets (2 comments) and endoscopist technical skill particularly as "*people may be more reluctant to remove proximal lesions due to concerns about safety, more likely to be flatter serrated lesions*" (4 comments).

Round	1	2	3
Statement	*"A proximal polypectomy rate is an acceptable additional detection measure to improve awareness of proximal lesion detection."*	*"Proximal polypectomy rate is an acceptable additional detection measure in colonoscopy in the absence of location data for unresected polyps. Procedure adjusted proximal polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure indication."*	*"Proximal polypectomy rate is an acceptable secondary measure to the primary KPI. Procedure adjusted proximal polypectomy rate may be used to account for variables which may affect polyp detection, such as the procedure indication and patient demographics."*
Strongly agree	4 (21%)	3 (15%)	5 (24%)
Agree	11 (58%)	11 (55%)	13 (62%)
Neutral	2 (11%)	4 (20%)	2 (10%)
Disagree	2 (11%)	2 (10%)	1 (5%)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)
Total responses	19	20	21
Chart			

Table 2.5 Delphi responses to PPR statements, figures provided are number of responses (percentage of round responses).

The PPR statement was amended to use PPR as an additional KPI and include adjustment for procedure indication (*Table 2.5*). In round two, 9 panellists commented on PPR. Comments

suggested PPR was useful as "*a tool to improve right sided polyp detection*" and was a surrogate for "*a more thorough examination*" (5 comments). Concerns remained that PPR may push endoscopists to "*tackle more difficult polyps when they shouldn't*" (3 comments), but may be useful to "*identify endoscopists in need of additional support/training*" (1 comment). Two comments agreed polypectomy KPI should also be adjusted for patient demographics.

The PPR statement was amended to use PPR as a secondary KPI. In round three, 8 panellists commented on PPR. These reiterated the usefulness of PPR as a measure (3 comments), repeated concerns around polypectomy beyond an endoscopist skill set (3 comments) and recognised that PPR "*may encourage upskilling/supported development*" (1 comment).

2.3.7 Displaying of mean values statements and responses

The following statement regarding display of mean values was accepted by 90% of panellists:

> "*It is acceptable to display mean numbers of polyps or mean polypectomy rate as a value per 100 procedures.*"

This reached consensus in round three (*Table 2.6*).

The initial statement included a literature summary describing data suggesting MNP of 0.8 polyps per procedure is equivalent to an ADR of 35%,[115] potentially making significant changes in detection less obvious if displayed as a decimal. Multiplying MNP by a factor of 100, to give a mean per 100 colonoscopies, could improve interpretation and identification of changes over time. For example, comparing the change from 0.75 to 0.81 MNP per colonoscopy, and 75 to 81 MNP per 100 colonoscopies. However, using "*per 100 colonoscopies*" may cause confusion regarding the denominator, as data will be calculated from any number of colonoscopies in a period and not the last 100 procedures.

In round one, 12 panellists commented on displaying mean values, suggesting that an integer was an "*easier concept*" to interpret and "*more understandable*" than a decimal (6 comments). It was highlighted this value "*would need careful explanation*" as this could be "*quite confusing for endoscopists*" particularly "*about number of procedures performed by endoscopist[s]*" (4 comments).

Round	1	2	3
Statement	*"Displaying mean numbers of polyps or polypectomies as a value per 100 procedures, is easier to interpret than a mean per procedure."*	*"Displaying mean numbers of polyps or polypectomies as a value per 100 procedures, is easier to interpret than a mean per procedure."*	*"It is acceptable to display mean numbers of polyps or mean polypectomy rate as a value per 100 procedures."*
Strongly agree	5 (26%)	6 (30%)	4 (19%)
Agree	10 (53%)	8 (40%)	15 (71%)
Neutral	2 (11%)	3 (15%)	1 (5%)
Disagree	2 (11%)	3 (15%)	1 (5%)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)
Total responses	19	20	21
Chart			

Table 2.6 Delphi responses to display of mean values statements, figures provided are number of responses (percentage of round responses).

Before round two supporting information re-emphasised that the KPI would be explained carefully. In round two, and 8 panellists commented on displaying mean values. Panellists agreed per 100 procedures was "*more meaningful"* and "*easier to interpret*" with a clear introduction (4 comments). Concerns were raised over "*variability of the data*" when used "*from month to month*" with small numbers of procedures and emphasised "*clearly*

identifying how many procedures the values were calculated using" (3 comments). Two comments perceived per 100 procedures "*remains confusing*".

In round 3, supporting information re-emphasised that the number of procedures would be clearly stated with further information available on how any KPI is calculated. All comments were positive regarding displaying values per 100 procedures "*as the KPI is clearly explained and justified*".

2.3.8 Rectal exclusions

The following statement regarding rectal exclusion was accepted by 76%:

> "*In combination with the primary KPI, the proportion of polypectomies in the rectum of polyps <1cm may be used as a secondary measure to flag potential underperformance.*"

This met the minimum criteria for consensus in round three (Table 2.7).

In round one, six comments suggested that excluding hyperplastic polyps in the rectum would aid the accuracy of detection measures. Location data are only available for resected polyps, therefore panellists were provided with a rectal exclusion statement for MPR in rounds two and three.

In round two, 11 panellists commented on rectal exclusion. Comments described rectal exclusions as a "*helpful adjunct*" or a "*flag system*" to reduce gaming (4 comments), but highlighted the risk of suggesting "*rectal polyps are of no clinical significance*" (5 comments).

In round three, the statement was amended to recommend assessing the proportion of polyps in the rectum as a secondary KPI in combination with a primary detection KPI (*Figure 5*).In this round, 10 panellists commented on rectal exclusion, similarly highlighting reduced gaming (4 comments), however concerns persisted regarding potentially reducing rectal polypectomy and "*caution should be taken in the wording*" particularly as "*PCCRC rectal cancers were common and rectal lesions were often missed*" (4 comments). Other concerns included high "*variation among endoscopist*" regarding removing rectal hyperplastic polyps (2 comments) and causing "*more confusion than clarification*" (1 comment).

Round	2	2	3
Statement	*"Using mean polypectomies per procedure excluding rectal polyps is an acceptable detection measure in colonoscopy."*	*"Using mean polypectomies per procedure excluding rectal polyps under 1 cm is an acceptable detection measure in colonoscopy."*	*"In combination with the primary KPI, the proportion of polypectomies in the rectum of polyps <1cm may be used as a secondary measure to flag potential underperformance"*
Strongly Agree	2 (10%)	3 (15%)	3 (14%)
Agree	4 (20%)	9 (45%)	13 (62%)
Neutral	10 (50%)	4 (20%)	4 (19%)
Disagree	4 (20%)	4 (20%)	1 (5%)
Strongly Disagree	0 (0%)	0 (0%)	0 (0%)
Total responses	20	20	21
Chart			

Table 2.7 Delphi responses to rectal exclusion statements, figures provided are number of responses (percentage of round responses).

2.3.9 Tattoos

In round one, a comment suggested capturing *"whether further therapeutic procedure was planned … could be used as [an] 'intention to treat'"* for detected but not removed polyps.

NED captures location data for tattooing polyps as a therapy, when removal is not possible, to aid location at future colonoscopy or surgery. The following statement was presented in round two:

> *"If calculable, a proximal polypectomy or polyp tattooed rate is an acceptable additional detection measure in colonoscopy."*

This did not reach consensus (Table 2.8) and was removed after reviewing panellists' comments and statistically reviewing the suggested KPI.

In round two, 10 panellists commented on tattoo rate. This measure was described positively as a "*safer metric*" (3 comments). Significant concerns were highlighted by the panel (5 comments) including the clinical risks of "*over-tattooing*" of small polyps, the variety of tattoo protocols in different endoscopy units across the country, and the likely low yield of the measure "*as only polyps >2cm are tattooed routinely I think the numbers are likely to be very small*".

The review of evidence provided in round 3 identified that UK guidance recommended that only polyps larger than 2cm or suspicious of cancer outside the rectum or caecum should be tattooed, however the number of tattoos and their site is a decision for local trusts suggesting high variability.[11] Similarly, low yield was demonstrated when applied to our cohort of 62 000 colonoscopies; proximal polypectomies were identified in over 10 000 cases and only two further cases of proximal polyp tattoo were identified.

2.3.10 Delphi consensus decision

All five suggested KPI reached consensus (Figure 2.5).The NED-APRIQOT trialists group chose MNP as the primary trial outcome, as this was acceptable to endoscopists. The NED-APRIQOT statistical team's analysis demonstrated the procedure adjusted model of mean detection KPI differentiated endoscopists performance well. However, procedure adjusted PDR and PR, did not due to their binary nature at the procedure level (≥1 polyp or 0 polyps). This is summarised in Figure 2.6, an extract from Lu *et al's* (publication awaited) statistical work presented to the NED-APRIQOT Trialists group.

Round	2
Statement	*"Using mean polypectomies per procedure excluding rectal polyps is an acceptable detection measure in colonoscopy."*
Strongly Agree	2 (10%)
Agree	4 (20%)
Neutral	10 (50%)
Disagree	4 (20%)
Strongly Disagree	0 (0%)
Total responses	20
Chart	

Table 2.8 Delphi responses to tattoo statement, figures provided are number of responses (percentage of round responses).
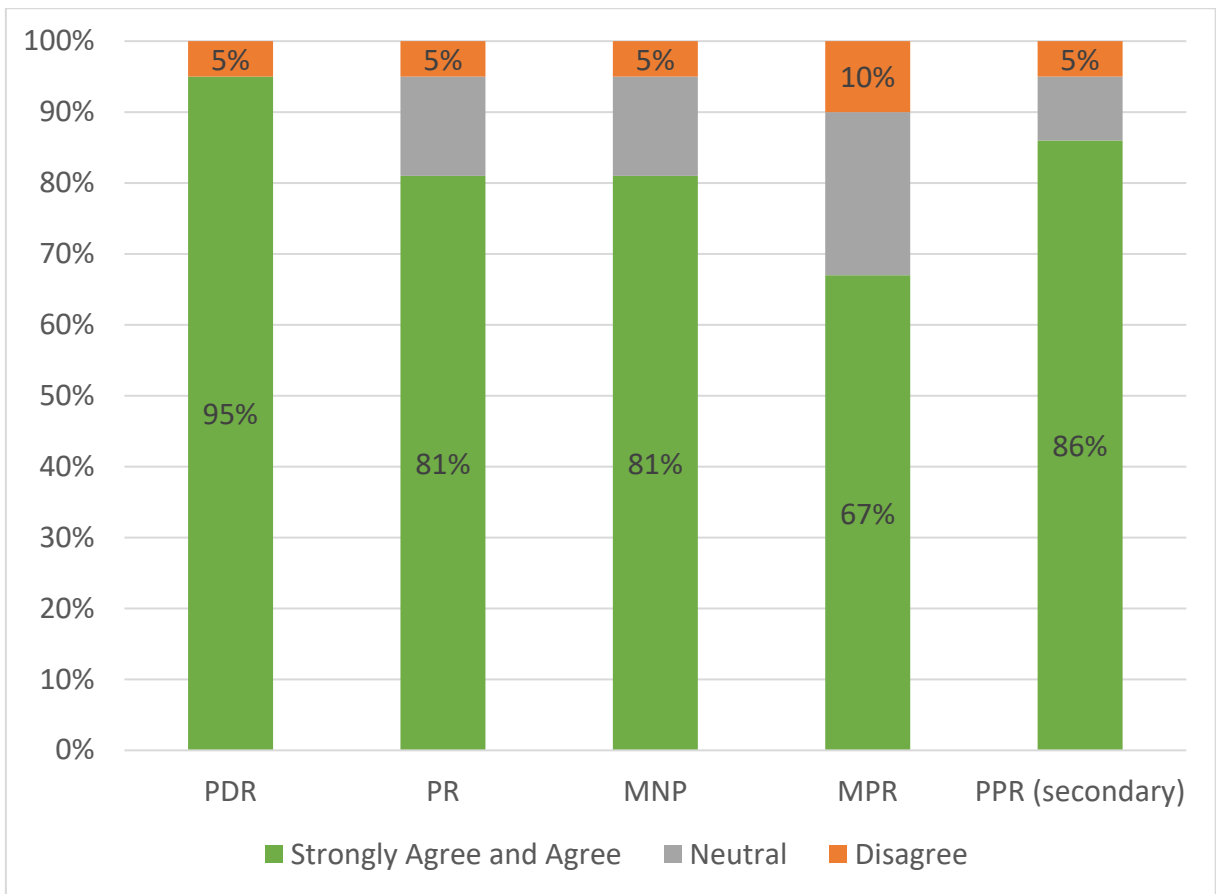
Figure 2.5 Consensus rates in round three for the five KPIs: polyp detection rate (PDR), polypectomy rate (PR), mean number of polyps (MNP), mean polypectomy rate (MPR) and proximal polypectomy rate (PPR).
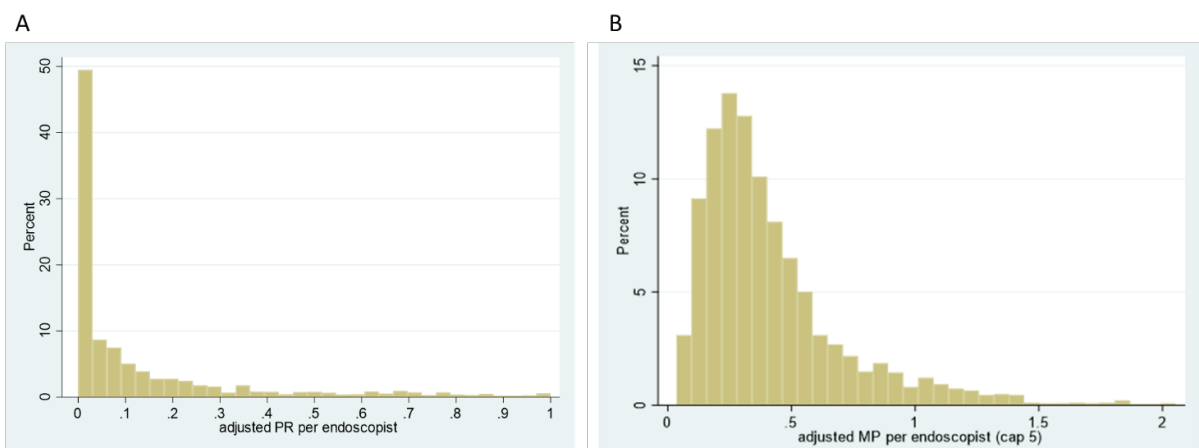
Figure 2.6 Histogram showing distribution of procedure adjusted polypectomy rate per endoscopist as a proportion of 1 (PR, chart A) and mean polypectomy rate per endoscopist displayed as an average per procedure (MP, chart B) extracted from Lu et al (publication awaited). This demonstrated adjusted PR and PDR at the endoscopist level were very positively skewed, with over 40% of endoscopists achieving an adjusted PR of 0%. MP had a positively skewed distribution but differentiated endoscopists with low detection.

2.4 Discussion

2.4.1 Summary of principle findings

This is the first Delphi process to show acceptance of a mean detection KPI for colonoscopy quality. MNP achieved a consensus of 81% and was described as encouraging endoscopists to detect all polyps avoiding a one-and-done phenomenon. Data from NED using a cap of five polyps per colonoscopy and using a case-mix adjustment reassured panellists about the use of a mean over a median measure and the risk of skew from large numbers of polyps. Panellists agreed mean values should be displayed as a number per 100 procedures (90%) described as improving clarity.

Although the selection of candidate KPIs was limited somewhat by the availability of data items within NED, all five case-mix adjusted KPI presented to panellists gained consensus as acceptable. PDR had the highest consensus (95%) as an acceptable KPI, however case mix adjusted PDR did not differentiate endoscopists' performance well in separate statistical work.

Polypectomy based KPIs were accepted by endoscopists as additional measures, however persistent concerns were raised by panel members regarding encouraging endoscopists to undertake polypectomies beyond their skill level. PPR was accepted as a secondary measure and was described as improving proximal polyp detection and being less prone to gaming from identification of less significant hyperplastic polyps in the distal colon. This was chosen as a secondary outcome in the NED-APRIQOT.

2.4.2 Strengths and limitations

This Delphi process benefitted from a wide range of expert panellists, achieving planned inclusion of a variety of professional backgrounds and female panellists reflecting the UK colonoscopy workforce. Selection of panellists through JAG and trialists' clinical and academic networks risked a potential bias to select those who may be more likely to reach consensus.

Patient representation was not included in the Delphi process, which is a potential limitation of this work. This was perceived to be due to the complexity of the data around KPIs involved in the Delphi process and the aim to ensure acceptability of a KPI to trial participants who were all endoscopists. The NED-APRIQOT trial group had patient representatives who were involved in discussions and decisions regarding the selection of

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KPIs for both the Delphi process and subsequent selection for the trial.[6] However, future work should consider qualitative assessment of patient perspectives to guide KPI selection and development of endoscopy quality standards.

The large panel size and inclusion requirements limited the availability of panellists and therefore this selection bias. The participant information sheet emphasised that anonymised responses were not identifiable to other participants or trialists reducing the impact of professional relationships on rankings and comments, and emphasised the aim of the Delphi was to identify acceptance for the wider endoscopy audience.

The modified Delphi approach providing summary information to panellists in rounds helped generate comment and debate. The number of comments decreased with each round, which may represent increased agreement between panellists, however this may be due to the increased time taken to participate in each round, with the increased number of documents required to be reviewed. This included statements and how they were adjusted, all free text comments, and answers to questions posed by panellists.

The provision of real-world statistical data in the final round of the Delphi process had two advantages: it guided the team's analysis of these KPI with the dataset and provided panellists with data related to their queries and debate (providing insights into the distributions and characteristics of KPIs). This potentially helped gain consensus with mean KPI statements, allaying panellists initial concerns about the non-parametric nature of polyp data and the use of a mean. However, it is difficult to attribute consensus to the provision of data, without a counterfactual Delphi withholding statistical results.

2.4.3 Strengths and limitations in relation to other studies

No previous Delphi processes have assessed mean detection KPI. A Delphi consensus was published as part of the European Society for Gastrointestinal Endoscopy (ESGE) quality improvement initiative, only included detection KPIs that were binary at the procedure level. The ESGE describe a similar modified Delphi process, providing statements with additional evidence in three rounds. Unfortunately, the ESGE panel make up and selection process is not described in published literature,[33] making it unclear how representative the panel was to the UK endoscopist workforce. The ESGE panel reached consensus on ADR and PDR as "*measures of adequate inspection*", however statements regarding other detection KPIs failed to reach consensus including those on proximal polyp detection rate (23.1%

consensus), proximal adenoma detection rate (37.5% consensus) and polypectomy rate (42.8% consensus). The NED Delphi reached consensus on polypectomy rate as an acceptable detection KPI and proximal polypectomy rate as acceptable secondary outcome measure, but only "*in the absence of a link to histological polyp data*". Without this NED based proviso, our statements similarly did not reach consensus.

2.4.4 Implications for clinical practice

This NED Delphi process was intentionally limited in its scope for the creation of an acceptable KPI for the NED-APRIQOT trial using current NED data fields with an absence of a link to histological polyp data.

This NED Delphi process and the existing literature suggests that polyp detection KPIs are credible and accepted by endoscopists in quality improvement, particularly with their inclusion of significant non-adenomatous polyp detection.[121] Future iterations of NED may collect more detailed location data for all detected polyps and link to histological data, allowing review of adenoma and serrated polyp detection rates, broadening the list of potential mean detection KPIs. The acceptance of new KPIs and potential future exclusions should be explored in future Delphi processes before implementation, and should consider such a methodology providing KPI analysis data to inform panellists.

2.5 Conclusion

These results were presented with the statistical analysis of each KPI to the NED-APRIQOT trialists group in May 2019. They agreed to use MNP as the primary headline KPI and PPR as a secondary KPI, given their acceptability and ability to differentiate endoscopists after adjustment for case-mix. MNP and PPR were used in future draft behaviour change interventions before use in the NED-APRIQOT. The interaction of endoscopists with these case-mix adjusted KPI was explored qualitative interviews to develop their presentation in Chapter 3. Themes of gaming behaviours associated with the one-and-done phenomenon are explored further in Chapter 4, and the implications of this work on future research are considered in Chapter 5.

Chapter 3 Development of an Audit and Feedback Behaviour Change Intervention to Improve Polyp Detection at Colonoscopy

3.1 Introduction

This chapter describes the development of a BCI for improving polyp detection at colonoscopy for evaluation in the National Endoscopy Database Automated Performance Reports Improving Quality Outcomes Trial (NED-APRIQOT), a multicentre randomised cluster control trial.[6] Limited understanding around theoretical mechanisms of change underpinning audit and feedback (A&F) behaviour change interventions (BCI) has been identified as a key limitation of the existing A&F evidence-base and a major inhibitor of advances in this area.[63] As described in Chapter 1 previous A&F studies in colonoscopy are of poor quality with providing limited feedback on behaviours associated with detection.[86] This chapter describes behaviours associated with colonic detection and the design of a theory informed BCI targeting these. It describes the method of qualitative cognitive interviews used to iteratively develop the BCI and the results of these interviews using themes from FIT.

3.1.1 Introducing behavioural theories

Feedback intervention theory (FIT), described in Chapter 1, was chosen for the development of this BCI.

In brief, FIT describes behaviours within a hierarchy of tasks: tasks pertaining to self-identity (meta-task behaviours) at the top, performing known behaviours (task-motivation behaviours), and learning behaviours (task-learning behaviours) at the bottom. Regulation occurs through comparing these behaviours to identified standards. A FIT-based BCI seeks to change the 'locus of attention' to discrepancies between behaviours and their standards ('feedback-standard gaps'). A person may respond to a feedback-standard gap by adopting a strategy to resolve the gap and increasing effort, or alternatively may quit, reject the gap, or change their standards. BCIs focused on task-motivation behaviours are hypothesised to be most effective. Feedback pertaining to meta-task behaviours can shift attention away from the task to the 'unmet goals of the self', causing anxiety (cognitive interference). The effectiveness of a FIT-based BCI is under the control of moderators of behaviour, these include the complexity of the task (task-dominance), motivation, situation and personality

variable, and the contents of the BCI providing a correct solution to support adopting a strategy, setting goals, and demonstrating positive change over time (velocity).[69]

Anecdotally the author was aware that social comparisons are used frequently in A&F processes within endoscopy practice, which is explored in more detail in Chapter 4. The TPB with FIT was therefore used in the development of the BCI and topic guide for cognitive interviews.[3]

3.1.2 Defining the target behaviours associated with detection in colonoscopy

As described in Chapter 1, colonic polyp detection and resection prevents the development or colorectal cancer (CRC).[4,34] During colonoscopy there are behaviours that endoscopists can perform which can increase their detection of colonic polyps, and are recommended by the BSG.[122] These target behaviours include:

- *Withdrawing the colonoscope slowly (withdrawal time)*

This is the time taken to withdraw the colonoscope, during which the mucosa is inspected. Data from the bowel cancer screening programme (BCSP) in England demonstrated longer withdrawal times were associated with higher detection of polyps.[123] The BSG recommend a minimum withdrawal time of 6 minutes and an aspirational target of 10 minutes.[11]

- *Spending more time in the proximal colon (segmental withdrawal)*

An observational study showed a statistically significant increase in proximal (right side of the bowel) polyp detection when colonoscopists spent more than 4 minutes 7 seconds withdrawing in the proximal colon.[124] In observational studies of PCCRC, endoscopists who performed a polypectomy in the proximal colon in over 25% of procedures had lower odds of their patients developing PCCRC.[4]

- *Prescribing hyoscine butylbromide (Buscopan)*

Buscopan reduces spasm in the colon, and during colonoscopy it is used to reduce folds and optimise mucosal visualisation.[125] The benefits of Buscopan have been demonstrated in a

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[3] These behavioural theories are separate from the behaviour change techniques taxonomy (BCTT), a hierarchical structured taxonomy of techniques used to label BCI components, to aid identification for researchers, clinical practitioners and policy development audiences.[64,248]

number of retrospective and prospective studies, including English BCSP data demonstrating a 30% increase in adenoma detection [123]. A meta-analysis of available studies of Buscopan use in 2014 concluded that it provided marginal improvement in polyp detection[126]. Representatives from the BSG, JAG and the English BCSP recommend using Buscopan in the majority of patients.[125]

- *Turning the camera back on itself in the rectum (rectal retroflexion)*

Retroflexion in the rectum is recommended by the BSG in at least 90% of colonoscopies.[11] Early studies showed marginal improvements in rectal polyp detection from retroflexion.[123,127]

- *Turning the patient on withdrawal (turning)*

Moving the patient during colonoscopy withdrawal facilitates distension of different colonic segments, as gas rises to the least dependent areas. Multiple trials demonstrate significantly improved polyp detection with dynamic position changes.[128–131] This is most significant in the right colon using the left lateral position; in one trial proximal polyp detection increased from 18% to 26%.[131] Turning the patient does not take long; one study showed an additional 44 seconds was required per procedure.[132]

The NED is able to capture data on endoscopists' polyp detection (Chapter 2), but also these behaviours which increase polyp detection: withdrawal time, proximal detection of polyps (proximal polypectomy rate (PPR)), Buscopan prescription rates and rectal retroflexion rates. This BCI was designed and developed for use within NED as part of the NED-APRIQOT.[29]

3.2 Method

3.2.1 Rationale

The primary aim of this phase of the work was to inform the design and development of a behaviour change intervention (BCI) for the NED-APRIQOT study. The objectives were to:

1. Design a BCI based on FIT.
2. Iteratively develop and inform the design of the BCI based on participants' perceptions of the content, design, and perceived impact on behaviour.
3. Observe and describe the context of the endoscopy centre environment which may impact implementation of the BCI.

3.2.2 Designing a theory informed BCI

A theory informed BCI was developed, using FIT,[69] and informed by endoscopy quality improvement literature,[11,133] results of the Cochrane review of audit and feedback (A&F),[63] and wider A&F literature as discussed in Chapter 1. In brief, this was designed to incorporate key concepts within FIT:

1. Standard identification: a headline detection KPI and process outcome behaviours which influence detection. These were agreed in the parallel Delphi process (Chapter 2) to ensure credibility among endoscopists.[134]

2. Identifying a feedback-standard gap, comparing performance to a standard: Clear targets for detection KPI, depicted as dichotomous or categorical compliance outcomes. This included:

   a. Motivation using a social comparison to peers.[134,135]

   b. Attention: multi-modal performance presentation with colour, text and graphical material. Discrepancies between standards and performance were colour coded.

   c. Velocity: A trend over time to assess degree of change and previous feedback cycles.[83]

3. Adopt strategy to eliminate gap: A short action plan generated by an algorithm including 'correct solutions':

   a. Process outcomes associated with achievable task-motivation behaviours which influence detection, including withdrawal time, proximal detection, Buscopan prescription and rectal retroflexion.

   b. A clear direction to change behaviour specific to the individual based on these measured process outcomes.

   c. Non-punitive and encouraging reflection.[65,134]

The research team met, discussed, and adjusted an initial draft of a BCI and topic guide for qualitative interviews. BCI version (V) 1 used in the first interviews and the final BCI V5 used in the trial are shown in Appendix B and C respectively.[64]

3.2.3 Cognitive interview study design

Independent endoscopists were recruited for face-to-face audio-recorded semi-structured cognitive interviews at their workplace. The aim was to explore their interaction with the BCI

and their perceptions of the BCIs' likely impact on their behaviours in clinical practice. Clinical leads of English NHS endoscopy centres eligible for the NED-APRIQOT study in the Northern region or West Midlands were contacted by email. Sites which responded were selected by convenience sampling for participants' availability, although a range of large and small centres were included. Eligible endoscopists were identified with centre's clinical leads[6] and purposively sampled with criteria comprising length of endoscopy experience and professional role (clinical lead, clinical-nurse endoscopist, gastroenterologist, surgeon, and trainee) to broadly match the UK endoscopy workforce.[111]

Participants were provided with a participant information sheet and, once any questions they had had been answered, gave written consent; the information sheet explained interviews would cover behaviours in endoscopy and A&F, and that their endoscopy performance data would be accessed before and discussed at the interview.

A BCI was prepared for each participant and presented at the interview. Participants were asked to talk aloud as they interacted with the BCI. A topic guide was used for probes, prompts and to explore participants' perceptions of the impact on their behaviour as they interacted with the BCI. This was reviewed and revised (if needed) after each centre's interviews to facilitate depth and data saturation.

Interviews were undertaken in batches/rounds of 3-4. After each round the BCI was refined. Recruitment continued until sampling strata were filled and data saturation was reached, defined as no new code clusters arising in the last three interviews after 10 complete interviews.[136] Interviews were transcribed removing any identifiable information for analysis with demographical data pseudo-anonymised using a unique participant identifier. Participants were provided with a copy of their anonymised transcripts to ensure anonymity, accuracy, and that their meaning was accurately conveyed.

Ethical approval was granted by the Newcastle University Ethics Committee and the NED-APRIQOT was approved by the Health Research Authority.

3.2.4 Ethnographic work

Ethnographic data were collected through observations by a single researcher (JC). Using a focussed ethnography approach,[137] short term field visits were made to endoscopy centres. A tour was given of the endoscopy unit by a participant and field notes were audio recorded. During visits ad hoc conversations with endoscopy staff members were reflected

on in an audio log after each centre visit. This work focussed on the context of adopting strategies in the BCI and process outcomes. The output of this work was a diagrammatic depiction of each endoscopy unit visited outlining:

- The room layout, equipment and staff position relevant to target behaviours,
- The timings of how endoscopy lists are organised, reviewing number of patients (points) allotted per list and interruptions from emergency procedures,
- Endoscopy nursing and assistant staff present in the room, perceptions on staffing levels in the unit generally and formal planned communication.

As an endoscopist JC worked or trained in five endoscopy centres in the UK over 5 years, and therefore had explicit and implicit background knowledge of the field of endoscopy, the functions of endoscopy rooms and equipment. Instead of "*bestrangement*" of the familiar this knowledge was used during ethnographic observations of endoscopy centres.[137]

3.2.5 Analysis method and iterative development of BCI

A framework Method analysis and iterative BCI changes were made after cognitive interviews, based on Gale et al [23] the following steps were undertaken:

1. **Familiarisation**: preliminary reading of the full transcripts. Transcript accuracy was checked by listening to the recordings and reading the transcripts in parallel, and added contextual information facial expressions and gestures from logs, tone of voice, sarcastic or comedic inflexions, words with emphasis and pauses. Reflective logs, observations and maps were reviewed.

2. **Generation of initial codes and map development**: all key concepts were identified in the interview transcripts, using open coding. Concepts were summarized into a descriptive code, ideally using the participant's own words. Maps were redrawn electronically, removing site identifiable details, and annotated with observation notes.

3. **Developing an analytical framework**: transcripts were analysed in batches of four. After each batch of interviews, codes were tagged to FIT themes of:
   a. Standard identification and credibility for each KPI in the BCI.
   b. Identifying a feedback-standard gap, including attention, the velocity of change and effort engaging in feedback.
   c. Adopting a strategy to eliminate the gap.

Within these FIT themes, codes were clustered into TPB behavioural, control and normative beliefs subthemes. Map findings were linked to relevant subthemes.

4. **Iteratively refining BCI**: Subthemes were used to change relevant sections of the BCI, which were then used in the next batch of interviews.

5. **Applying the analytical framework**: subsequent batches of transcripts were coded using these subthemes of the analytical framework, linked to relevant map findings, and the BCI iteratively changed.

6. **Charting data**: Subthemes were charted by FIT, TPB and BCI version in an excel matrix across the analytical framework.

7. **Interpreting the data**: Once interviews were completed, the framework was reviewed with the original data with quotes to ensure accuracy and triangulated with maps, observation data and personal reflections.

Interviews and analysis were undertaken by JC. Saturation of code clusters was defined as reached if no new clusters were identified for three interviews after the tenth interview.[136] Codes were logged with a clear audit trail. As the coding and analysis progressed the research team met regularly to review and discuss findings and iterations of the BCI.

3.3 Results: Participants and BCIs

3.3.1 Participant demographics and sampling

The participants (n=19) were interviewed from six endoscopy centres. The BCI version they viewed, their experience in years, clinical backgrounds and further accreditations in the Bowel Cancer Screening Programme (BCSP) or Train the Colonoscopy Trainers Course are shown Table 3.1. Participants fulfilled our sampling criteria. Ten identified as female, and nine as male. Age was recorded at interview in decades to avoid identification; five participants were in their thirties, ten in their forties and four in their fifties.

Site visits were undertaken at site 1-5, however due to participants' time constraints a tour of Site 6 was not possible. Summaries and maps from ethnographic field notes for sites 1-5 are shown in Appendix D.

Saturation was reached at the 19th interview with no new code clusters arising within the subthemes of the analytical framework for three consecutive interviews (Figure 3.1). No significant iterative changes were required after analysing transcripts from BCI V5.

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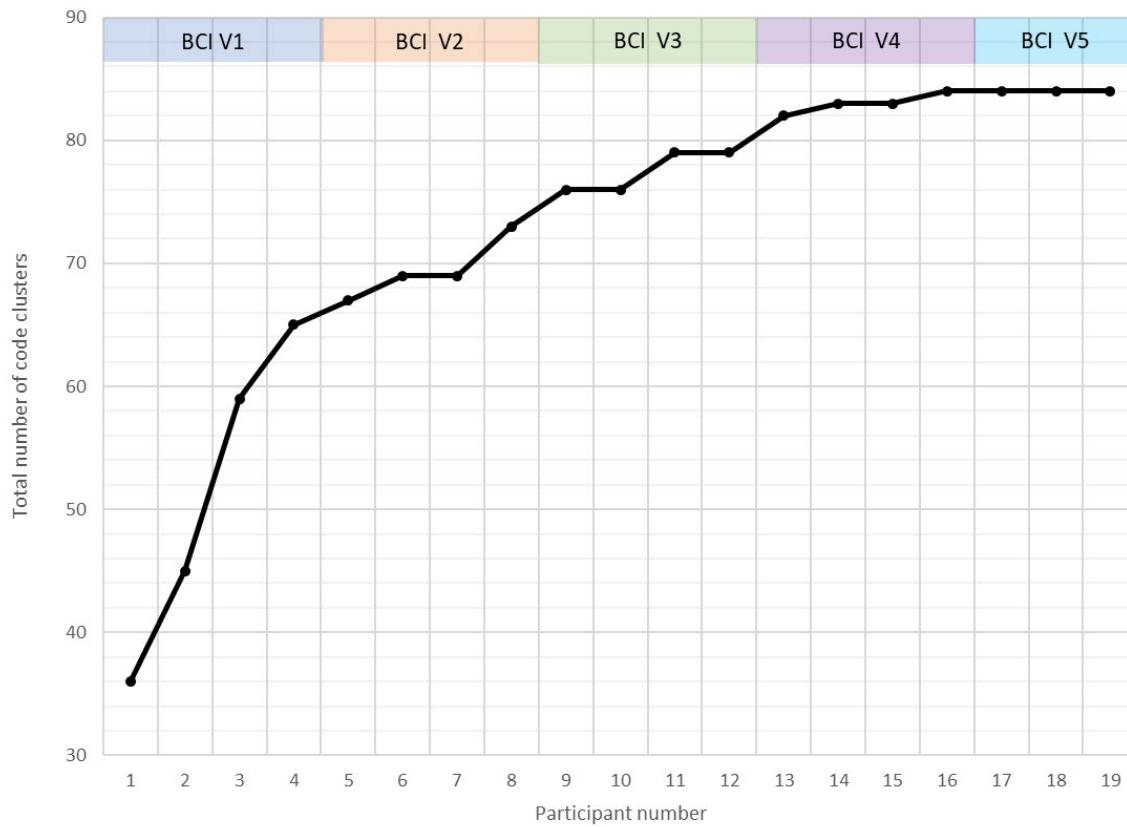
Figure 3.1 Chart showing the total number of code clusters in the framework analysis over 19 participant interviews. The behaviour change intervention (BCI) version (V) received by the participants are shown in colours at the top of the chart.

BCI version	Participant	Site	Endoscopy experience (years)	Professional title	Clinical background	Further accreditation	BCI headline detection vs. target
V1	P1	1	12	Consultant, unit-lead	Gastroenterology	BCSP, Trainer	Within
V1	P2	1	3	Clinical endoscopist	Nursing	Trainer	Above
V1	P3	1	7	Consultant	Gastroenterology	Trainer	Below
V1	P4	1	3	Consultant	Colorectal surgery		Above
V2	P5	2	23	Consultant, unit-lead	Gastroenterology	BCSP, Trainer	Above
V2	P6	2	22	Consultant	Gastroenterology	BCSP, Trainer	Above
V2	P7	2	20	Clinical endoscopist	Nursing	BCSP, Trainer	Above
V2	P8	2	2	Consultant	Colorectal surgery		Below
V3	P9	3	11	Consultant, unit-lead	Gastroenterology	Trainer	Not enough
V3	P10	3	12	Clinical endoscopist	Nursing	Trainer	Above
V3	P11	3	2	Consultant	Colorectal surgery		Not enough
V3	P12	3	6	Clinical endoscopist	Nursing		Above
V4	P13	4	7	Consultant	Gastroenterology	Trainer	Above
V4	P14	5	17	Clinical endoscopist	Nursing	BCSP, Trainer	Above
V4	P15	4	4	Consultant	Gastroenterology	Trainer	Within
V4	P16	5	2	Clinical endoscopist	Nursing		Below
V5	P17	1	2	Specialist Trainee	Gastroenterology	Trainer	Within
V5	P18	6	2	Specialist Trainee	Gastroenterology	Trainer	Above
V5	P19	6	26	Consultant	Colorectal surgery	Trainer	Not enough

Table 3.1 Endoscopy centres, participants' roles and BCI used. Further accreditation: BCSP – Bowel Cancer Screening Programme. Trainer – Train the colonoscopy trainer. BCI headline detection versus target: Below – headline detection was below target, within – headline detection was within target, above – headline detection was above target, not enough – headline detection was not calculated as not enough procedures were performed that month.

3.3.2 Format of each BCI version

BCI V1, the algorithm used to generate statements and action plans, and behaviour change elements were mapped to FIT and the Behaviour Change Techniques Taxonomy (BCTT) [64] and are shown in Appendix B.

The iterative changes to the BCI are divided into standard identification (pg. 60), identifying a feedback-standard gap (pg. 65), and adopting a plan (pg. 71).

As well as iterative developments of the BCI from these results, the results of the parallel Delphi process, development of a NED-APRIQOT website and emailing system, and statistical work to calculate procedure adjusted KPI were incorporated into successive versions.[6,138]. A summary of these features for each report version is in Table 3.2. Different unadjusted headline detection KPI from the Delphi process were used in BCI V1 including Polyp Detection Rate. All subsequent interviews used Mean Number of Polyps (MNP) adjusted for age, sex and indication.

BCI Version	Format	Participant access	Data from NED	Further information	Headline detection KPI
V1	Word document	MS Word or Printed	Manually compiled	Nil	Polyp detection rate, Mean polypectomy rate or Mean Number of Polyps (MNP), unadjusted
V2	Word document	MS Word or Printed	Manually compiled	Nil	MNP adjusted for case-mix if >5 procedures, MNP unadjusted for <5 procedures.
V3	PDF	Email	Manually compiled	Introduction document. Click links to website mock-up in PDF	MNP adjusted for case-mix*
V4	Email and PDF	Email	Automatically generated, limited data	Introduction document. Click links to pilot site	MNP adjusted for case-mix*
V5	Email and PDF	Email	Automatically generated, full data	Introduction document. Click links to active site	MNP adjusted for case-mix*

Table 3.2 BCI format, access by participants, data source and headline detection figure used.

If <5 procedures were performed that month this was highlighted, and an unadjusted total number of polyps and total number of procedures was provided.

3.4 Results: Standard identification

Below are the subthemes participants described surrounding standard identification of mean number of polyps (MNP) as the headline standard, and process outcomes. Changes made to the BCI are summarised in Table 3.3. Themes are described and illustrative quotations are shown in Appendix E Table E.1.

3.4.1 MNP standard identification

Participants receiving all versions of the BCI accepted detection of polyps as an important marker of colonoscopy quality and the *"main goal"* (Participant 12 (P12), BCI version 3 (V3)) of the endoscopist, highlighting the association between low polyp detection and post-colonoscopy colorectal cancer (Table E.1 Detection important). Participants held positive beliefs about the use of a mean number of polyps, having a broad inclusion of non-adenomatous polyps and polyps detected but not resected. It was perceived as benefiting from not being "*binary*" (P3, V1) thus avoiding the "*one and done*" phenomenon (P15, V4) (Table E.1 MNP acceptable).

As discussed in the Delphi process (Chapter 2) participants perceived potential problems of skewed data with MNP (Table E.1 MNP skew), from detecting multiple polyps either through documenting insignificant hyperplastic polyps dependent on polyp assessment skills (discussed in Gaming, Chapter 4), or from having seen cases with polyposis (multiple polyps). In later versions skew was addressed with a case-mix adjusted MNP, and a cap of 5 polyps to reduce the impact of a large numbers of polyps being detected in one procedure, this was acceptable, the "*rationale … sounds okay*" (P17, V5).

Participants held control beliefs that detection was dependent on their patient case-mix, a factor not under their control (Appendix E Table E.1 MNP and case-mix). The positive impact of certain colonoscopy indications, such as planned therapeutics or bowel cancer screening patients, on detection was highlighted. Participants described MNP adjusted for case-mix as "*fair*" (P18, V5) and created a "*level the playing field*" (P14, V4 Table E.1 MNP adjusted).
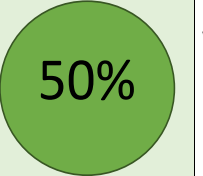
	Version 1	Version 5
BCI MNP headline		
MNP Standard identification	- Detection important - MNP accepted: broad and non-binary - Control belief: MNP skewed and unadjusted for case-mix	- Cap avoids skew - MNP adjusted for case-mix accepted
MNP Comprehension	- MNP calculation unclear - Getting used to a to higher figure and higher target	- Introductory and click link material improved comprehension - Breakdown of case-mix adjustment provided on website
BCI MNP headline for low numbers		
MNP credibility and low numbers of procedures	- Generally credible - High error perceived with low numbers - Sought longer period - Unclear how many procedure performed	- Email contact provided in case data not credible allowing participant to query it - If low numbers, provides an unadjusted number of polyps detected (rather than adjusted MNP) - Highlights 4-month figure

Table 3.3 BCI changes to MNP standard identification

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3.4.2 MNP comprehension

As MNP was a new KPI to participants, in BCI V1 and V2, there was some difficulty with initial comprehension and requests for a clearer explanation, *"I think maybe just a little caveat that says [how] this is calculated"* (P3, V1, Table E1 V1 and V2 comprehension). Participants highlighted *"without understanding what the data and evidence is behind [MNP], I can't really make an opinion on that really"* (P5, V2), and that *"you'd have to know where it was coming from and how it was coming and what the context is"* (P3, V1).

In BCI V3 and V4 notes were developed, explaining the MNP and its calculation. These were presented as an optional click link, leading to a PDF or website link. Not all participants engaged in these links, preferring to *"infer"* (P11, V3) meaning. When used, this improved comprehension, *"[comprehends MNP] So that's, then, looking at, you're not just taking one off and, yeah, yeah"* (P14, V4). Participants were used to a percentage figure of polyp or adenoma detection rate, and were unsure of what equivalent MNP to expect, *"What's a good MNP?' I don't know"* (P13, V4), and would take *"a good few months just to get used to"* (P15, V4, Table E1 V3 and V4 comprehension).

Participants engaging in click link data accepted the adjusted MNP but wanted more information about the breakdown of their procedures case-mixes and how the algorithm determined their case-mix adjustment, *"I would quite like to be able to find out how that was calculated or predicted, yes, just out of curiosity really"* (P13, V4), and suggested a table to assess *"What were the features of the patients that might have impacted onto it [adjusted MNP]?"* (P15, V4, Table E1 Case-mix breakdown)

In V5, introductory materials were sent prior to the BCI being delivered, and the website provided a table breaking down the participant's case-mix for the last 4 months and the impact on the adjusted MNP. This improved understanding of MNP and the BCI report, *"the rationale you've just described sounds okay"* (P17, V5), *"it's very easy to read, this part and it's quite easy to understand"* (P18, V5, Table E1 V5 comprehension).

3.4.3 MNP credibility and low number of procedures

Participants receiving all version of the BCI described the data as generally credible, saying it *"does feel about right"* (P6, V2) and *"makes sense"* (P10, V3, Table E1 Credible). As a new source of data an email address was included from V2 onwards for feedback about concerns about credibility: *"It's learning to trust NED and if that's going to be where my data is ... But I*

think it would be useful for me just to, if I feel that it doesn't feel right, just to look for any anomalies and to report that back." (P7, V2)

There was agreement with participants at all sites that monthly KPI calculated with low numbers of procedure risked high *"error"* (P3, V1) and may be perceived as *"statistical bollocks"* (P5, V2) or an *"extrapolation"* (P4, V1, Table E1 Low number high error). Participants with low numbers of procedures risked rejecting the data as not being *"useful or meaningful"* (P8, V2) and sought out data from a longer period of time (Table E1 Rejects monthly data).

Participants highlighted the importance of clearly displaying the number of procedures in the period, to allow them to take the data with *"a degree of salt"* (P11, V3). Although this information was provided on the report, it was not always clear to participants in V1-V3 (Table E1 Time and numbers).

In V4 and V5, if fewer than five procedures were performed the 4-monthly data was highlighted, but with a click-link to review a longer term KPI. This was seen as credible, as a *"better figure to look at"* (P14, V4) and *"the most helpful stuff"* (P15, V4). When provided, monthly KPIs were seen as a useful *"early warning"* (P13, V4) or to assess *"just in case you've dropped"* (P17, V5). The descriptions of the number of procedures were clear and *"good to get a bit of context"* (P15, V4, Table E1 Highlighting 4-month period).

3.4.4 Process outcome standard identification

Participants described the importance of the four process outcomes - proximal polypectomy rate (PPR), withdrawal time, hyoscine butylbromide (Buscopan) prescription and rectal retroflexion. Participants recognised that PPR was *"important in terms of cancer risks"* (P3, V1), particularly through *"identification of the sessile serrated polyps in the right colon"* (P6, V2, Table E1 PPR). Participants held beliefs that withdrawal time was important and associated with polyp detection (Table E1 Withdrawal time). Participants at all sites described behavioural beliefs that Buscopan increased detection of polyps, from both published evidence and personal experience, believing it achieves *"a greater distension of the bowel, so I can have a better look around"* (P11, V3, Table E1 Buscopan). Participants described retroflexion, also referred to as retroversion, as important and a behaviour endoscopists *"always do"* (P4, V1, Table E1 Rectal retroflexion). Unlike other process outcomes retroflexion was rarely discussed as improving polyp detection, and when

considering its detection impact one participant was "*not sure that rectal retroflexion would necessarily have the same effect as Buscopan*" (P15, V4).

3.5 Results: Identifying a feedback-standard gap

Below are the subthemes participants described surrounding identifying a feedback-standard gap using MNP. Changes made to the BCI regarding identifying the gap are summarised in Table 3.4. Themes are described and illustrative quotations are shown in Appendix E Table E.2.

3.5.1 Comparison of MNP to standard

In V1 and V2 participants were given two targets for unadjusted MNP, a minimum target of 80 polyps per 100 procedures, and an aspirational target of 100 polyps per 100 procedures (Table 3.4). These were based on an estimated conversion to ADR of 35% previously published, and an aspirational target of the top 20% detectors from an analysis on 100, 000 NED procedures.

There was a perception the "*target of 80 polyps per 100 procedure, it does seem to be rather high*" (P5, V2)*,* and only achievable if participants undertook bowel screening work or had a case-mix with a high number of polyps (Table E2 MNP target too high).

In V1 and 2, these targets were followed by a social comparison, stating the percentage of endoscopists who detected more polyps than the participant that month. Participants gave attention to this social comparison and described this as motivating, particularly for those who were already high detectors: "*I see now when I see 3% of colonoscopists found more polyps than me. I think I must have missed some. [laughter] I need to look harder.*" (P6, V2, Table E2 Social comparison). Two participants described the social comparison statement as confusing, preferring a graphical representation as a chart with a range (Table E2 Graphical form preferred).

From V3, the absolute minimum targets for adjusted MNP were removed due to a lack of credibility, and a social comparison was used as the headline target. Participants were given a headline adjusted MNP and social statement with a social comparison graph showing quartiles of performance nationally, with the top 25% in green, the middle 50% referred to as "*expected range*" in blue and the bottom 25% in red (Table 3.4).

	Version 1	Version 5
BCI targets		
Comparison of MNP to standard	- MNP target perceived too high - Motivated more by social comparison - Graphical comparison preferred - Written social comparator misunderstood, perceived as confrontational	- Set MNP target removed - Social comparison motivating – aspirational - Graphical comparison provided - Removed confrontational "*X% found more polyps than you*" statement.
Low numbers comparison	- False reassurance from MNP based on low numbers	 - No MNP given when low numbers - Increased attention to low numbers
Attention – Colour	- Red and green positive attention - Orange perceived as negative	- Blue used for expected performance, perceived as normal
Velocity – trend over time	- Attention to trend over 4 months - Attention to *dip* and review of performance - Used to monitor performance and process outcomes to assess impact of behaviour	*No changes*
BCI Effort	- Easy to engage with - Barrier to accessing click links due to log-in details - 8 minutes average review time, more if red flags - Few emotional responses	- Password reset option in introductory email - Provided contact details for centre lead support

Table 3.4 BCI changes to identify a feedback-standard gap

Participants in all quartiles described the social comparison targets as "*motivating me to go out and find more polyps*" (P9, V3, (Table E2 Social comparison motivating), for high performers top-quartile target gained attention "*I look to make sure that I'm above what is expected*" (P14, V4), and others perceived this as aspirational "*draw[ing] me towards being in that green box up there*" (P9, V3).

The written social comparison (*"% colonoscopists found more polyps than you"*) was misunderstood, and perceived as "*confrontational*" (P13, V4). One participant feared expected performance may wrongly be perceived as "*unsafe*" (P11, V3, Table E2 Social statement design). Subsequent versions removed the percentage in the statement aiming to keep the focus of attention on the preferred graphic.

3.5.2 Comparison of MNP with low numbers

In V1, participants with underperformance and low numbers were given a social comparison to endoscopists performing a similar number of procedures, chosen as a similar referent group. This was sometimes found to be reassuring. For example, Participant three's report showed a below target MNP but the social comparison was perceived as reassuring and they dismissed the gap between target and performance: "*[I'm] actually doing reasonably well within that cohort of people"* (P3, V1).

In V2, participants received a social comparison to all endoscopists irrespective of performance or the number of procedures, but false reassurance was still evident. P8 had a high MNP from the four procedures they had undertaken in the last month, but their four-month MNP was low. Their BCI's social comparison stated: "*Keep up this months' excellent work, 10% of colonoscopists found more polyps than you this month*", which P8 perceived as "*not helpful*" and did not "*encourage people to look at the actual data"* (P8, V2, Table E2 False reassurance).

In subsequent versions if fewer than five procedures were performed in the past month, monthly adjusted MNP or social comparison were not generated but instead the report displayed the unadjusted number of polyps detected, the number of procedures, and signposted a 4-monthly adjusted MNP.

The missing data caught the attention of participants, who accepted this "*I'm not too fussed … because the denominator is so small*" (P19, V5), but considered increasing their number of procedures, "*it's already nudging me towards picking up that list that I might otherwise have left*" (P9, V3), or defended their low numbers, "*Someone has to scope on a Monday … I'm far more interested … to know that when I do do it, it's to an acceptable standard.*" (P11, V3, Table E2 Attention to low numbers).

3.5.3 Attention to feedback-standard gap - colour

In V1 and V2 of the BCI, performance above the aspirational standard was highlighted in green and performance below the minimum standard in red. In V3 to V5 green and red were used for the top 25% and bottom 25% of MNP respectively. Green and red colours drew attention with a clear reaction of *"'Oh good, I'm green,' or, 'Oh sh*t, I'm red.'"* (P1, V1). Red particularly in the headline prompted more attention to the rest of the report, *"hang on you really need to look at this"* (P4, V1), and was perceived as positively highlighting an area that *"needs to be improved"* (P13, V4, Table E.2 Red and green positive attention). Some participants perceived red as *"a negative colour, so it's obviously a bad report"* (P16, V4) however this would still *"trigger"* and *"make people act"* (P9, V3) to consider behaviour change (P9, V3, Table E.2 Red negative attention).

In V1 and V2 orange was used for performance above minimum but below aspirational standards. Orange was perceived as a *"slightly negative looking colour"* (P1, V1), and not reassuring, *"I'm not reassured by that [orange colour], I'm more worried by that"* (P8, V2,Table E.2 Orange negative). In V3 to V5 blue was used for the middle 50% or expected performance. Blue this was perceived as *"expected"* (P15, V4), *"fine"* (P19, V5) and *"feels normal"* (P9, V3) although participants with blue outcomes were motivated to achieve a green result, *"I would prefer to get out of the blue and into the green"* (P14, V4, Table E.2 Blue normal).

3.5.4 Velocity - Trend over time

A trend of MNP over the last 4-months was shown on all BCI versions, which consistently drew participants attention (Figure 3.2). Participants described the trend being useful in providing a *"context"* (P3, V1) to other months' results, and *"more helpful than a snapshot….[promoting] high quality inspection in every procedure rather than chasing it when you are having a bad month"* (P15, V4). Participants described using the trend to assess if underperformance was *"static"* (P6, V2) or *"consistent"* (P11, V3) and if *"motivated to improve their figures then they would seek opportunity to do that"* (P6, V2) and would prompt them to *"talk to someone about it"* (P11, V3, Table E.2 Trend review).

Participants also gave attention to any *"dip"* (P6, V2) or *"blip"* (P7, V2) in performance along the trend line, alerting them to previous or current relative underperformance. Participants described reflecting on potential causes of the dip in performance, to *"unpick that and*

unravel … what was different?" (P7, V2), wanting "*to know a little bit more about*" (P14, V4) the procedures and reflecting on them: "*there were more procedures done… the more I do I worry about the detection rates because of the time constraints*" (P10, V3, Table E.2 Dip review).

Participants described reviewing the trend of process outcomes to assess for impact on detection, particularly Buscopan, "*It will be interesting to see if I change now with interventions, with the Buscopan and stuff*" (P18, V5), and withdrawal time, *you get that positive feedback that you've slowed your time and your detection rate has got better*" (P3, V1, Table E.2 Process outcome trends).

Mean number of polyps (MNP) over the last 4 months

| Overall adjusted MNP per 100 procedures since August 2019 | 80 | This is within the expected range of 43-112 MNP. | Information |

| 0 | 43 | 80 | 112 | 162 |

▮ Bottom 25%   ▮ Within expected range   ▮ Top 25%

MNP (adjusted) Aug 2019 to Nov 2019

	Aug 2019	Sep 2019	Oct 2019	Nov 2019
MNP (Adjusted)	67	111	37	88
No. Procedures	39	23	27	18
You detected this many polyps	72	117	41	83
We expected you to find this many polyps	74	73	77	65

Figure 3.2 Trend over time

3.5.5 Feedback effort

Participants described the automated report with endoscopist level data as an "*easy win*" (P1, V1). Participants described taking "*a while to get my head around*" (P17, V5) the new report, but the information was "*easy to see*" (P4, V1) and "*if you needed to drill down … the information is all there for you to do that*" (P16, V4) and without a significant cognitive load: "*I'm able to do it and I have a very short attention span*" (P19, V5, E.2 Low effort).

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Accessing further information in click links was dependent on remembering login details to the JAG website (E.2 Log-in barrier). Therefore, a password reminder and reset email were created at the start of the trial. Two senior endoscopist participants in Site 2 were concerned not all endoscopists would "*read emails very much and … disengage*" (P5, V2), and were unsure if the BCI should be "[*rolled*] *out across the whole department initially because I think there'd be a lot of opposition. You could, is that a reason not to do it? I don't know*" (P6, V2, Table E.2 Opposition), however, this was not described at other sites.

Participants were asked how long they would spend looking at the BCI. Seventeen participants responded with a mean of 8 minutes (range 1 - 30 minutes); nurses had a higher average (16 minutes, range 5 - 30 minutes, n=5) and surgeons a lower average (3 minutes, range 1 - 5 minutes, n=4, Figure 3.3). Participants receiving all version described they would spend longer reviewing the report if problems in red were highlighted, "*when there's something that is below the standard, that would make me look to research into why and spend a bit more time*" (P7, V2) and considered a plan, "*I would have a quick look and say, 'Right. I am doing fine. I am doing fine. Oh, that's red. What do I need to do?'*" (P15, V5, Table E.2 More time and plan if red).

Participants described the report as "*non-intimidating … friendly*" (P15, V4) and that interacting with the report "*is something I wouldn't get upset about*" (P2, V1, Table E.2 Non-intimidating). One unit-lead was concerned about "*how some people will react to [the BCI]*" (P9, V3), and suggested contact details for the unit-lead were clearly available on the report so "*they had an opportunity just to drop us an email, or give us a ring if they were troubled by it*" (P9, V3). This was included in subsequent versions of the BCI.

One participant had a negative emotional response during the interview, prompted by their low MNP, particularly the social comparison statement which was removed on subsequent reports. However, they were still motivated by the report, and went on to make a plan about improving their data accuracy and prescribing Buscopan; this is described in quotations and an extract from the reflective logs (Table E.2 Emotional response).
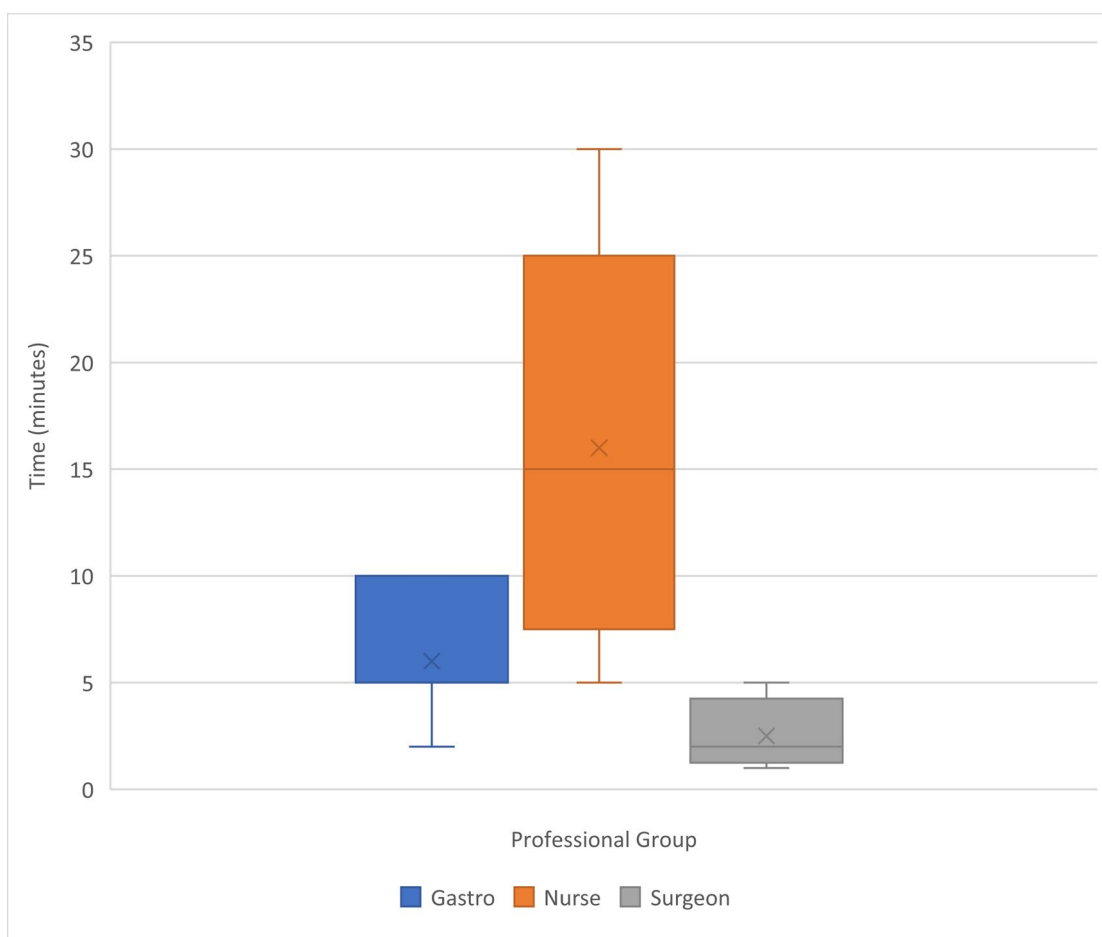
Figure 3.3 Box Plot of suggested time required to review the BCI by professional background. (Gastro – gastroenterology consultant or trainee endoscopist, Nurse – clinical nurse endoscopist, Surgeon – surgical endoscopist.)

3.6 Results: Adopting a plan and process outcomes

Below are the subthemes which were derived from participants describing adopting a plan and the process outcomes provided. Changes made to the BCI regarding adopting a plan are summarised in Table 3.5. Themes are described and illustrative quotations are shown in Appendix E Table E.3.

	Version 1	Version 5
Process outcomes	<table><tr><td>Proximal polypectomy rate</td><td>20%</td><td>Aim >25%</td></tr><tr><td>Mean withdrawal time</td><td>9 minutes</td><td>Aim >7 min</td></tr><tr><td>Buscopan Prescription</td><td>Unkown%</td><td>Aim >50%</td></tr><tr><td>Rectal Retroversion</td><td>100%</td><td>Aim >90%</td></tr></table>	Proximal polypectomy rate — 17 % — Aim >20% * When adjusted for indication your PPR is within the expected range Mean withdrawal time — 6 min (to nearest minute) — Aim >10 minutes Buscopan Prescription — 40% (to nearest %) — Aim >50% Rectal Retroflexion — 100% — Aim >90%
Adopting a plan using process outcomes	- All process outcomes had actionable behaviours - Further information needed on trend and performing process outcomes - Participants planned behaviour change despite low credibility in data from low numbers	- Provided further information links on trend, evidence and tips for performing behaviours associated with process outcomes
Proximal polypectomy rate (PPR) standard identification	- Important and associated with cancer risk - Unadjusted PPR viewed as case-mix dependent - Changed locus of attention	- Unadjusted PPR target lowered to 20% in addition to providing a PPR adjusted for case-mix
Withdrawal time standard identification	- Associated with polyp detection - All achieved 7-minute target	- Changed to 10-minute target and plan recommendation, accepted and aspirational
Other plans	- Talked to colleagues and considered coaching - Considered using *Endocuff*[4]	- Encouraged participants to discuss performance with others - Monthly tips on organising coaching and observation, and Endocuff use

Table 3.5 BCI changes to adopting a plan

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[4] *Endocuff* is an accessory device mounted on the end of a colonoscope, with a row of soft finger like projections (Figure 5) which fold back during insertion, and on withdrawal hold back colonic folds. This has been shown to improve adenoma detection rate in bowel cancer screening patients[213].

3.6.1 Process outcomes

Process outcomes of proximal polypectomy rate, withdrawal time, Buscopan prescription rates and rectal retroflexion rates were displayed in a table stating current performance, a target, and a link to further information about the behaviours. An automated decision matrix algorithm generated a plan for participants based on their performance of these process outcome KPI, targeting one underperforming process outcome (Appendix C).

The breakdown of process outcomes with associated behaviours was perceived as helpful in identifying "*very specific*" (P14, V4) actions, a clear target of "*what we'd like you to get*" (P3, V1) and through these plans low performance "*isn't a helpless situation in that there are ways that you can get your polyp detection rate up*" (P15, V4, Table E3 Actionable behaviours). Process outcome behaviours were perceived as task-motivation processes and "*not major changes to your practice*" (P11, V3), and plans prompting these behaviours and asking participants to engage nursing colleagues in prompts were perceived as effective, "*it's remembering to do it, it's the situation awareness to do it when you're doing a colonoscopy*" (P11, V3). Ethnographic work showed all units used a WHO checklist or huddle before each procedure, which could be used to incorporate these prompts (Appendix D).[5]

Participants receiving V1 and V2 requested further information in click-links. Participants requested a trend of process outcomes, "*It would be interesting to know what the Buscopan prescription was in the past few months. Is that linked together?*" (P1, V1), and demonstrating "*what the data and evidence is behind*" (P5, V2) all recommendations (Table E3 Further information). These were incorporated into the links provided in subsequent BCIs.

Participants described how the BCI format and process outcomes drew their attention to the feedback-standard gap and prompted behaviour change even when there were low numbers of procedures. Participants recognised "*the confidence intervals are so wide … [but] I'd still interpret that badly. I'd still go, 'Sugar, I need to up my game here'*" (P9, V3). Another explained after reviewing red areas on the report "*the numbers are so low you can't extrapolate any useful and meaningful data … [but] I might start using Buscopan actually, yes*" (P8, V2). One unit-lead recognised low numbers didn't have "*statistical value*" but "*results in most [behaviour] change*" (P5, V2, Table E.3 Despite low numbers).

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[5] Nursing prompts are discussed in detail in Chapter 4.

For behaviours that were perceived as having higher dominance (see Turning, pg. 78) or having potential risks to the patient (see Buscopan, pg. 76, participants described assessing the "*pre-test risk of there being polyps*" (P3, V1) before considering undertaking them. Participants described being more likely to perform detection behaviours in patients with a "*higher suspicion of something*" (P18, V5), and less likely in patients with a low risk of detecting polyps or cancer, such as "*young people*" (P13, V4, Table E.5 Pre-test risk).

3.6.2 Proximal polypectomy rate (PPR)

Participants received an unadjusted PPR, with a PPR target of 25%. Participants described that the unadjusted PPR was dependent on "*case selection*" (P6, V2), particularly bowel cancer screening, and the experience of the endoscopist having the "*necessary skill to take that off*" (P11, V3, Table E.3 Case and skill dependent). From BCI V4 unadjusted PPR target was lowered to 20% and participants were given a separate PPR adjusted for case-mix highlighting if this was above, below or expected performance (Table 3.5). This adjustment was recognised as important "*for proximal polyps … I might be scoping people who aren't really expected to have a lot of polyps in general*" (P13, V4). A social comparison and click-link information was provided to enable participants to see the data in more detail, "*[clicks on link for PPR] So, that data from national endoscopy database, proximal detection rate of 25% of endoscopies … national mean is 13%. So, am I okay with that*" (P17, V5).

A PPR was generally a new concept to participants, who were "*curious as to why that is*" (P2, V1) if PPR was low. Participants' attention focussed on reviewing proximal detection behaviours, "*am I coming out of the right colon a bit too fast?*" (P13, V4), and "*breaking [withdrawal] down into regions … to think a bit more about segmentally*" (P4, V1, Table E.3 Attention to PPR plan).

Participants with low PPR were given a plan to time withdrawal and "*spend four minutes looking for subtle right sided polyps*". Participants described the plan as having low dominance, being "*straight forward to look at and do*" (P1, V1) and made plans to time proximal withdrawal (Table E.3 Low dominance). Participants flagged that identifying the splenic flexure and timing proximal withdrawal, although important, may be difficult and risked "*overloading people*" (P15, V4). This was suggested to be addressed with endoscopist and nursing educational support using a "*framework to do it*" (P9, V3), and "*access to Scope Guide*" (P5, V2, Table E.3 High dominance). The Scope Guide imaging system shows the

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shape of the colonoscope, which ethnographic work showed was not available in all rooms at Site 1 and 2 (Appendix D).

3.6.3 Withdrawal time

V1 and V2 of the BCI provided the recipient's mean withdrawal time, and a target of 7 minutes. All participants at these sites had mean withdrawal times above this, therefore in V3 and V4 an aspirational target of 10 minutes was provided; however the plan algorithm recommended a withdrawal time of "*at least 7 minutes*" (Appendix C). This was flagged as being unclear by P13, who rejected the plan:

> "*I find a bit of it conflicting like this, 'Your mean withdrawal time is under ten minutes. A withdrawal time of under ten minutes is associated with low detection of adenomas' but 'aim to spend at least seven minutes withdrawing'. … That annoys me. … Do they want you to spend ten minutes withdrawing or do they want you to spend seven minutes withdrawing? … if ten is what is recommended and it's what everybody is going for then that's fine but then say, 'This month, ask an assistant to time your withdrawal and aim to spend ten minutes withdrawing' and not seven. I just ignored that plan because I think it is ridiculous.*" (P13, V4)

In V5, the aspirational target of 10 minutes was used and the plan was aligned asking participants to aim "*to spend at least 10 minutes withdrawing*" (Table 3.4 and Appendix D).

Participants described personal withdrawal time targets varying from 6 to 12 minutes (Table E.3 Personal targets). One participant disputed the evidence for a 10-minute target, preferring an 8-minute target: "*achieving more than 10 minutes …the gains are minimal so I think … it would be more helpful to say, 'Why don't you try and spend at least eight minutes?'*" (P15, V4). However, the higher target was accepted by most participants, "*obviously ten minutes is now the adequate time*" (P10, V3). When current performance was above 7 minutes participants made plans to increase withdrawal time to 10 minutes: "*I have never concentrated on [my] withdrawal time of 8 minutes, I must do 10 minutes … So, those things I can see doing.*" (P17, V5, Table E.3 Ten minute target accepted).

Participants accepted the plan to slow down and time their withdrawal as "*sensible and smart*" (P1, V1). Receiving data about withdrawal time would provide "*positive feedback that you've slowed your time and your detection rate has got better*" (P4, V1) or negative feedback identifying a "*need to change something*" such as "*coming back more slowly*" (P3,

V1). Providing withdrawal time targets were perceived as educational "*especially if they [endoscopists] trained quite a long time ago*" (P9, V3, Table E.3 Slowing down plan).

Ethnographic work showed all sites had a clock on the endoscopy monitor which was in view of at least one member of nursing staff during procedures. Nursing staff at sites 2 and 6 routinely timed withdrawal, and this was commonly done when requested at site 5 and self-reported by the endoscopist at sites 1, 3 and 4 (Appendix D). Self-reported times were thought to be less accurate, "*I think it is, it can be quite subjective*" (P2, V1), however, receiving any withdrawal time data was still perceived to prompt behaviour change, noting "*a conscious effort to look [at the clock for withdrawal time]. It does make me think about how long it's taken me to come back. I think I've definitely slowed down*" (P3, V1, Table E.3 Self-reported effective).

The plan to monitor withdrawal time was described as low dominance but was under the control of remembering to check the time, "*the problem I would have is I can't remember the time because you're so focused on so many other things going on*" (P17, V5). Using nursing staff to assist timing was perceived as easy, "*the nurse will obviously say I will put the timer on*" (P18, V5), and reduced the "*worry*" (P15, V4) of forgetting (Table E.3 Plan low dominance). At most sites at least one nurse was positioned to see the monitor during colonoscopy, to assist with timing; however, at site 2 both nurses were positioned behind the monitor during the test making timing withdrawal more difficult (Appendix D, see Chapter 4).

3.6.4 Hyoscine butylbromide (Buscopan)

Participants described using Buscopan in their clinical practice, although the target of 50% was new to them, "*I didn't know Buscopan prescription was in, I didn't even know that was a target*" (P8, V2). However it was viewed as "*important*" (P17, V5) and achievable, "*I would say, probably about 80% [of patients] I would give [Buscopan] to*" (P14, V4, Table E.3 Buscopan target).

Participants noted discrepancy between their practice and the Buscopan target, and described being motivated to give Buscopan, "*I can focus on that now*" (P4, V1, Table 18: Buscopan plan). Participants who did not routinely give Buscopan described planning to change behaviour "*maybe I should have a look at [Buscopan] and particularly in light of the fact that my polyp detection rate seems to be a little bit low*" (P8, V2), and using the report

to monitor changes in polyp detection from its use *"if I give the Buscopan, as from now, routinely, it would be interesting to see [if] the proof is in the pudding"* (P12, V3).

Ethnographic work demonstrated all sites had Buscopan available in the endoscopy room, and this was drawn up and ready if requested by the endoscopist (Appendix D). Buscopan was described as a low dominance behaviour as *"the nurses are happy and it's easy to get access to"* (P18, V5, Table E.3 Low dominance). Giving Buscopan was dependent on endoscopists remembering to ask for the medication, *"Did I give Buscopan? No, damn."* (P12, V3) and encouraging nursing staff prompts to remind them about Buscopan was perceived to be effective (Table E.3 Remembering Buscopan).

Participants discussed patient safety concerns and the risk of tachyarrhythmias in frail patients controlling their use of Buscopan, *"I think when they, [Medicines and Healthcare Regulatory Authority (MHRA)] alert came out … about the use of Buscopan in sort of ischemic heart patients and whatever. Then I think that gave everybody, we were told very much not to be doing it. Prior to that, I'd used it an awful lot more"* (P7, V2, Table E.3 Buscopan safety).

Three participants described how they would very rarely use Buscopan due to safety concerns or personal clinical experience of limited benefit in their routine practice, but would prescribe if there was *"spasm"* (P17, V5) or evidence that *"it was going to benefit my practice and the outcome"* (P10, V3, Table E.3 Not used).

3.6.5 Rectal retroflexion

Rectal retroflexion was provided with a target of 90%. Participants accepted this target (Table E.3 Target accepted). Four participants did not reach the target. These participants described performing the behaviour of retroflexion was under the control of patient comfort and *"case-mix"* (P9, V3) particularly patients with inflammatory bowel disease or post-operative anastomoses. Two participants described personal clinical experience of complications of retroflexion causing trauma to the bowel, making them *"very cautious"* (P18, V5, Table E.3 Retroflexion controls).

Although a retroflexion plan was not used (as this was lower down the action plan decision matrix than other process outcomes) they described reviewing retroflexion data as *"useful"* (P8, V2), and an easy thing to be prompted on, *"they [nurse assistants] would be willing to remind me"* (P9, V3). The linked educational information in V5 allowed one participant to *"feel comfortable trying it and see if it works"* (P18, V5, Table E.3 Retroflexion plan).

3.6.6 Turning the patient on withdrawal

The action plan decision matrix plan produced a plan advising on turning the patient on withdrawal (turning) if no process outcomes were below target. A '*monthly tip*' explaining turning was provided in all draft BCIs (Figure 3.4) [however the intention was that a new tip would be displayed each month in the trial].

Participants described beliefs that turning "*increases polyp detection rate*" (P1, V1) through "*distending the colon*" (P17, V5) for "*optimal visualisation*" (P10, V3, Table E.3 Increases detection). Participants described making plans around turning, as a "*helpful*" (P6, V2) reminder, and when recognised as a new behaviour, planned to "*give it a go*" (P3, V1,Table E.3 Turning plan).
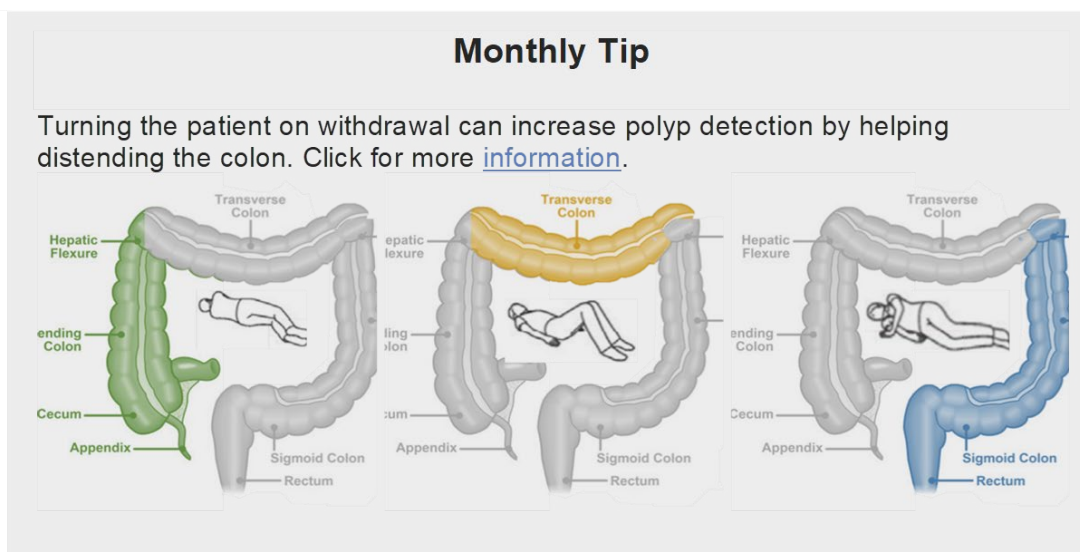
Figure 3.4 Turning the patient plan and first month tip

Participants described the task dominance of turning the patient, perceiving "*a bit of a learning curve*" (P4, V1) initially and a "*tendency to knock the scope back a bit*" (P6, V2). This improved with experience, "*I don't think there is anything now that I find difficult….I used to really huff and puff [at turning]*" (P15, V4) and observing others "*I mean when I saw it being done it worked very well and I tried it straight away and it worked*" (P10, V3 Table E.3 Turning task dominance).

Participants described if the views of the lumen were good they were "*less inclined to move a patient*" (P6, V2), and usually only considered turning "*when my views are obscured*" (P14, V4, Table E.3 View dependent). Participants described how adopting a turning strategy was limited by patient factors, including comfort, "*if a patient's uncomfortable I won't keep him on that side*" (P14, V4), being "*older and frailer*" (P13, V4), and "*also the patients' mobility as well. Some patients aren't easy to move neither*" (P10, V3 Table E.3 Patient factors). Turning usually involved assistance with nursing endoscopy staff, "*[occasionally] it's taking three nurses just to move them a quarter turn*" (P19, V5). Participants perceived an initial "*bit of a huff and a puff from the patient or the nurses that you're turning them*" (P3, V1), however this was addressed with good communication and experiencing the benefits, "*they [nursing colleagues] see that pay off*" (P15, V4, Table E.3 Huff and puff).

3.6.7 Monthly tips

The provision of an educational monthly tip was perceived as positive:

> "*I really like the tip as well. I think that is quite a good thing for new people but also maybe for people who have been scoping for years and years and years just as a bit of a reminder …Colonoscopy practice has changed lots*" (P15, V4).

Participants described planning to talk to colleagues about performance, including "*my fellow nurse endoscopists*" (P12, V3) or "*experienced colleagues*" (P4, V1) to discuss their behaviours or plan observation, "*I should have someone watch my technique*" (P4, V1, Table E.3 Colleague support). The final BCI encouraged participants to discuss their performance with others, and provided contact details for their centre lead. A monthly tip was developed for the trial giving advice on organising coaching and observation (Figure 3.5).[6]

Participants described barriers of space to "*interact and discuss*" (P18, V5), and depending instead on "*vague chat[s] in the corridor*" (P1, V1, Table E.3 Social spaces). Ethnographic work showed that endoscopy units within sites 2, 3 or 4 did not have communal staff break areas (Appendix D).

Participants described considering using the accessory device Endocuff (footnote pg. 72), to improve their polyp detection, if other process outcomes were above target, "*I probably wouldn't necessarily slow down more but think … Do I look at using the Endocuff or*

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[6] Plans to discuss performance with colleagues, observation and coaching are discussed in detail in Chapter 4.

something like that?" (P3, V1, Table E.3 Endocuff). Participants described these being available, after sites were involved in a clinical trial, but being unsure of their benefit, *"we did start to use Endocuffs … I don't know if they made much of a difference"* (P10, V3, Table E.3 Unclear Endocuff benefit). A monthly tip was developed for the trial summarising the evidence of benefits and risks of Endocuff (Figure 3.5).

Use an Endocuff

If your patient has a high-risk indication for polyps (polyp surveillance or bowel cancer screening), think about using devices to enhance visualisation.

The ADENOMA trial demonstrated higher adenoma detection rate with Endocuff vision (Ngu 2019).

You may have seen this before, but we thinks it's important, click **here** to see why.

Tip – consider coaching

To help with problem solving, try coaching.

Coaching is using a local colleague, to help with a specific skill or aspect of colonoscopy, to find strategies to solve a problem, over a limited number of sessions.

Try and email a colleague or chat to your endoscopy lead about getting coaching lists into your normal practice. Read more **here**.

Figure 3.5 Monthly tip examples

3.7.1 Results: Final BCI mapping

The final BCI V5 was mapped to the BCTT (Figure 3.6), demonstrating sixteen BCTT elements were used. An explanation of the annotated BCTT elements and the action plan algorithm is shown in Appendix C.

Figure 3.6 BCI V5 mapped to the Behaviour Change Technique Taxonomy elements

The following annotations are mapped to elements of the figure:

- 9.1 Credible source
- 1.6 Discrepancy between current behaviour and goal.
- 7.2 Green cue signalling reward. Red, blue, green colour coding throughout.
- 2.7 Feedback on outcomes of behaviour.
- 10.4 Social reward statement
- 1.1 Goal setting behaviour
- 6.2 Social comparaison.
- 1.2 Problem solving
- 1.3 Goal setting outcome
- 1.4 Action planning
- 7.1 Prompts
- 1.1 & 1.2 Goal setting and problem solving
- 1.6 Discrepancy between current behaviour and goal
- 2.7 Feedback on outcomes of behaviour
- 4.1 Instruction how to perform behaviour
- 1.5 Review behaviour goal encouraged.
- 3.1 Social support (unspecified)
- 4.1 Instruction on how to perform behaviour
- 2.7 Feedback on outcomes of behaviour
- 2.4 Self-monitoring of outcomes of behaviour
- 1.6 Discrepancy between current behaviour and goal
- 2.7 Feedback on outcomes of behaviour
- 5.4 Monitoring of emotional consequences

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3.8 Discussion

3.8.1 Summary of principle findings

This chapter describes the development of a theory-informed BCI designed to improve polyp detection using feedback of performance and a personalised plan based detection-associated process outcome behaviours. Case-mix adjusted MNP was accepted by participants as a credible detection KPI, and comprehension of this new measure was improved with introductory and explanatory materials.

A graphical social comparison of adjusted MNP with an aspirational target of the 75th percentile of performance was perceived as motivating. Statements ranking endoscopists by performance nationally were perceived as confrontational and removed.

Those with a low number of procedures in a month perceived a high risk of error and data from a longer 4-month period was signposted and monthly adjusted MNP removed; however these participants still adopted a strategy to improve process outcome performance. When those with a low number of procedures did not receive a monthly adjusted MNP, their attention focussed on the number of procedures they performed.

Using red and green background colours for KPI was effective at shifting attention to areas of underperformance and achievements. Orange was perceived to have negative connotations therefore blue was used to highlight expected performance and still motivated participants to achieve a green result. Participants gave attention to their trend over time, used this to review dips in their performance, and planned to use this to monitor performance change after adopting a strategy. The BCI was perceived as being easy to engage and interact with. Accessing the click-link information was under the control of remembering log-in details, therefore introductory materials were developed to prompt these.

There were few emotional responses to the BCI; one participant who had an emotional response to underperformance engaged in a plan to improve, and contact details for a local centre lead were provided if further support was required. Providing process outcomes with task-motivation behaviours reduced perceptions of helplessness when reviewing underperformance, and participants were happy to use personalised action plans to adopt a strategy to improve detection. Process outcomes of proximal polypectomy rate, withdrawal

time, Buscopan prescription and rectal retroversion were all believed to be important for detection and associated with low dominance behaviours which they could adopt. Ethnographic mapping identified few environmental barriers: WHO checklists facilitated plans for prompts, clocks were in view during procedures to time withdrawal and Buscopan was available. However, not all rooms had a Scope Guide to aid timing segmental withdrawal and the limited social spaces may reduce opportunities for colleague support.

Participants considered the likelihood of the patient having polyps before prescribing Buscopan or turning the patient on withdrawal. Providing a PPR changed the locus of attention of endoscopists to consider a timed segmental withdrawal strategy. Most participants reached withdrawal time target of 7 minutes, therefore an aspirational 10 minute target was used in plans and encouraged slower withdrawal. Participants considered adopting strategies of discussing their performance with others, coaching, and using adjuncts to endoscopy; monthly tips were welcomed even by endoscopists with high performance and developed to prompt these behaviours.

3.8.2 Strengths and limitations

A strength of this work is the theory informed nature of the BCI development, the first of its kind in the field of gastrointestinal endoscopy. A recent systematic review of electronic A&F BCIs identified nine electronic A&F studies and showed only two explicitly reported using theory to inform the intervention design.[139] The Cochrane review of A&F recommended use of theory in BCI development to improve effectiveness.[63] This BCI was developed using FIT[69], the intervention elements were mapped to the BCTT,[64] and its effectiveness has gone on to be assessed in the NED-APRIQOT.[6]

The identity of the interviewer (JC) as an endoscopist, and his prior professional interactions with some of the study participants, influenced the dynamic of the interviews. Participants were aware JC was an endoscopist and comfortable using the shared technical language and socio-cultural references. JC was acquainted with four participants through academic or clinical work (P2, P4, P15, P17) and had previously received training from 5 participants (P1, P3, P9, P10, P13). These acquaintances and JC's juniority to participants in age and position as a trainee relaxed the participants and helped build rapport.

A limitation of this work is the unreal nature of cognitive interviews, including three potential effects. Firstly, although participants engaged well with the BCI and made plans to

change behaviour, these were isolated observed interactions with the BCI, likely increasing motivation to engage. Secondly, participants were asked to describe how they would react or what they would do 'in the real world', however this was hypothetical and may differ from how they would actually react and behave. Thirdly, participants were aware that JC was monitoring behaviour and involved with the NED-APRIQOT, and likely the development of the BCI. This may have pressured participants to temper negative or over emphasise positive reactions. However, participants were made aware of the importance of their honest opinion and interaction, and JC's reflective logs document that these seemed genuine, with no shortage of criticism.

Endoscopy unit-leads were used to identify eligible endoscopists. In sites one and two JC noted a selection bias of centre leads volunteering endoscopists with an interest in colonoscopy quality. Although not part of the formal purposive sampling criteria, from site 3 onwards this risk was highlighted to centre leads to emphasise the importance of including 'regular' endoscopists. As all participants were required to agree to be interviewed and receive feedback about their performance the recruitment process may still have introduced a bias in selecting endoscopists with an A&F interest or a motivation to improve performance.

Participants described how their interaction with the BCI would change over time, as familiarity increased with the format, and described checking behaviours for the impact of plans. Unobserved engagement and changes to engagement over time is not assessable in single cognitive interviews. A systematic review of engagement in digital behaviour change interventions similarly found engagement was poorly assessed, and either self-reported descriptions of hypothetical future usage, as described here, or measuring engagement retrospectively, with little literature assessing the association between these.[140] Prospectively assessing engagement and changes in interaction over a period of months would be best assessed with a pilot study. This was planned with interviews after multiple BCI reports as part of the NED-APRIQOT, however, this was dropped due to the impact of the coronavirus pandemic in March 2020. Engagement with the BCI and access to the website through click links is being assessed as a secondary outcome in the NED-APRIQOT and a process evaluation is planned to include qualitative interviews exploring interaction with the BCI within the trial.

3.8.3 Strengths and limitations in relation to other studies

The UK has a diverse workforce undertaking colonoscopy,[111] and a strength of this development work was the inclusion of endoscopists from a the full range of professional backgrounds and experience, in combination with the richness of the data this suggests the themes are applicable to the wider UK endoscopy context and the full range of professionals recruited into the NED-APRIQOT.[141] There were no clusters of codes dominated by one professional background, although nurse endoscopists planned to spend more time reviewing the BCI than other professional groups. Inclusion of different professional backgrounds is lacking in the literature. A recent systematic review of A&F trials in colonoscopy identified 12 studies of A&F for colonoscopy performance improvement since 2010.[86] Of these only one study described including endoscopists from different professional backgrounds (gastroenterology and surgery), and none described including clinical nurse endoscopists.

The same meta-analysis found that low performers derived the greatest benefit from feedback.[86] Interestingly, only one study in the analysis looked at performance improvement in a mixed symptomatic and screening service setting, the rest studied screening endoscopists.[86] In the UK the Quality Improvement in Colonoscopy study, not included in the meta-analysis due to the centre-level nature of intervention, included 68 colonoscopists from a mixture of gastroenterology, surgical and nursing backgrounds, including screening and non-screening procedures. This study similarly described improvement in detection KPI with centre-level A&F interventions in the lowest baseline performers.[84] In the UK, screening endoscopists are more likely to perform high standard colonoscopy, remain above national targets and are therefore less likely to benefit from feedback interventions.[142] The involvement of both screening and non-screening endoscopists in the development of the BCI may increase its perceived relevance to both groups in the NED-APRIQOT and therefore increase its potential efficacy.

Focusing participants' attention to a feedback gap was achieved with red and green colours. The approach of colour coding individual data points based on being on the right (green) or wrong (red) side of a target has been criticised in the behaviour change literature, described as *"at best it is useless at worst it is harmful"*.[143] This argument is premised on the high error associated with single observations (common cause variation) and the external impact of other factors on observations (special cause variation). Taking action in an 'on-off' manner

prompted by receiving a "red" outcome, which may be explained by common and special cause variations, risks increasing variation overall. To address this, the authors recommend colourless control charts, plotting data and expected variation. This chapter's results show that the behaviours encouraged by the BCI may not be 'on-off' actions but incorporated into routine clinical practice. Participants' perceptions confirmed common and special cause variation in KPI can be problematic, and the final BCI considered special cause variation by using a case-mix adjusted KPI, and minimised common cause variation by not providing a headline KPI when the number of procedures were low. However, firstly, as described in Chapter 1, variation in detection KPI in colonoscopy is high and associated with risk of PCCRC. This suggests that, although a simplification, variation in detection KPI and process outcomes to improve this should be highlighted. Secondly, this criticism regarded displaying data to managers, to make data informed decisions. The recipients of this chapter's BCI are clinicians, with limited time resource to review performance data. This work demonstrates using red and green drew attention to process outcomes and behaviours, and encouraged plan making to improve detection, with minimal risk of harm.

The use of qualitative interviews in the development of a A&F BCI has previously been undertaken in Canada.[144] This work found similar themes of the credibility of the BCI being dependent on data accuracy, and the preference for a relevant peer comparison. However, the work reflected on wider implications for A&F in colonoscopy, described in Chapter 4, and did not use endoscopists own data or undertake an iterative approach to developing an A&F BCI. The Canadian study interviewed a more experienced cohort of participants (mean 20 years experience, range 4-30 years), which the authors describe may not be representative of their local workforce. International workforces significantly vary, particularly with the UK's well-established nurse endoscopist workforce.[87,145] This larger UK study similarly recruited a cohort of participants with more accreditations and an interest in A&F, but also a broader range of professional backgrounds and experience.

3.8.4 Mechanisms and implications for clinicians or policy makers

The BCI is designed to be provide monthly feedback. Current endoscopy A&F guidance recommends at least 6-monthly feedback,[30] and our participants were used to receiving A&F data quarterly or biannually (Chapter 4). As expected, the number of procedures in our BCI were therefore lower and participants with low procedure numbers questioned the

credibility of the report's data. Despite this they still said they planned to engage in behaviours to improve their detection rate.

Participants described planning to review the impact of behaviour change on their KPI. Within FIT this process is described as velocity, identifying change in performance from previous interventions, and is likely to augment the effects of a BCI.[69] A previous study of a BCI in colonoscopy in the United States, including 16 endoscopists with a wide range of number of procedures, demonstrated significant improvement in quality measures with monthly feedback, but not quarterly.[99] The benefit of more frequent feedback is in keeping with the Cochrane review of A&F and has two hypothesised benefits: data being perceived as more relevant when delivered closer in time to performance and the positive effect of repeated feedback cycles.[62,63]

Previous studies developing electronic A&F have been criticised for not considering the emotional impact of BCIs.[139] Previous work in occupational therapy has highlighted the importance of emotion-triggering situations in A&F such as feelings of failure to provide good care, being unable to achieve positive health outcomes or conflict between what healthcare providers are asked to do and the norms they hold as important.[146] In this study, emotional responses were explored as part of FIT and cognitive interference associated with identifying a gap in performance. Few participants demonstrated an emotional response to the intervention, however when these occurred, they were prompted by a social comparison, particularly a numerical rank, being perceived as confrontational, and the use of the colour red. Cognitive interference and associated emotional responses were reduced in this BCI through suggesting task-motivation behaviours to potentially improve performance, which reduced feelings of helplessness. Further emotional responses to wider A&F in endoscopy are described in Chapter 4.

3.8 Conclusion

This chapter describes the development of an evidence and theory informed BCI, which is being tested in the NED-APRIQOT, the multicentre randomised control trial which is ongoing.[6] At the time of writing, this has completed recruiting 548 endoscopists in 36 endoscopy centres, half of these centres were cluster randomised to receive the BCI monthly for nine consecutive months. Data collection will complete in November 2021, and at this point a process evaluation is planned, using qualitative interviews to assess how participants

engaged with the BCI. These will also explore the use of colleague support, the wider social support associated with A&F in colonoscopy is described in Chapter 4 and may influence the implementation of this and any future endoscopy A&F BCIs. The implications of this work on future research are considered in Chapter 5.

Chapter 4 Audit and Feedback Processes in Colonoscopy Quality

4.1 Introduction

A&F interventions have been shown to improve compliance with desired practice in healthcare professionals.[63] There are calls for the more explicit use of theory to understand mechanisms of change in BCIs to inform their development, implementation and evaluation,[60] including the use of logic models and descriptive theories of change.[147] This chapter explores wider A&F practice in colonoscopy and the implications for A&F interventions going forward.

With the increased awareness of the correlation between low polyp detection and post-colonoscopy colorectal cancer (PCCRC), there is an increased focus on improving colonoscopy quality to prevent missing cancers.[34,148] Developments in endoscopy A&F in the UK (see Chapter 1) have included nationally recommended key performance indicators (KPIs) of colonoscopy quality,[8,11] the implementation of JAG accreditation programmes and courses,[149,150] and advanced accreditation for endoscopists undertaking BCSP and BoSS screening work. Trials of A&F to improve colonoscopy performance to date have had heterogenous results; it has been hypothesised that this is due to colonoscopy being a complex motor skill and/or poor development and implementation of BCIs.[71]

Feedback intervention theory (FIT)[69] has been demonstrated to be a suitable theoretical model for assessing mechanisms of A&F intervention's effectiveness in healthcare settings.[59,82]. Colonoscopy A&F processes often use a social comparison of KPIs [71,86] and the theory of planned behaviour (TPB) is recommended to further explore the influence of normative comparisons on behaviours.[62,63] Colquhoun et al proposed that a broader range of relevant theories may optimise A&F interventions,[60] and the Theoretical Domains Framework (TDF) provides a comprehensive checklist to aid exploration of wider A&F phenomena.[80]

Theoretical models of behaviour change often only focus on the intended benefits of an intervention. BCIs may also generate negative effects. In the public health sector, similar interventions involving human agency and interruptions to complex social systems have been demonstrated to potentially have unintended or harmful consequences.[151] These have included BCIs that have been associated with higher rates of adolescent problem behaviour,[152] teenage pregnancy,[153] and rates of sexually transmitted infection in men

who have sex with men.[154] In these examples, it was hypothesised that a better understanding of underlying mechanisms for harm or paradoxical effects may reduce harmful consequences. Predicting these potential problems does not mean a BCI should be wholly abandoned but, rather, provides the opportunity to modify it to avoid or minimise harms.[155] Dark logic models can be used to evaluate plausible harms and hypothesise their underlying mechanisms through a-priori theorisation[155]. In a clinical A&F context harms could include adverse outcomes which differentially affect patients in the care of practitioners who, themselves, are the target population for A&F interventions. This includes paradoxical effects, whereby an intervention increases a behaviour it seeks to prevent, and unintentional harmful effects to patient care.

In the development of the NED-APRIQOT a qualitative interview study was undertaken to explore the phenomenon of current A&F practices in colonoscopy. Chapter 3 described the development of an A&F BCI,[6] this chapter explores the current phenomena surrounding A&F processes in endoscopy using a theoretical model based on FIT, to inform the design of a future BCI.

4.2 Methods

4.2.1 Rationale

This work aimed to advance understanding of the mechanisms by which A&F might operate in endoscopy, to improve colonoscopy quality. Lack of understanding of mechanisms of change underpinning A&F has been identified as a key limitation of the existing evidence-base and a major inhibitor of advancing quality improvement.[134]

The objectives were to:

1. Describe current local A&F practices in endoscopy:
   o Identify how delivery of feedback is currently operationalised in endoscopy, who currently receives feedback, how frequently and in what form is it delivered.
   o Identify factors that currently influence clinical behaviour, behaviour change and how recipients are supported to improve performance in endoscopy.
2. Explore perceptions of feedback and how this could impact on future A&F BCI, current behaviours in endoscopy and its acceptability to endoscopists.

The planned outcome of this work was a descriptive model of current A&F practices in endoscopy, relating to FIT and the TPB. This work aims to inform the implementation of A&F BCI in endoscopy.

4.2.2 Study design

As described in Chapter 3, independent endoscopists were recruited for face-to-face audio-recorded semi-structured qualitative interviews at their workplaces. Clinical leads of English NHS endoscopy centres eligible for the NED-APRIQOT study in the Northern region or West Midlands were contacted by email. Sites which responded were selected by convenience sampling for participants' availability, although a range of large and small centres were included. Eligible endoscopists were identified with centre's clinical leads[6] and purposively sampled with criteria comprising length of endoscopy experience and professional role (clinical lead, clinical-nurse endoscopist, gastroenterologist, surgeon, and trainee) to broadly match the UK endoscopy workforce.[111]

Participants were provided with a participant information sheet, which explained interviews would cover behaviours in endoscopy and A&F and gave written consent. A topic guide was used, reviewed and revised (if needed) after each centre's interviews to facilitate depth and data saturation (Appendix F). As part of the interviews, participants were given a list of stakeholders in endoscopy and asked to rank whose perception of their performance was most important (Figure 4.1). Using the rankings participants were asked to describe what they perceived the views of others, in relation to their performance.

Interviews were transcribed removing any identifiable information for analysis with demographical data pseudo-anonymised using a unique participant identifier. The interviewer (JC) kept a reflective log and made ethnographic observations about each endoscopy centre. Participants were provided with a copy of their transcripts to ensure anonymity and what was transcribed accurately reflected their intended meaning. Ethical approval was granted by the Newcastle University Ethics Committee and the HRA within the NED-APRIQOT.

Whose perception of your performance is most important to you?

Rank:	Importance
You, seeing your own detection rate	
Clinical **endoscopist colleagues**	
Clinical endoscopy **unit lead**	
Unit **managers**	
Patients	
Nursing colleagues	
Professional bodies e.g. JAG, NMC, GMC, BSG	

Figure 4.1: Extracted from interview topic guide

4.2.3 Analysis method

A thematic analysis using a Framework Method approach was undertaken;[156,157] FIT provided an analytical lens with variables of interest and a preliminary basis for a relationship between codes, as highlighted in Figure 1.2 (pg. 15). The TPB was used to identify behavioural, control and normative beliefs for tasks and strategies to eliminate a feedback-standard gap.[77] The TDF domains from 'social influences' were used to explore the power, hierarchy and inter-group conflict within bucket themes.[81]

FIT proposes that A&F interventions should aim to improve performance by encouraging coping mechanisms through personal reflection and supervision. A&F processes should maintain the endoscopist workforce and provide credible data on performance to avoid rejecting feedback messages. In FIT, Kluger and DeNisi [69] define cognitive interference as "*shifts of attention away from the task and toward the unmet goals of the self*" and propose this is related to anxiety and confidence.

The thematic analysis using a Framework Method approach with the use of inductive 'open coding', based on Gale et al [23] and Braun et al [157]involved the following steps:

1. **Familiarisation**: preliminary reading of the full transcripts was done to acquaint the single researcher (JC) with the text in the dataset. Transcript accuracy was checked by listening to the recordings and reading the transcripts in parallel. Contextual information about tone of voice, inflexions such as comedy or sarcasm, words with emphasis and pauses were added.

2. **Generation of initial codes**: all key concepts were identified in the interview transcripts, using an inductive 'open coding' approach. Concepts were summarized into a descriptive code, ideally using the participant's own words.

3. **Developing an analytical framework**: after eight transcripts, codes were grouped into clusters and subthemes tagged to FIT domains or TPB beliefs. Codes that did not sit within FIT or TPB were analysed in 'bucket' subthemes.

4. **Applying the analytical framework**: subsequent transcripts were coded using the index subthemes of the analytical framework. The analytical framework was reviewed and amended after each subsequent transcript.

5. **Charting data**: The relationship between subthemes across the analytical framework were reviewed and plotted into a logic model based on FIT. These were reviewed with the original quotation data to ensure accuracy and triangulated with observation data and personal reflections from the time of the interviews.

Below is an example of a quotation, two relevant codes and their cluster, subtheme, and theme. The original quotation stated:

> "*So if we go back to the individual I just talked about, that individual knew, and it must have been really high pressure, that if this wasn't successful with the flexi sigs then we couldn't really maintain her as an endoscopist and therefore there would be a big salary hit. So there was a big financial background to that so I guess her motivation there is to maintain her income I guess.*" (Participant (P) 1)

Code 1: *"High pressure working environment for endoscopist as performance reviewed"*
Cluster: *"Stopping endoscopists scoping creates high pressure working environment"*
Subtheme: *"Performance anxiety"*
Theme: *"Feedback Intervention Theory – Cognitive interference"*

Code 2: *"Financial consequences of stopping scoping"*
Cluster: *"Personal: feelings of failure, financial consequences"*
Subtheme: *"Consequences of stopping scoping"*
Theme: *"Feedback Intervention Theory – Quit"*

Interviews and analysis were undertaken by a JC, codes were logged with a clear audit trail. As the coding and analysis progressed the research team met to review and discuss findings, with an in-depth review of the analytical framework after Participant eight. Recruitment continued until participant sampling strata were filled and reasonable data saturation was reached, defined as no new subthemes arising in the last three interviews after 10 complete interviews and an interpretive judgement of JC and the research team to stop charting data and finalise the report.[66,136]

The TDF domains from 'social influences' were used to explore the power, hierarchy and inter-group conflict within bucket themes.[81] JC identified the other TDF domains as difficult to use at interview in reflective logs, and covered within FIT, TPB or bucket themes in the analytical framework (Table 4.1). The TDF was therefore removed from the topic guide after the 8th interview.

TDF domain	Analytical Framework Themes (subthemes)
Knowledge & Skills	Task performance
Social role and ID	Task performance (Meta-task)
	ID performance gap (Centre data, Others' perceptions)
Beliefs about capabilities	Quit
	Task performance (Meta-task)
	Cognitive interference
Beliefs about consequences	Quit
	Gaming
	Critical incidents
Motivation and goals	Task performance
	Endoscopist ID KPIs
	Enablers
Memory, attention, decision processes	Task performance
	ID performance
Environment context/resources	Barriers
Social influence	ID performance gap (Others' perceptions)
	Nurse prompts
	Supervision actions
	Buddying
	Teaching and training
Emotion	Cognitive interference
	Reject gap
Behavioural regulation	Eliminate gap themes
Nature of the behaviours	Task performance
	Teaching and training

Table 4.1: Theoretical Domains Framework, domain mapping to FIT, TPB and Bucket subthemes.

4.3 Results

4.3.1 Participant demographics and sampling

The participants (n=19) were interviewed from six endoscopy centres (Table 3.1, pg. 64) at this point saturation was agreed to be met with the research team. Ten identified as female, and nine as male. Age in decades was recorded at interview to avoid identification; five participants were in their thirties, ten in their forties and four in their fifties. The mean interview length was 65 minutes (range 40-88 minutes). Surgeons had shorter duration

interviews (mean 50 minutes, range 40-61 minutes) than other job roles (mean 69 minutes, range 53-88 minutes). The three unit-leads spoke for the longest (mean 79 minutes range 76-88 minutes).

Seven participants were from a gastroenterology background, six from nursing background, four from a surgical background and two were speciality trainees in gastroenterology. There was a mean of 10 years (Range 2-26 years) independent endoscopy experience in all roles. Table 4.2 shows purposive sampling criteria were met at the 19th interview, after targeted selection for trainee endoscopists and experienced surgeons. Consultant gastroenterologists and unit-leads were unlikely to have less than 2 years' independent colonoscopy experience, trainees were unlikely to have more than 2 years' independent colonoscopy experience before becoming consultants, so (as was anticipated) not all strata were filled.

Site 1	Site 2	Site 3	Role									
Site 4	Site 5	Site 6	**Unit-lead**		**Gastroenterologist**			**Surgeon**		**Nursing**			**Trainee**	
	0-2 years							P8	P11	P2	P16		P17	P18
Experience	**3-20 years**		P1	P9	P3	P13	P15	P4		P10	P12	P14		
	>20 years		P5		P6			P19		P7				

Table 4.2: Purposive criterion sampling schedule

Participants performed a mean of 3.5 endoscopy lists per week (range 1-6 lists, Figure 4.2). Participants from a nursing background performed a mean of 5 lists per week (range 5-6 lists), gastroenterologists a mean of 3 lists per week (range 1-5 lists) and surgeons a mean of 1 list per week (range 1 – 1 list). Participants had further endoscopy accreditations as trainers (n=14), in upper gastrointestinal endoscopy (n=14), and BoSS (n=7) and BCSP (n=5) screening programmes.
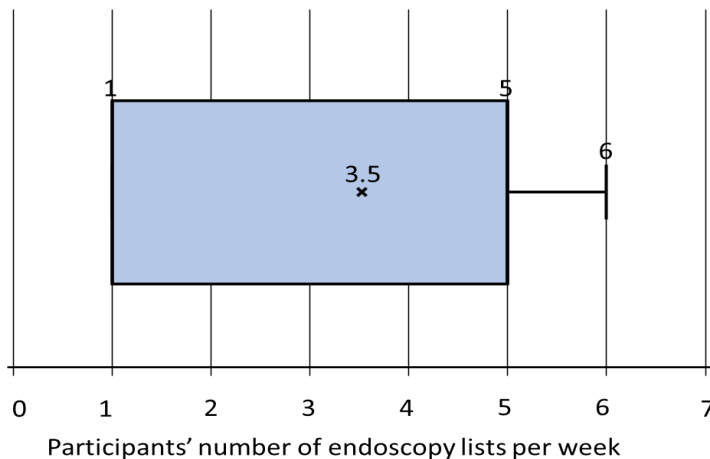
Figure 4.2 Box plot of number of lists performed per week by participants (n=19)

Prior to interview, participants had a baseline assessment of recent mean number of polyps detected at colonoscopy over a month. Ten participants had high performance, three had medium or expected performance, three had low performance and three had not performed enough procedures to accurately assess performance.

4.3.2 Structure and layout of endoscopy centres

'Centres' were defined as an organisation which provided endoscopy services with a centralised structure for management of endoscopy performance, all centres were part of NHS trusts. Of the six centres recruited, four were in the North East of England and two in the West Midlands. Most centres operated over different hospital sites, with a mean of 3 sites (range from 1 – 5 sites) per centre. Centres had a mean of 6 endoscopy rooms across sites (range 2 – 8 rooms). This gave a good range of small and large endoscopy centres. All centres provided bowel cancer screening and training.

The number of procedures booked onto endoscopy lists is defined by a points system, 1 point is equivalent to around 15-20 minutes of work. Shorter procedures such as upper gastro-intestinal endoscopy and flexible sigmoidoscopy are in general allocated 1-point, colonoscopies are allocated 2-points, and advanced therapeutic procedures are allocated more points.[158] Centres 1, 4, 5 and 6 allocated 12-points of work to morning lists, and 10-points to afternoon lists. Centres 2 and 3 allocated 10-points of work to morning and afternoon lists. (Appendix D)

4.3.3 The developed analytical framework

The themes of the analytical framework are summarised in Figure 4.3. Concepts in codes were well matched to the analytical framework using FIT, TPB or bucket subthemes. The TPB subthemes were used to augment the FIT model. The TPB was useful in categorising and exploring specific 'eliminate gap' strategies and normative beliefs in 'ID performance gap'.

There were some differences between FIT concepts and the analytical framework. 'Comparison occurs – identifies a gap' was divided into three themes: identification of the KPI in colonoscopy associated with performance ('Endoscopist ID KPI'), the mode of receiving A&F data ('ID performance') and identifying a feedback-standard gap ('ID performance gap', incorporating the FIT 'attention' concepts). The FIT concept 'change standard' was broadened to 'gaming', describing behaviours where performance or data were manipulated to achieve goals. The FIT concept 'coping mechanisms' was divided into

specific strategy themes of 'personal actions', 'supervision actions' and the bucket themes of 'nurse prompts', 'buddying' and 'teaching and training'.

The FIT concept 'effectiveness' was broadened to include clinical context and described four task-moderator themes impacting on all other A&F processes: 'cognitive interference', 'enablers', 'barriers' and the bucket theme 'critical incidents'. The 'enablers' themes included FIT concepts of 'resolving feedback motivation' and 'velocity'. The 'barriers' theme included FIT concepts of 'situation and personality variables'.

4.3.4 Results of FIT logic model and format

The FIT based logic model in Figure 4.3 is expanded in Appendix G, showing a full map of the analytical framework with all themes, subthemes and code clusters. Themes' relationships are summarised with arrows. Each subsequent heading is a theme from this model. The results are structured using this framework, a summary figure for each theme is followed by a descriptive account of subthemes and codes with illustrative quotations.
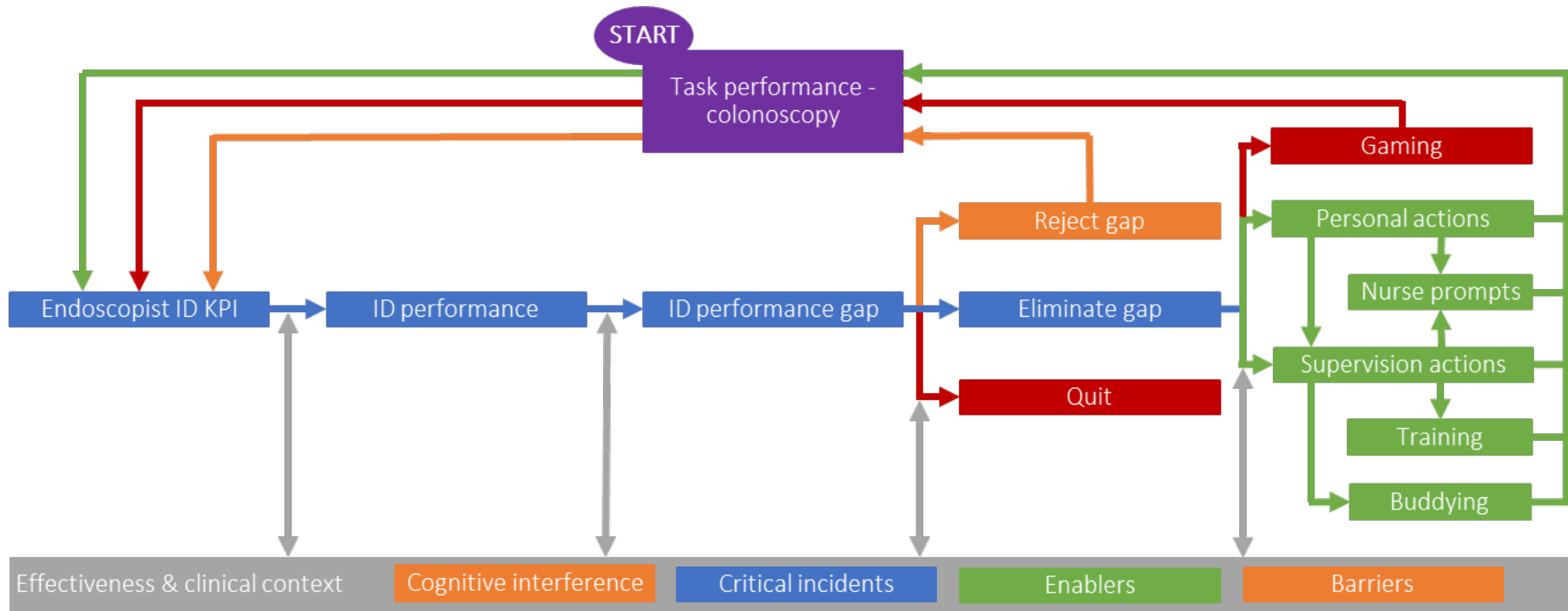
Figure 4.3 A logic model summarising themes of the analytical framework, based on feedback intervention theory (FIT) for audit and feedback processes in colonoscopy.

Legend Purple: task performance-colonoscopy theme describing meta-tasks, task-motivation and task-learning behaviours in colonoscopy.

Blue: themes of with identification of A&F. Green: themes of intended positive outcomes from A&F, including personal actions, nurse prompts,

supervision actions, training and buddying. Orange: the paradoxical outcome of rejecting A&F, where the endoscopist disregards the

performance gap. Red: themes are the potential harms or adverse consequences of A&F interventions, including quitting from endoscopy and

gaming documentation and behaviours. Grey: Effectiveness and clinical context themes are task moderators impacting on engagement of all

other A&F processes, these themes include cognitive interference, critical incidents, enablers and barriers.

4.4 Theme: Task performance

Task performance describes the tasks associated with colonoscopy, as perceived by participants, at the task-motivation, task-learning, and meta-task levels. These are summarised in Figure 4.4.
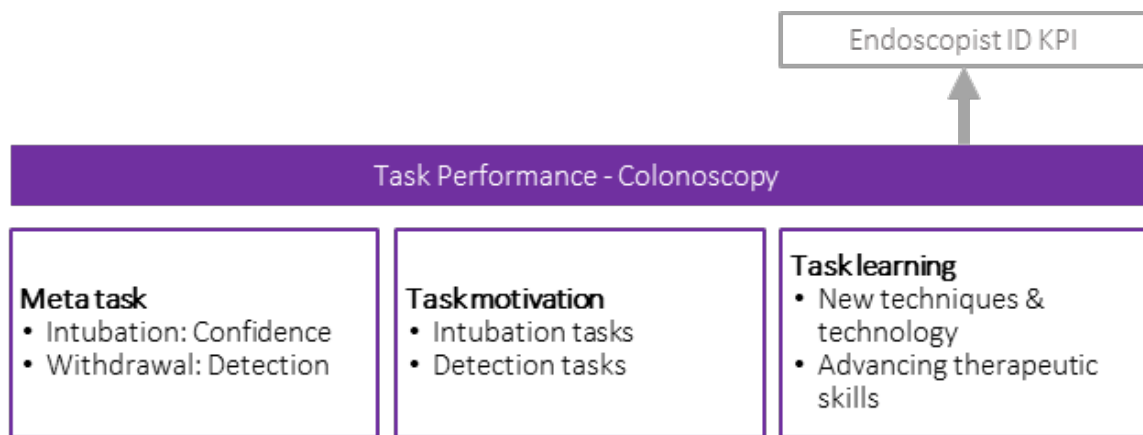
Figure 4.4 Task performance sub-themes and codes.

4.4.1 Task-motivation processes

In general colonoscopy was described as a "*two step technique*" (P4): firstly intubation, that is getting the colonoscope from the anus to the caecum; secondly withdrawal, the process of identifying pathology and managing it on the way out. Colonic intubation was associated with many different task motivation behaviours, including position changes, managing air, using water insufflation, and loop management, these became background thoughts to the main goal of "*get to the caecum*" (P12).

> "*So I suppose you can break [colonoscopy] into a two-step technique. I tend to break operations up into lots of little steps, that have to be achieved, before you proceed to the next one. So, I would achieve it by saying, the first step is intubation, unless there's an obviously large lesion that you need to deal with and once that's complete, check the patient's position, check you've given them the correct medications and then you can start the second part, which is withdrawal and detection and resection.*" (P4)

> "*So you're busy thinking 'get to the caecum', what am I going to do, change position, withdraw some air, put some water in, what can I do to optimise my position and you're thinking all these things in your head.*" (P12)

The task-motivation processes associated with polyp detection on withdrawal are described in Chapter 3.[7]

4.4.2 Task-learning processes

As independent endoscopists, the skills involved in intubation and withdrawal were rarely described at the task-learning level. One participant identified task-learning processes on intubation when training to become an endoscopist, including timing when to turn the patient and applying "*torque*" (P2) to the scope to remove loops in the bowel.

> *"Like from the consultants down to the nurse endoscopists, they will sort of say, "Well you could have moved the patient a bit quicker," or, you know, "that's why you're stuck…" or, "you need to sort of put more torque on and apply more application of torque," and it's put in a way, as I say, it doesn't make you feel crap, you know, it's designed to identify your problem".* (P2)

Participants described new techniques as task-learning behaviours that required training. On intubation, participants described using water insufflation with new water-pumps. This required initial demonstration and them being "*trained to do it*" (P9) by other endoscopists before using it independently.

> *"To do the underwater, what I still found was that I was very tempted to stick my finger on the CO2 button. So, I just switch it off now. So, that was just something I've learnt for myself. I went and watched actually [the unit-lead] do a list and just sort of start me off and yes, I've just found sort of my way sometimes".* (P7)

> *"Yeah, I was part of the WASH study, so we did get shown [water insufflation] as part of that. But to be honest, when you hear about these things then you just kind of have a go. Because it's not something you're going to do any harm by trying, you know."* (P14)

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[7] These include time taken to withdraw the colonoscope, giving the medication hyoscine butylbromide (referred to as 'Buscopan' by participants), using nurse or assistant prompts, retroverting the colonoscope in the rectum and turning the position of the patient on withdrawal.

On withdrawal, advancing therapeutic skills such as polypectomy were described as task-learning processes, requiring observation and supervision. This participant described being supervised to improve their needle technique, used to inject liquid under a polyp before removing it.

> "Yeah, so maybe demonstrating also, like this is the way to do it, and then looking how I do it and tell me what I've done wrong … 'you jab and then you remove the needle too quickly. You need to maintain your needle for longer or very slightly lift your needle back'. So, obviously small fix that you need to do on your own technique to help you, but obviously, they were showing me first how they do it themselves. Let me do it and then tell me what I need to change with that particular thing." (P18)

4.4.3 Meta-task processes - Confidence

Participants generally described colonic intubation as a complex motor skill and participants struggled to describe some of the higher-level behaviours involved. One participant resorted to science fiction metaphor.

> "It's quite a nice technical challenge…Using the force and I use that in the 'Star Wars' thing to work out how you're going to coax the scope round. So, hope the force is with you and you can be like Luke with the helmet off, dropping the scope just down into the middle of the Death Star." (P19)

Participants identified self-confidence and being "*sure that you're capable*" (P7) as a meta-task belief for reviewing performance. Having confidence was described as helping psychologically to manage drops in performance, by taking on board suggestions to improve and review performance with peers.

> "If you have a run of a couple where you've not managed to get round, you think, 'That's going to affect my figures,' which is nonsense because I know I'm a good endoscopist and sometimes it's [figures are] not always that important." (P1)

> "[When receiving feedback] I'm doing alright, I think I would find some of the stuff, you know, some of the sort of suggestions of ways of doing things quite easy". (P2)

> "When the [performance] data comes through, oh yes, we're all scrutinising it … So, we're very amenable to doing that and just checking, and you just think, you wouldn't be doing it [colonoscopy] if it wasn't sure that you're capable of doing it". (P7)

When reviewing feedback, participants described "*awareness*" (P2) of competence through training, positive feedback from colleagues and successfully undertaking "*tricky*" (P14) procedures "*boost[ed]*" (P10) confidence.

> "*But I think by doing the training … I probably do have quite good competence on what I'm doing, an awareness of what I do and why. I'm aware that I get little ups and downs and blips and those kind of things but I think I'm okay.*" (P3)

> "*I still do struggle at times as you know but it's the fact that [colleagues] hold you in high regard as well. That you're a good endoscopist … Or if [colleagues] know I'm training somebody they'll say, oh, you've got an excellent trainer there and that kind of boosts your confidence even though you just subconsciously get on with it.*" (P10)

> "*I feel quite confident and competent, although I suppose, like everybody, you get dips and peaks and troughs, which is the world, especially, of colonoscopy… But then you get times where you do get round something really tricky, and somebody hasn't got round before, and then that gives you a bit more confidence. You take bigger, do more technical procedures. And that kind of makes you feel a bit more confident as well.*" (P14)

Colonoscopy was described as "*an uncomfortable procedure*" (P2) and may inevitably cause pain. Participants described concerns of putting patients "*through a lot of distress*" (P8) or "*torture*" (P11) due to pain, and significant discomfort should stop a procedure. One participant described the necessity of confidence in ability to "*put yourself in an uncomfortable situation*" (P1) and occasionally cause the patient pain to "*complete the procedure*" (P1).

> "*I'm not one whose going to push through a very painful, uncomfortable, difficult colonoscopy, just to get caecal intubation, if that's not right for the patient, then I'm not going to do it. There are other ways that we can image patients that don't put them through a lot of distress. If the patient is very distressed and they can't cope with the pain and there's persistent looping or whatever, I'm not going to keep pushing and pushing it up. So the most important thing to me, at the time when I'm scoping is that patient in the room.*" (P8)

> "*… [If] you've had a run of a few people who are uncomfortable, I don't think that actually saying that you said, no I'm not going to torture you anymore and withdrew,*

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I don't think that's an unreasonable situation to be in. Rather than when we have reasonable alternatives, in terms of CT colonography". (P11)

"I think confidence and that ability to slightly put yourself in an uncomfortable situation where you're doing colonoscopy, I think you have to be able to live with that because I don't believe any colonoscopist or gastroscopist who says they never feel uncomfortable. You've got to live with that because ultimately you are occasionally hurting people and it's uncomfortable. That's an awful thing to do but if you don't do that you're not going to complete the procedure. I think it's impossible to say, 'I never hurt anybody' as an endoscopist." (P1)

4.4.4 Meta-task processes - A mindset required for detection

On withdrawal participants described a meta-task process of a detection mindset. Participants described to find more polyps on withdrawal *"you just get your eyes set in it"* (P7) and creating the mentality of a *"ninja"* (P12) finding polyps.

"So I've come back, it's like ninja [ninja chop hand gesture], where's the polyp, where's the polyp [ninja chop] and I'm looking again and again [ninja chop]…So it is interesting and I do think there is a lot more pathology in the right than what I've ever thought and that mentality is in my head now." (P12)

"And I did a lot of work, and a lot of that was about slowing down and really looking at subtle things, you know, getting your eye in on polyps and views of SSLs [sessile serrated lesions, flat polyps], and things like that." (P14)

4.5 Theme: Endoscopists identify KPIs

The subthemes below describe which KPIs endoscopists' identified as being important to their performance (Figure 4.5). These were: detection, comfort scores, caecal intubation rates (CIR), number of procedures and endoscopic non-technical skills.
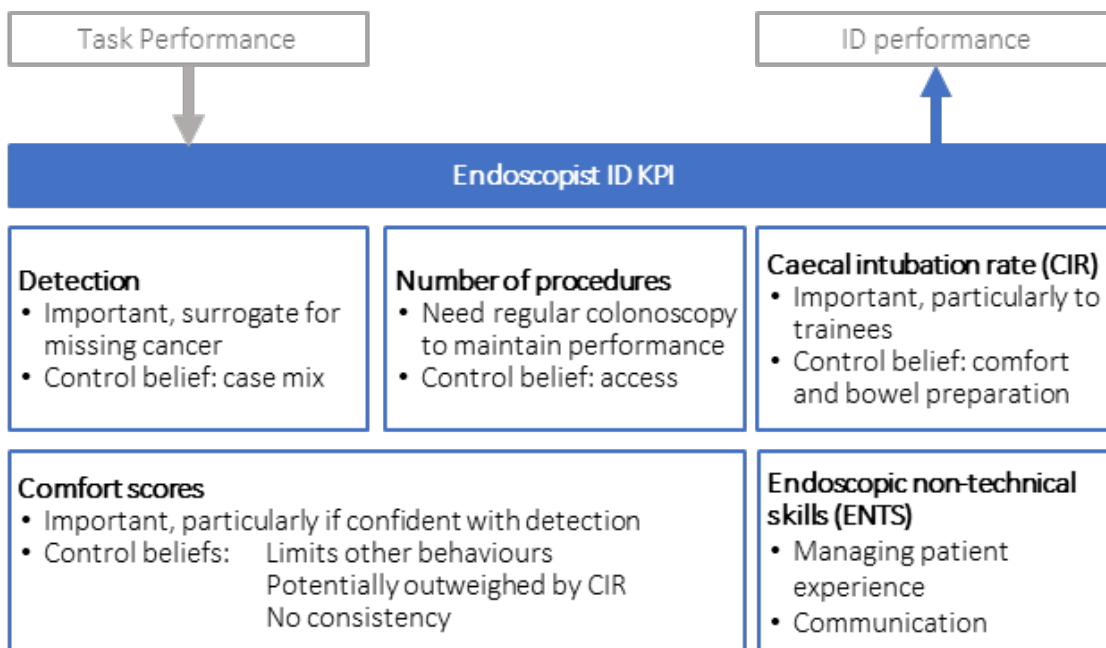
Figure 4.5 Endoscopist identified (ID) KPIs sub-themes and codes.

4.5.1 Detection

Detection of colonic polyps and adenomas was mentioned as important by all endoscopists and described as their "*main goal*" (P12). There were beliefs that low detection of polyps or adenomas was a surrogate for missing colorectal cancers and other important pathology.

> "*I love polyps. Polyps is my main goal*". (P12)

> "*That's why we do the colonoscopy just to find polyps and try and remove them*". (P18)

> "*You catch polyps they are not then going to develop cancer, and that is what is important*". (P2)

> "*Missing a 2mm adenoma might not be a disaster but we use it as a surrogate and so if you can miss that you could be missing bigger pathology.*" (P15)

> "*[Polyp detection] indicates how much time you take, how aware you are of the things that you're looking for. Avoiding the new kid on the block of endoscopy, post colonoscopy cancer, which is also very important.*" (P18)

Detection was under the perceived control of the endoscopist, through identified task-motivation behaviours (see Chapter 3) and detection mindset (see A mindset required for detection pg.103). Participants described low control over the case-mix of their patients, which impacted on detection performance. Participants with BCSP accreditation and

dedicated polypectomy lists perceived they had patients with more polyps, versus participants with interests in inflammatory bowel disease (IBD) surveillance perceived fewer polyps.

> *"The data this is raw data it's going to bugger everything up because I do EMRs [endoscopic mucosal resection, advanced polypectomy] and BCSP lists so one of the immediate criticisms of this is of course my data is going to look great, because I'm doing EMRs and BCSP so, you need to be more sophisticated [when providing KPIs]".* (P5)

> *"[If detection is low] I think firstly I would probably look at the cases that I had had. Is there anything that explains it there? Have they all been IBD patients that have been scoping that month and they have been dye sprayed so I won't find any polyps?"* (P15)

Case-mix was also perceived to be under the control of the endoscopists' gender. Participants who identified as female described performing colonoscopy on more young female patients with fewer polyps.

> *"There are only really two female endoscopists so they often get a lot of, 'Could this go on a female endoscopist list,' so then sometimes I think, 'Well am I doing lots of previously failed procedures in women with very difficult colons?'"* (P3)

> *"On the last lot of data I got I think my polyp detection rate was about 35 % which I think is good and I think it is especially good because of the group … I think because I am female I tend to get a lot of young females who are query IBD and I also do a lot of IBD based endoscopy so actually I think given the sub-set of people I am endoscoping I think that's a good figure."* (P13)

4.5.2 Number of procedures

Participants identified the number of procedures as important and were believed to be correlated with overall endoscopy performance, "*you need to do about 120 per year to keep your hand in really*" (P1). Regular endoscopy experience without breaks was perceived as necessary to maintain and improve performance and not become de-skilled. At the same time, participants believed that a very high volume of endoscopy lists could reduce the quality of examination (see Fatigue and ergonomics pg. 197).

"My percentages are low because I don't do so many patients." (P2)

"I definitely do better during periods where I've got more sustained practice." (P3)

"It's just getting the continuity and the thing about scoping is, it's keeping it up because if you're not skilled at doing it, because you're not when you're training, you have to do it very, very regularly to keep that up because you just lose it quite quickly. So you deskill quite quickly, so if you have a three or four week break where you don't have any scope lists, you deskill in that period of time." (P8)

"Especially given the frequency of the lists or the lack of frequency that I have, [improving performance] has perhaps taken longer than it might have done otherwise". (P11)

Participants described commitments such as annual leave, clinical "*on-calls*" (P9) for surgical and medical endoscopists and training others reduced their access to independent endoscopy lists. This was perceived as limiting the number of independent colonoscopy procedures they could perform in a period.

"I think training is really good but that obviously disrupts my performance because if I'm training then I'm not actually scoping." (3)

"26 colonoscopies over four months. Just not enough, is it? That means I'm not doing enough endoscopy at the moment, but that's because we've got a lot of on-call pressures and a lot of our lists have been cancelled." (P9)

"I have one list a week, which is on a Monday, however that does get unfortunately regularly cancelled because hand over on-call on a Monday, bank holidays, etc, etc. So it's not quite as regular as I would like". (P11)

4.5.3 Caecal intubation rate

Participants CIR as an important marker of quality, and "*the first thing anyone would look at*" (P1). CIR was perceived as particularly important to less experienced endoscopists and was the first KPI mentioned by both trainee participants.

"As a registrar you still, even though you are signed off, but I remember my focus very much being on what my caecal intubation rate was and pretty much nothing else which is not even really thinking about the rest of it and just being like, 'I must get to caecum.'" (P13)

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"[CIR] is one of the main KPIs so I'd be wrong, I'd be lying if I said no, and that's probably what triggers me the most to look". (P17)

"So, numbers-wise about that. Caecal intubation rate, I think the last time was about 93 …" (P18)

Participants described CIR as being limited by bowel preparation (*prep*) quality, which endoscopists had low perceived control over.

"My caecal intubation rate is lower than it should be perhaps, mainly because of poor bowel prep". (P2)

"… Bowel prep can contribute. So, that's probably the biggest one, in my eyes, that's what is the most important one. I think sometimes you can't change bowel prep." (P17)

"So, that's about all you can do really and just look at that bowel prep – see that the bowel prep, you know, you're not getting a string of patients where they're not being encouraged to take their bowel prep in the right way or been advised wrongly." (P19)

4.5.4 Comfort scores

Comfort scores and surrogates for patient experience were identified as being important to endoscopists; as participants described, in undertaking colonoscopy "*you are occasionally hurting people*" (P1, see Confidence pg. 101). Participants described being "*pleased*" (P8) when patients were comfortable and "*unhappy*" (P7) with causing discomfort. Participants who were confident in their detection and part of the BCSP, focussed on improving comfort.

"I know one of my colleagues [got] very very comfortable procedures. I mean the discomfort rate is probably about 3 or 4% for myself so I've seen that come down a little bit by just again, being a stimulation to reflect and think." (P1)

"I think I'm fairly confident with [detection] so I'm really going to switch my attention now to some patient comfort scores, making sure that they're as low as they can possibly be in terms of kind of patient satisfaction." (P6)

"When I first picked up screening again, some of my comfort scores, I was a little bit unhappy with, but everybody says it's how I'm quite hard on myself". (P7)

Patient comfort and experience were perceived by endoscopists from all professional roles as being one of the patient's primary concerns (see The patient pg. 119). Participants described patient comfort may limit behaviours related to pathology detection, such as caecal intubation, turning the patient and the length of the procedure.

> *"How comfortable are they? If they've been uncomfortable in one position, you're not necessarily going to put them back in it just for the sake of looking".* (P3)

> *"If there was a patient who was struggling, then I wouldn't push, and I think that's the most important thing. In terms of the patient experience, it has to be right, you can't compromise that. Sometimes, you can't avoid uncomfortable procedures and sometimes that happens … I wouldn't carry on for the sake of a KPI, no."* (P17)

Participants described situations where patient comfort was outweighed by the importance of completing a test, as an incomplete test may *"affect patient's long-term outcomes"* (P7). This was described as with the patient's consent, but tension was described with the endoscopy nurse team (see Endoscopy nursing team pg. 121).

> *"I don't think that patient discomfort would really influence my polyp detection rate. I think that I'm comfortable to encourage the use of Entonox … I will use techniques and changes and discussion, I'll use every tool that I've got to try to keep that but I don't think, I'm not somebody that will go, "This is just so bad." There may be a difference but I don't think that it would be a huge difference and I don't think it would affect patients' long-term outcome. I hope that it wouldn't."* (P7)

> *"You can be at odds with the nursing staff sometimes, sometimes depending again, it gets back to how well they are trained and how confident they are in your abilities…They will jump in to quick and say, "Do you want to stop?" "[Sigh] No, I don't want to stop because this patient really needs this test," you know, and I think the best you're getting across you're not there to hurt the patient you are there to try and get a good test for the patients so they don't have to come back and have the test again."* (P2)

> *"You look at the overarching reason that you're doing the test, if it is for … if you're doing a colonoscopy for someone who is anaemic with a high risk symptoms for right-sided malignancy, then under those circumstances, one may be more inclined to say, I*

appreciate this is dreadfully sore … but it really is important that I get to the end."

(P11)

Two participants described comfort scores as having "*no consistency*" (P5), being different for different nurses, and not equating to "*the patient's experience*" (P5).

"There's no consistency with regard to whether the data is the endoscopist's personal view or whether it's they have taken feedback from the nurses in the room talking to the patient … At any rate, what we've found is that what the nurse records in the room doesn't necessarily equate to what the patient's experience is, as they have described in the recovery area". (P5)

"Comfort has been such a difficult thing … every unit does it differently, newer nurses will call your patients as higher discomfort because they've never seen the procedures before …we've got everybody using different nursing scales". (P7)

4.5.5 Endoscopic non-technical skills

Endoscopic non-technical skills (ENTS) of managing the patient experience and good communication were identified as important for colonoscopy quality and perceived as separate from other measurable KPIs.

"You want to know you've given them an experience that isn't going to put them off coming back in the future because a lot of people do, a lot of people are returning customers in this field. So yes, I think it's more important that people are having a good experience, as well as a good test and that's day-to-day, rather than KPIs every three months." (P16)

"I think what I was talking about there was more to do with sort of skill, aspirational type – soft data, I suppose, the soft approach to endoscopy like so how they conduct themselves, how they work the patient, how they work the problems out, how they do, the skill level". (P2)

"A lot of problems that you come across can be prevented by good communication with the patient and making them understand why you're doing and what you're doing." (P17)

"I think that's about you being able to explain to them what's happening so that they are aware that there is a reason you are doing something and as long as they are aware of what you are doing they don't really seem to mind". (P13)

4.6 Theme: Mode of identifying performance and feedback

This theme describes how KPIs were identified by participants (Figure 4.6). Participants from all sites described receiving their personal KPI data in email correspondence from the endoscopy unit-lead. Two centres had a face-to-face Endoscopy User Group (EUG) meeting where these KPIs and centre level plans were discussed collectively (see Group discussion of KPIs pg. 162).
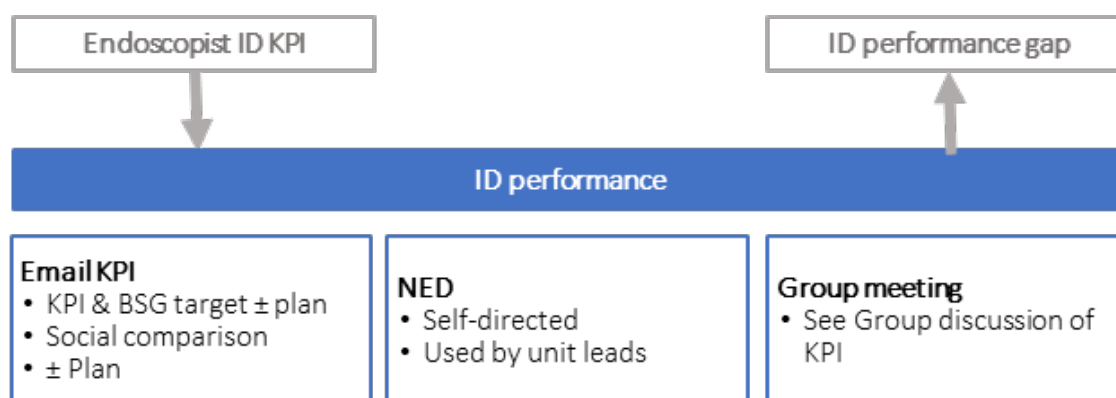
Figure 4.6 Mode of identifying (ID) performance sub-themes and codes

4.6.1 Email

The email feedback processes were broadly similar across centres; all centres provided endoscopists with their individual polyp detection rate, number of procedures, caecal intubation rate and comfort score. Four centres provided six monthly data and two centres provided quarterly data (Table 4.3).

All centres gave a social comparison to peers but the comparison varied. One centre gave endoscopists a broad overall centre level KPI; two centres showed all endoscopists individual KPIs anonymised; and three centres showed all endoscopists named KPIs. All centres provided a target performance using the BSG and JAG standards; these were stated in five centres' reports, and in one centre each endoscopist was graded against each target. Comparing to these targets was described as a "*nudge*" (P9).

Site	Interval	Format	Social comparison	Discrepancy ID	Plan with data
1	6 months	Email	All endoscopists data - Identifiable	Grades endoscopists to BSG/JAG standards	Individual comment identifying discrepancy Individual email if significant underperformance
2	6 months	Email & EUG	All endoscopists data - Non-identifiable	States BSG/JAG standards	Centre comment identifying discrepancy Individual email if significant underperformance
3	6 months	Email	All endoscopists data - Identifiable	States BSG/JAG standards	No plan with data Individual email if significant underperformance
4	6 months	Email	All endoscopists data - Non-identifiable	States BSG/JAG standards	No plan with data Individual email if significant underperformance
5	3 months	Email & EUG	All endoscopists data - Identifiable	States BSG/JAG standards	No plan with data Support meeting offered if significant underperformance
6	3 months	Email	Centre performance - Non-identifiable	States BSG/JAG standards	No plan with data Individual email if significant underperformance

Table 4.3: Centres A&F performance processes

No centres provided a specific individualised plan to improve performance with the data. One centre provided a comment for each endoscopist highlighting any discrepancy from standards, "*if someone is not doing very well …we give them some advice on what to do and how they want to improve. So in that spreadsheet there will be a little bit of stuff there*" (P1). One centre highlighted a centre level discrepancy and gave a general plan to all endoscopists with advice to improve performance, describing having seen "*high discomfort scores in recovery*" and suggesting "*these are the kind of things you might wish to consider to improve comforts such as; a constant dialogue with the patient; …*" (P5).

In sites where no plan was provided, endoscopists identified they would prefer to be given a plan on "*how you could improve your detection rate*" (P10) or "*practical*" and "*quite targeted steps*" (P13) to improve performance.

"It would be helpful to have you know some feedback as to how you could improve your detection rate." (P10)

"I think especially if it was, 'This is why your data is…have you thought about doing this or this which might improve your numbers or this…' It would have to be…what's the word? It would have to be quite targeted and with some steps that you could…so, quite practical I suppose the things that you could do to try and change your numbers if you wanted to I guess." (P13)

All centres offered individual correspondence and support to endoscopists who were significantly underperforming (see Supervision actions pg. 158).

4.6.2 National Endoscopy Database (NED)

Four participants described using NED to identify their own KPIs, including both trainee participants, and did not rely on regular feedback from unit-leads to assess their performance. Self-directed access was limited by forgetting to check data and not checking *"on a regular basis"* (P17).

"I will regularly compare my performance to a range of other benchmarks, using NED, be it at a trust average or a national standard. Yes, I think that's very important for giving you a context and a level at which you're performing." (P9)

"We get obviously KPIs for non-screening stuff, it would be up to me to go to the NED website." (P17)

"So, your levels [KPI] are good and I might just look myself, but not on a regular basis." (P18)

"It's dreadful because I haven't looked in quite a while, perhaps I should have done before this interview and I can't remember my figures off the top of my head." (P11)

No other endoscopists described accessing their own performance data using NED; rather participants described waiting for more data *"next quarter"* (P16) and wanting to see more detection data. One participant described they would not have time to access and *"interpret data in our own way … and analyse it myself"* (P4).

"I haven't had the next quarter through yet, so I'll see if I've found any more polyps." (P16)

"I've not seen it. I've not seen the [adenoma detection rate (ADR)] at all. I can't tell you at all. I have no idea what it is. (Interviewer (I): Would you want to be seeing it more often do you think?) Probably. Yes." (P10)

"It was helpful to see the data, we all like to look at data and interpret data in our own way, so it was nice to receive the data and I wouldn't have the time to sit and analyse it myself, so that was useful" (P4).

All unit-leads were aware of NED and used this for assessing KPIs. The unit-lead participants in the largest endoscopy centres, with over 30 endoscopists, described difficulty monitoring individual performance trends over time, *"with such a big unit and people spread out over so much, it's quite hard to keep a tab on that level of performance and trends, definitely"* (P9). Although NED had eased access to and analysis of performance data, it took time to *"delve down to find it"* (P1). One unit-lead participant was concerned that nationalisation of data fields in reporting systems to enable them to upload to NED had limited the functionality of local systems to collect extra data and was *"a pain in the arse"* (P5).

"I have been using their NED data for the last two years to do that, and we have been generating some of our data from EndoSoft [an endoscopy reporting system (ERS)] with their kind of dumps that they do every now and again. So I've been using a bit of both [NED and ERS data]. I think it's a challenge to keep a tab on a lot of different endoscopists. It just kind of comes with the territory". (P9)

"I think the last look at NED would suggest we're about 91-92% for caecal intubation rates for colonoscopies… But I mean I find looking at NED quite straight forward but you've got to navigate your way around NED. It's not immediately obvious who is who on there. You can't just open NED and go, "Oh great. I need to tell [endoscopist] this month that he needs to turn people more or his polyp detection rate has dropped." It will be there but you'd have to really delve down to find it." (P1)

"Before, you could not actually generate the report without a mandatory operation to say why you didn't do something … now because we've got NED and [ERS providers] making changes, it's rather difficult for us to make anything mandatory … it's a glorious project to do this nationally and unique in the world, isn't it I suspect and so, I'm completely bought into doing this but personally, it's been a pain in the arse." (P5)

4.7 Theme: Identifying a performance gap

This theme describes how participants identify a gap between their performance and a standard or goal (Figure 4.7).
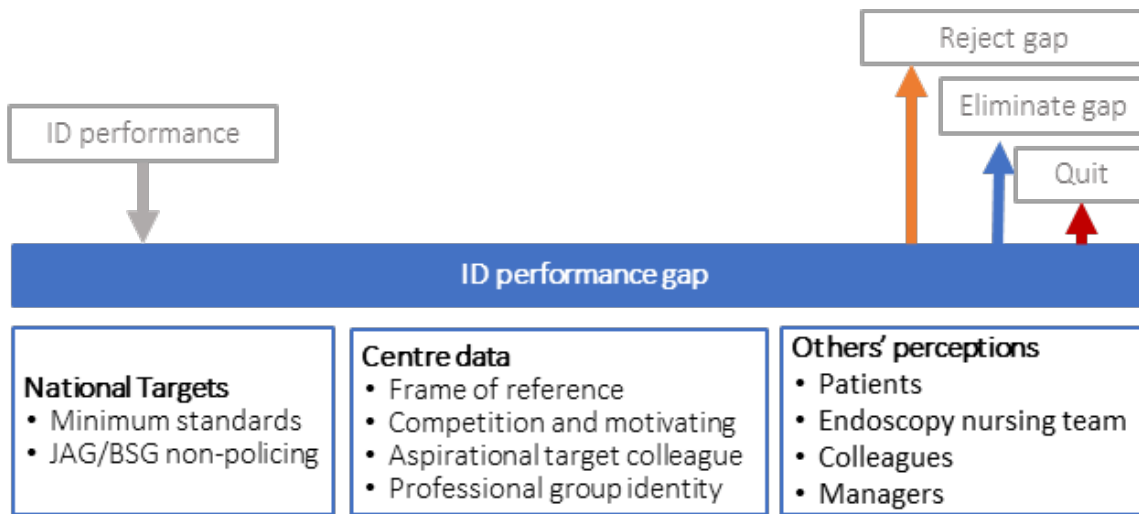
Figure 4.7 Identifying (ID) a performance gap sub-themes and codes.

4.7.1 National targets

Participants compared their own performance to JAG and BSG guidance; this was believed to be important and perceived as a minimum standard or universal benchmark.

> *"National guidelines of what you need to achieve is quite important because of that sets a benchmark for everybody, you know."* (P2)

> *"Yes, because [BSG standards are] minimum stuff, aren't they? They're the 'we should be able to catch all with that'. If you're going below that, you're definitely underperforming."* (P3)

> *"And it's obviously very important that I have the kind of support and doing what national bodies advise me to do. It would be crazy to think of going outside those indicators."* (P6)

Some participants "*just want[ed] to know I'm above the minimum standard … as in BSG published minimum standard*" (P9). However other participants described these minimums as not enough and were motivated to achieve more from a national normative comparison or their own past performance.

> *"I wanted to make sure I met a certain standard and the minimum wasn't good enough. I wanted to be doing well and I wanted to be doing well so that patients*

were comfortable and I was finding pathology but I also didn't want to be last I guess and it was a… [Pause]. I was almost competing against myself to do better every time if that makes sense." (P15)

"Personally for me I would be more interested in the national data than the unit data. …There is a much broader range of skills out there than there is just based in one unit and consultants, nurse specialists, gastroenterologists and if I know that I am sitting up there with that top 25% of the best that makes me happy." (P10)

Although national bodies such as JAG and the BSG provided benchmarks for minimum performance, they were not perceived as having a "*policing role*" (P9) for endoscopists. JAG's global rating scale (GRS) had a perceived role in assessing A&F performance processes at a centre level but had no external agency in scrutinising individual's endoscopy performance.

"I don't think they [professional bodies] really have a perception of me. I do my best to meet their criteria. But they don't really have a policing role, and I think that quality assurance of me is the responsibility of my unit and my Trust." (P9)

4.7.2 Centre data

As described all units provided some comparison of performance to peers in the same centre (see Email pg. 110). A centre level comparison was felt to provide a natural frame of reference; some endoscopists saw being "*middle of the road and normal*" (P9) as reassuring.

"I like being able to see everybody else's because then that allows me to rationalise my own standpoint. I think if I only got my numbers, I think I would be a bit like, 'Well where is that as a frame of reference?'" (P3)

"I'm not aiming to become the 'lead endoscopist' within the trust or whatever. So, I am happy to sit in the middle so to speak … I absolutely want to be above the baseline standard and I don't want to be sitting just on the baseline, I want to be comfortably above it, but nor am I particularly driven to exceed the limits of what we can do so to speak." (P11)

Participants from all backgrounds described seeing others' performance and a sense of competition as motivating.

"Yes, we're all competitive beings, aren't we, and it motivates me." (P9)

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"(I: [clarifying] You kind of identify say a top tier there that you want to achieve to that level?) Yes… It does sound very competitive. [Laughter]. Yes." (P15)

"There was one quarter where I wasn't winning and I didn't like it at all and one of the other nurse endoscopists had taken over from me". (P16)

"So, yes, being a surgeon, you always want to be in the top percentile. I'll try and get that up." (P19)

The BCSP endoscopist participants from gastroenterology and nursing backgrounds were particularly motivated by competition.

""I also like to compare against others as well … it's a little bit of competition, I think. [Laughs]. … we get feedback through BCSP for our KPIs, and that's the first, I look to make sure that I'm above what is expected. But I also like to know how I'm doing against my colleagues in the same screening centre. Because, I don't know, it is a competition, no matter, you know, how much we say that it isn't. I want to be up there with the rest of them." (P14)

"[A BCSP endoscopist] and I are quite competitive. I think he wouldn't mind me saying that. … I think that it's a sort of healthy competition in the kind of sense that he looks at my ADR figures, perhaps in one quarter, his are sort of 57-58 percent and maybe mine are about 53-54 and then that's competitive". (P6)

"I think that let's be honest, we all get a bit competitive when the [BCSP] data gets shown and that sort of thing, and within sort of the, yes, you do, you get competitive about it all. [laughter]". (P7)

Participants "*near the bottom*" (P14) of centre data described feelings of inferiority and being disheartened. However, this was also a motivation to reflect and improve.

"I do not want to be the bottom… I dipped down over quite a couple of cycles, and looked very hard, because I did not like to be that person who was, you know, near the bottom of the pile. And I did a lot of work, and a lot of that was about slowing down and really looking at subtle things [polyps] … And it certainly worked." (P14)

"I guess. It just drives you probably. I think it's more of a character thing. So, it drives you to be better … If I was below the normal, I would not feel comfortable with

someone being much higher, I'd be like 'why's that?' You feel a bit of, not competition in a negative way but you kind of feel a bit inferior somehow." (P18)

Participants from all backgrounds and experience described identifying a high performing or expert colleague as an "*aspirational*" (P18) target and wanting to "*emulate*" (P2) their practice and results.

> *"[Reflecting on top role models with good performance] I think [a nurse endoscopist]'s there and I think as obviously [a local expert] is what he is because he's internationally renowned so he must be good at it, you know. So, that's kind of what I try and do so, I try and emulate like that. I will compare myself to those rather than compare myself to other people."* (P2)

> *"It might sound a bit ridiculous but actually, my target is to be the most... if someone's detecting say 15 or 20%, then that's probably my target."* (P17)

> *"Detection rate wise or caecal intubation rates and I compare myself with some of the senior gastroenterologists and that's what ... everyone wants to be the best they can be and I would like to push myself to get to near their figures."* (P4)

Participants identified themselves as being in a professional group, describing a "*natural instinct*" (P8) to compare to others from the same professional background, making sure their performance aligned or was "*roughly the same*" (P3) as similar colleagues. Participants perceived "*differences between different specialities*" (P19) which impacted on KPI, such as "*job pattern*" (P15) and case-mix. One surgical participant described professional backgrounds as "*apples and pears, I think gastroenterologists should compare with themselves and we should compare with ourselves*" (P8).

> *"I guess I tend to just look at local colleagues. I think local colleagues are okay because there's a big variation between all of us about how many we do. So I think I can look at people that I work with who I think have a similar kind of intensity or a similar sort of job pattern to mine and think, 'Well if I'm doing roughly the same as them then that's okay,' or if I'm doing more than others then I might say actually that I know I'm doing okay."* (P3)

> *"I think what we all tend to do, which is a natural thing to do is to compare yourself to the people next door to you. So you compare yourself to people in your own department. So I wouldn't compare myself to the gastroenterologist because they do*

quite different things from the work that I do in endoscopy but I would certainly compare myself to my surgical colleagues and that's a natural instinct to do that … Some people are doing EMRs [advanced polypectomy], people are doing colitics, people are doing very different types of screening. There's different types of workload. So I think it's all important that there is a natural instinct to look at your colleagues." (P8)

"I think you kind of have a concept in your mind of what your level is at and who you should be, what group you should be in." (P9)

"So, looking at gastroenterologists and nurse endoscopists, colorectal surgeons and others. Just if you were looking at the data… on differences between different specialities and how well they were doing. … it's keeping a corporate look at your group of background to make sure that you're not way off compared to other people." (P19)

4.8 Theme: Identifying others' perceptions of performance, normative beliefs

The source of feedback on broader endoscopic non-technical skills and wider patient experience was normative. Participants described instances of feedback from patients and colleagues (Figure 4.8). The perceptions of others concerning the participant's performance was explored in the ranking exercise. Some participants struggled with comprehension of the ranking of importance exercise and the wording of this was iteratively clarified as the set of interviews progressed. Seventeen participants undertook the ranking exercise of normative beliefs, and a summary of their rankings is shown in Figure 4.9. Participants reviewing their own detection rate and patient perceptions were ranked as most important. Participants from a nursing professional background ranked the perception of patients highly (mean rank 1.5, range 1-4) compared to other professional backgrounds (mean 3, range 1 to 4).
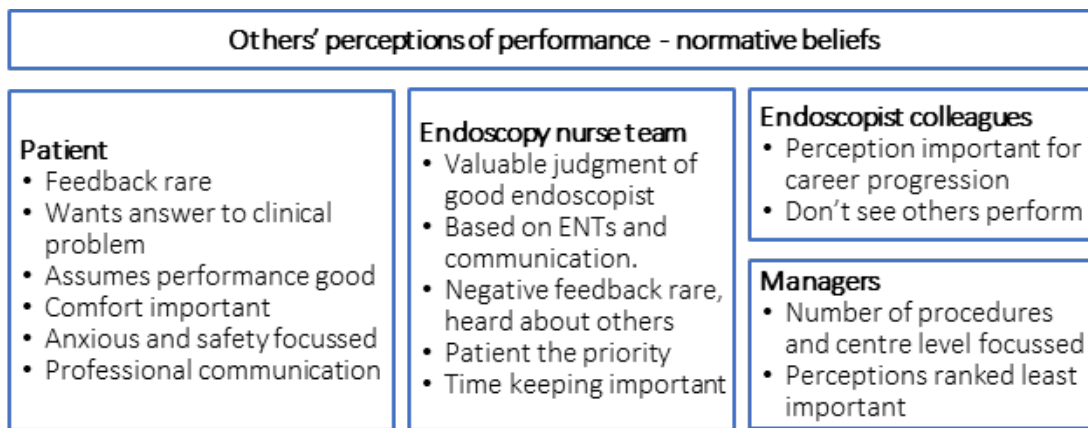
Figure 4.8 Other's perceptions of performance sub-themes and codes
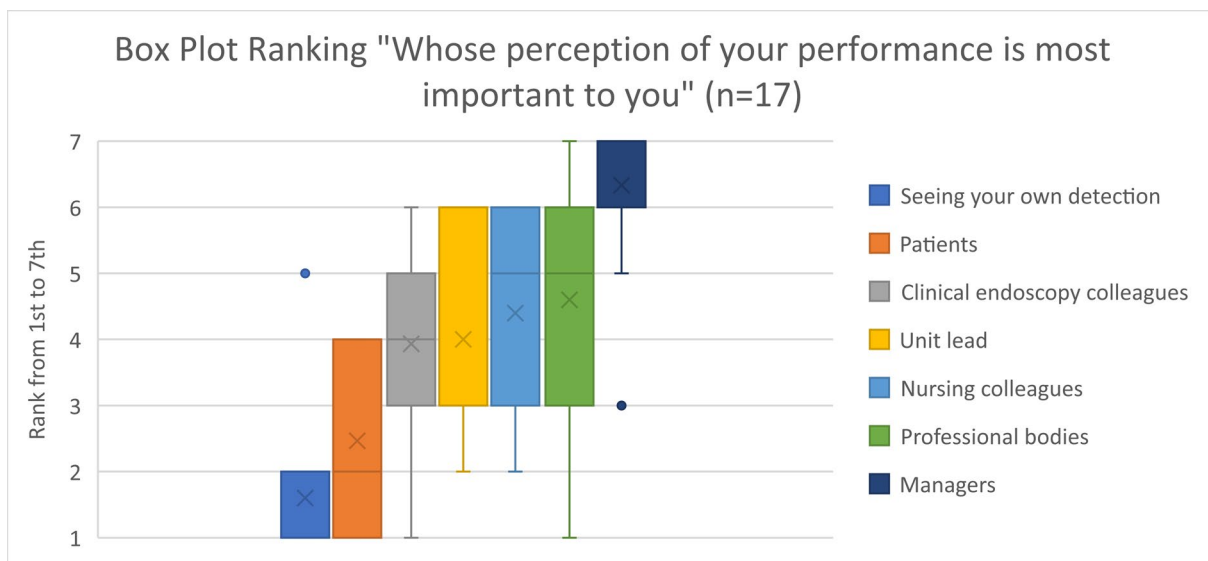
Figure 4.9 Box plot showing distributions of importance rankings for stakeholders in endoscopy performance

4.8.1 The patient

One participant described receiving written feedback directly from patients. No other instances of negative feedback from patients or complaints were described.

> *"We don't always get a lot of individual patient feedback. But if you get a letter addressed to you that you've given that person a good time, for want of the wrong word … if I just feel I've had that interpersonal, that good communication with them during the whole experience then that's really important." (P7)*

Participants' perceptions of patients' beliefs about performance are summarised in Table 4.4. Areas covered included endoscopists answering the clinical question, safety, performing well and professional communication.

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Participants' beliefs	Illustrative Quotation (Participant)
Patients want an answer to the clinical problem and exclude cancer	*"I think the patients wants me to cure them or give them an answer to what the problem is. … This is particularly apparent when patients come with symptoms".* (P2)
	"Patients, like we were saying, the patients want to know, they don't care how many polyps you find really I don't suppose. They just want to know can you find cancer if it's there and are you going to hurt me in the process". (P3)
	"Patients come obviously hoping to find a cause for the symptoms. Are sometimes disappointed if you don't find a cause for the symptoms but also some patients come not expecting to find sometimes what you do find. … But a lot of the time the patients are just relieved when the tests are normal or it's not cancer or anything like that." (P10)
Patients assume endoscopists perform well and performance is managed, without understanding KPIs	*"I think they have assumed that we're all competent and we're all at the top of our game, so I want to be as good as I can be so that… I don't think they ever think that we have these kind of dips, you know. They just assume that when they come through the door and they have a colonoscopy that the person doing it is going to be at the top of their game."* (P14)
	"I don't know what an ADR would mean to a patient, or you don't get an ADR anyway but a completion rate would mean to a patient because they don't understand all the other confounding things that go alongside it. Statistics I don't think mean an awful lot to that one individual person necessarily." (P15)
	"I think you are policing performance but I don't think it's the wrong thing to do. … I think you should, everyone should do it. If I was a patient, I would like to know that someone is there, if I was in that position." (P18)
For patients, comfort is more important than detection	*"They just want somebody who it doesn't hurt. That's more what, I think, plays on their mind than your adenoma detection rate."* (P3)
	"When I'm personally scoping the patient, the most important agenda is the patient. So I have to make sure that the patient feels comfortable, psychologically and comfortable in the room and also comfortable throughout the scope and I have to make sure that I don't miss anything while I'm scoping them." (P8)
	"I think probably the patient's main concern, what I often think, is comfort really. They don't want to have a prolonged, uncomfortable procedure. They want the procedure to be done as quickly as possible but equally they understand you have to have a good look on the way out and I always say that to them when I am at cecum. I say, 'We are on the way out now. I need to have a good look at everything but it won't be too much longer' and as long as they are comfortable they don't really mind that much." (P13)
	"But actually, it depends what performance means, but if we're talking about KPIs I don't think patients really mind. I think they just want to know you're going to do a good job and they're going to be reasonably comfortable." (P9)

Table 4.4 Participants' perceptions of patients' beliefs

Participants' beliefs	Illustrative Quotation (Participant)
Patients are anxious about procedures and want a safe test	*"I think the patients are obviously often extremely anxious coming in for their procedures, if they're people that have got to come back to the department again in future times, they're obviously very worried about what you may or may not find".* (P7)
	"I can only imagine you would want a colonoscopist that would keep you comfortable and would find things and that you will be safe maybe. This is me putting words into the patients' mouths". (P15)
	"They [patients] just want to be safe and have the best". (P16)
Patients want professional communication, to explore and manage expectations	*"The things that patients are worried about, they want to know they haven't got a life-limiting illness and they don't want to be in pain. I think a lot of it is how you deal with a patient beforehand and that patient expectation, so in terms of letting them know that colonoscopy can be uncomfortable, etc, etc, that you'll do what you can."* (P11)
	"I think they want you to listen to them, I think they need to know that they're going to be listened to, they're going to be respected". (P12)
	"A lot of problems that you come across can be prevented by good communication with the patient and making them understand why you're doing and what you're doing." (P17)

Table 4.4 continued Participants' perceptions of patients' beliefs

4.8.2 Endoscopy nursing team

Participants described the endoscopy nursing team as making a valuable judgement of who is a "*good endoscopist*" (P15), as they were "*the ones that scope with you and see you all the time*" (P3).

> *"Yes but the nurses see endoscopists all the time, they are in lists twice a day for X number of days per week and if you go to the nurses and ask them, whose the best endoscopist in this department, who would you go to, to have a colonoscopy, they will give you a very clear answer and they'll say this is why."* (P4)

> *"They make assess – I know as a nurse when I used to work here as a staff nurse I used to watch individuals and I always knew who was good and who wasn't... the nurses see a lot of endoscopists and you know they'll often say oh you're a very good endoscopist. They'll say it to other people and they kind of compare."* (P10)

> *"If nurses know they are working with a good endoscopist it strengthens your working relationship".* (P15)

Participants perceived nursing team judgements were formed for "*totally different reasons*" (P15) than standard KPI, but based on ENTS including the communication and "*manag[ing] the room*" (P19). Positive direct feedback were described and "*boost[ed]*" (P10) confidence.

> "*They [the endoscopy nursing team] talk about people get stroppy and who throws things around, who is really good with the patients and who is not.*" (P3)

> "*I don't think a spreadsheet is necessarily how nurses perceive that though. I think they make a judgement on us very quickly and then that changes over time as they work with us. I think quality endoscopists are important to nurses for totally different reasons and it is measured in a totally different way.*" (P15)

> "*I sort of felt that I did the bad news [about a bowel cancer] in a way that I usually do it and afterwards … I said to the student nurse, "Are you feeling all right about hearing about that?" Sort of did a bit of a debrief with her and she said, "You're really good." … she came the next day and she said, "I looked up the model you used for using the breaking bad news." And she said, "I'm actually going to use you for my next assignment … we're always talk about poor practice …But I'm using that as an example of really good practice." And I thought that was so nice to have that feedback of something that you do a few times every week and it was that, and you just hope that that communication episode has been as good as it can be for a patient … that's what's important as well that whatever it is that you find or you've done, that you've actually communicated that in the best way*". (P7)

> "*If the nurses are happy helping somebody and scoping with somebody, they're comfortable with their performance, they're comfortable with how they manage the room, that sort of thing.*" (P19)

Negative feedback was rarely discussed directly, one participant described "*I know from what nurses say, 'oh you're a bit slower aren't you', that's fine, that's okay, as long as the patient is okay" (P4).* Generally, endoscopists heard about the negative performance of others, "*you hear people being spoken about … but it's rare you hear feedback about yourself*" (P17). Some spoke about triangulation of indirect feedback to assess their own performance.

> "*I suspect the nurses pick up things and probably have feedback points because you hear them talking about other consultants so they must talk about you, they must do*

…They never tell you what you're doing, do they? So you probably have to triangulate it to find out what you're doing." (P3)

"Nurses will do a bit of, "Oh well, that person doesn't…" Or, "They're not so good at doing that." And it's a bit of that informal chat that you try not to encourage in the procedure room. But you kind of think, well, they must think that I'm okay, they see everybody, don't they, really?" (P7)

"I don't really know what [nursing colleagues] think of me or what they think of my performance. But I think they're pretty good judges of it". (P9)

"You get wind of the nurses who are: "I don't want to work with him". You know there's a problem. That's the sort of indirect feedback really… I hear anecdotally from the nurses that: 'So and so has a long withdrawal time but eight minutes of that she's sitting in the rectum talking'." (P19)

Participants believed that the patient was the priority for nursing staff who were advocates for their safety and comfort.

"If I was looking from my nursing point of view, the patient's priority should be the priority, everything else doesn't matter." (P2)

"Because that's the other thing, the nurses don't want you to be causing the patient pain because they have to be the patient's advocate too." (P14)

"I think nurses are probably an important one as well. So, what's their agenda? They are the patient's advocate, aren't they, so all the comfort scores and things are really relevant to them". (P15)

Time keeping was believed to be important to the endoscopy nursing team.

"I think they're [the endoscopy nursing team are] probably more looking at how do you treat the patient, what your lists like. Do you run miles behind? Are you really slow?" (P3)

"You see a huge lesion that has only been booked for 50 minutes and you think it's going to at least an hour and a half, sometimes I will actually cancel the procedure. So, I am mindful of those things … you don't want to keep the nursing staff really a long way beyond what their [hours are]". (P6)

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"Yeah, I suppose, they [the endoscopy nursing team] want different things out of us, don't they? They want to be finished on time [Laughs], so they go against the slowing down, which doesn't ever stop me,". (P14)

Participants described conflict between the endoscopy nursing team's advocacy for patient comfort and the need to complete a test for clinical reasons (see Comfort scores pg. 103).

4.8.3 Endoscopist colleagues' perceptions

Clinical endoscopy colleague's perceptions were ranked next. Two participants applying for BCSP accreditation described how perceptions of colleagues were important for career progression.

"I suppose if I was thinking about doing stuff like bowel screening then there are some of the bowel screeners that I would say... Yes. I'd want to know that they were happy". (P3)

"I don't want people talking that I've missed two cancers when I've actually only missed one and one is hard enough to deal with. … It's one of the things about cancer screening, I want to be watched, I want to know what my figures are." (P12)

One participant believed as colleagues' perceptions were less important as they rarely saw other endoscopists perform.

"I think an endoscopy colleague could never watch you do an endoscopy, they would base their decision on a detection rate. So, if you had a regular feedback process where people be would watching you scoping, that would clearly be number one for me. In my job role, that doesn't exist, so for that reason, I'm not going to put those at all in there." (P17)

4.8.4 Managers

Endoscopy centre managers perceptions were ranked as least important. Participants perceived managers were more focussed on "*how many numbers I do*" (P7) and hitting centre level "*targets in terms of getting patients seen*" (P15) and not individual colonoscopy quality.

"So I guess for the unit-lead or the managers, it's going to be a bit more about numbers and number of failed procedures and number of re-dos and complications." (P3)

"Managers are interested in one thing, we're interested in another, they're interested in seeing a hundred [low risk] patients in two weeks or whatever. We're all driven by a subspecialty interest which is this is the interesting stuff, but it's very low volume and the tariff for EMR is very poor". (P6)

"Their role seems to be separate to that in terms of they are probably more thinking about how to get the patients through and how to meet all of the targets". (P13)

"Managers are more interested in us meeting targets in terms of getting patients seen and done and treated within a certain amount of time. I am not convinced they look at the detail of how we actually perform … My perception is that it is more about the mechanics of how the department functions rather than the individual endoscopist." (P15)

4.9 Theme: Reject gap

These subthemes describe the phenomenon where a gap is identified between an endoscopist's performance and a standard, but the endoscopist rejects this gap and does not plan to change behaviour (Figure 4.10). In these instances, endoscopists either did not engage with the feedback showing a gap, dismissed the feedback as having low credibility, dismissed the performance gap with another context, or had a defensive reaction rejecting the performance gap.
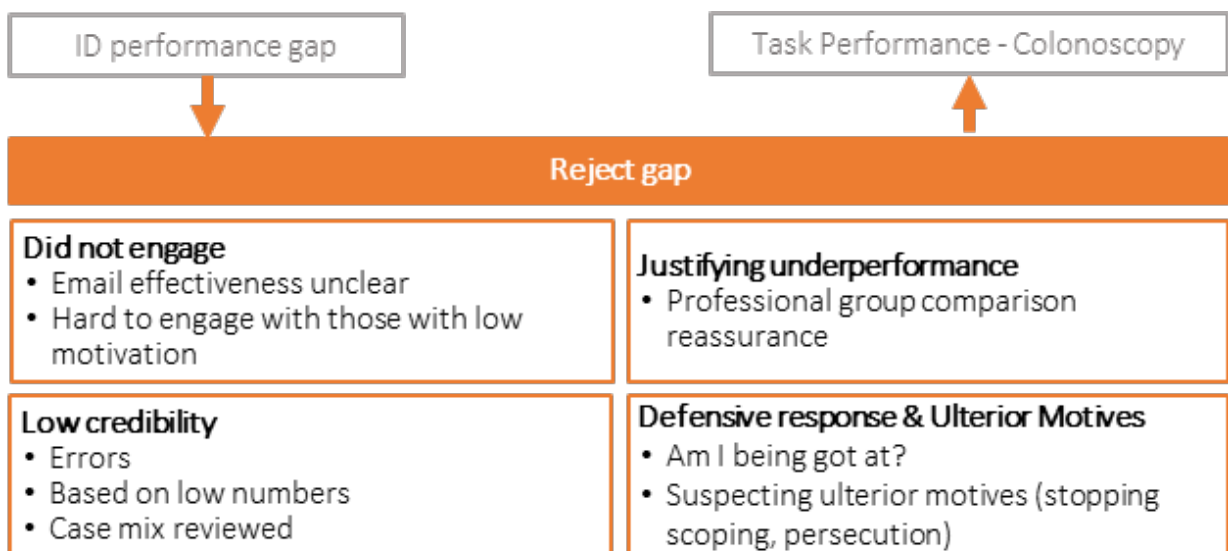
Figure 4.10 Reject gap sub-themes and codes

4.9.1 Did not engage

All three unit-leads were unsure how effective A&F email messaging was, who read emails or for how long. This was reflected when participants were unable to remember specific details about the performance data they had received.

> *"What I tend to do when I give my feedback, and to be fair, I don't know how much our endoscopists read it". (P1)*

> *"I think emails and messages to people are the least effective. People don't like receiving them and people don't read them". (P5)*

> *"I'm not sure how long they spend looking at it". (P9)*

> *"God. I can't even remember the last time I had one [email feedback] to be quite honest." (P10)*

Two unit-leads described a challenge that those least engaged in feedback emails were potentially those who would benefit the most. They considered that those with low motivation were the hardest to engage with.

> *"However, you might be person … who just doesn't want to do endoscopy and won't be motivated, in which case it doesn't really matter what information you give them, they're not going to change." (P1)*

> *"The people who you need to reach are the people least likely to read emails … those people who don't need to be communicated are the ones who read all the stuff and engage with all the things that you do, whereas the people who do tend to not meet the KPI's are the ones who it is the most difficult to change their behaviour or communicate with." (P5)*

4.9.2 Low credibility

In development of the BCI, low credibility of the performance data being presented was a common reason to reject a performance gap, with endoscopists dismissing all data if there were one or two errors (see Chapter 3). One unit-lead described endoscopists responding to feedback emails and "*question[ing] the quality*" (P9).

> *"You get the usual range. Some will say 'thanks a lot', some will say 'oh yeah, good'. But, like I say, some of them are often very glad to take, and some will question the quality of the data. Not unreasonable. [Laughs]."* (P9)

Participants described how, if KPIs were below a target over a short period or over a low number of procedures, endoscopists dismissed the data and planned to review again later once more procedures were performed, before considering changing behaviour.

> *"Quite often you get a little dip, but it isn't sustained and so you don't need to have to go through a formal process and intervention".* (P5)

> *"My second [action] would probably be to look at the data in terms of numbers because if I say I hadn't done many cases or the numbers were very small I would be tempted to say, 'I will still speak to my colleagues but maybe it is just that I haven't done that many and it's just the way the numbers have fallen so maybe I will just keep an eye on it for another six months or something and see if nobody else is concerned…'".* (P13)

> *"I think it's taking a step back and looking at that and then I guess just reviewing has something changed? If it was over a month or a couple of months I don't think I would lose too much sleep over it. If we are looking at something that has maybe persisted over a year then at that point I would probably talk to someone".* (P15)

With face-to-face feedback one participant described an observation about their performance they disagreed with and sought further observation to seek evidence of the credibility of the feedback.

> *"You do need to be receptive to feedback that's negative because at the end of the day, it's all about patient safety but if you do disagree, then you do need to get another opinion."* (P4)

Case-mix adjustment was identified as being important for comparing detection KPIs (see Detection pg. 103). Performance gaps identified through normative comparisons were not perceived as meaningful if workload and case-mix were not considered. If detection was low, participants described reviewing their case-mix from that period, to justify the low detection and avoid changing behaviour.

"I don't think you can compare apples and oranges. I think even in a trust, comparing surgeons with medics I think is difficult because I think sometimes the case-mix is different" (P3)

"The data this is raw data it's going to bugger everything up because I do EMR [polypectomy] and BCSP lists". (P5)

"I would probably look at the cases that I had had. Is there anything that explains it there? Have they all been IBD patients that have been scoping that month and they have been dye sprayed so I won't find any polyps?" (P15)

"It depends on what my list has on it you see. If you get a lot of young people with just vague symptoms, then your ADR is going to be lower than if you're doing symptomatic older patients." (P19)

4.9.3 Justifying underperformance

This subtheme describes endoscopists accepting the credibility of the data but rejecting the performance gap. Participants described using centre-level social norm data to benchmark against peers and be reassured *"if everyone else's is similar"* (P3). Performance being perceived as similar to others within an identified professional group provided reassurance and reduced motivation to improve, even if this performance was below an aspirational target (see Centre data pg. 115).

"I guess if your performance is not so good but everybody else's is similar then you're a bit like, 'Well that's probably okay,' and that's probably not quite the right way to go about it." (P3)

"I would want to see more people at my level, on the report, to know if I'm as crap as the report is making out or if this is reality of where I fall." (P16)

"When I look at other endoscopists they always seem to be a little bit higher than mine. There was also one of our other nurse endoscopist colleagues who was always the same as me and we did a lot of endoscopy, us two, and I wondered whether it was because we did so many that that had an effect and that the people who were actually higher detection rates did very few colons… the ones who actually had higher detection rates than me were actually, I thought personally, not as good endoscopists." (P10)

"You want to see where you stand within the group and everyone else. So, for me, it reinforced to do what I was doing. I don't think I made any particular changes, to be honest." (P17)

However, social norms were not described as potentially demotivating by all participants. As described, participants often chose to compare themselves to high performing colleagues (see Centre data pg. 115).

"(I: If you were in the lower end but there was a lot of you in the lower end, would that be reassuring to see that?) No, because that's what drives me. I guess it depends what drives you, and what drives me is to feel I'm doing the detecting at a high level and so if I was at the lower end, I think it would bug me." (P17)

4.9.4 Defensive response and ulterior motives

In feedback messages with negatively perceived performance data one participant described a defensive "*Am I being got at?*" (P3) phenomenon. This increased the chance of justifying underperformance through a comparison to colleagues, to "*rationalise my own standpoint*" (P3) and reduce the emotional response to perceived underperformance.

"So I'm well aware that often my first thing in these things is defensive, "Well I'm really busy. I've got lots of other things on. When am I supposed to scope?" I lose all these sort of things. So I think initially, I guess it depends what kind of person you are but I think my initial response to any kind of feedback of any sort appears to be, initially, a little bit defensive… I like being able to see everybody else's because then that allows me to rationalise my own standpoint. I think if I only got my numbers, I think I would be a bit like, 'Well where is that as a frame of reference?' I think because it's got a reference frame on it and comes with the opportunity to discuss it, I think it's okay." (P3)

Participants described anxieties focussed on possible motives of the feedback other than to improve performance. These suspected ulterior motives included accusing endoscopists of not doing enough and persecuting endoscopists who were wrongly perceived to be incompetent, which may lead to endoscopists being stopped from scoping. One unit-lead participant described trying "*to clarify the goals were to improve*" (P9) performance before giving feedback.

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"I know that there is concern amongst my colleagues that this kind of data is used against you and I think there's some people that feel that it may be used to stop you doing certain procedures, which I think is worrying and I hope that's not the intention of it." (P8)

"I think what you need to be very careful of is that you don't move beyond monitoring to ensure safe standard and to drive up and improve standards into persecution, … making more of an issue for an individual than is actually the case when perhaps that individual needs time just to settle in and let things calm down, rather than actually that individual is not competent at doing what they are doing." (P11)

"So I did a little bit of warming up with some emails to make sure he had all the information before we met, and tried to clarify that the goals were to improve his performance rather than be critical or anything like that." (P9)

4.10 Theme: Quit and stopping scoping

This theme describes situations when receiving A&F data, participants would consider stopping doing endoscopy, or quitting (Figure 4.11). This theme is linked to confidence (pg. 101) and cognitive interference (pg. 179).
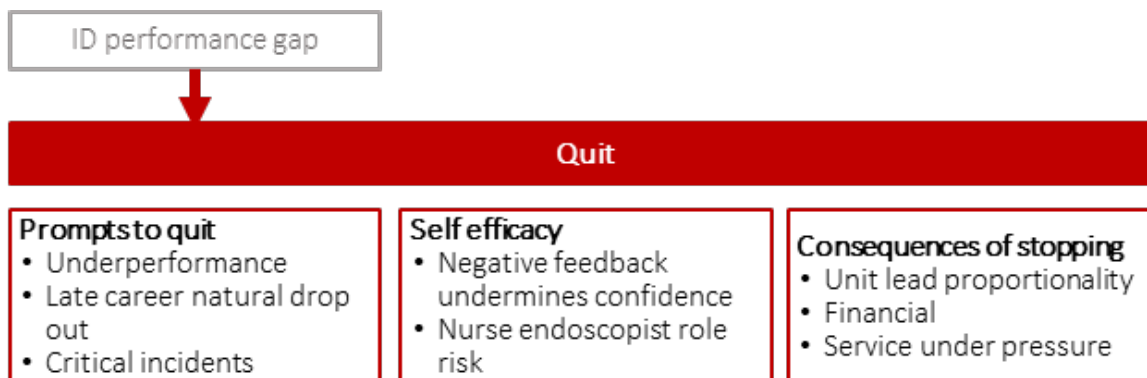
Figure 4.11 Quit sub-themes and codes.

4.10.1 Prompts to quit: Underperformance, natural dropout, and critical incidents

Participants described how, if persistent performance below a minimum standard was to be identified and did not improve despite implementing a plan, they should consider stopping scoping.

"What I probably can't formally say is whether the information I send to others has got the same move [to change behaviour]. What we do know is that if we look at the

spread of data on our spreadsheet, [performance] probably has inched up year on year and therefore some people perhaps their job plans have changed and perhaps should be giving up endoscopy. [pause] … It's been a lever to try and help them to say, 'It's time not to do endoscopy anymore and do something different.'" (P1)

"If we're not good at something and we've tried to address it and we can't find what's wrong and you can't address it, then maybe you just need to think about something else or giving it up, I guess." (P18)

Participants described a "*natural dropout*" (P1) of endoscopists at late career stages, related to their lower numbers of procedures and the higher risks of isolation in senior endoscopists. Isolation (pg. 195) was associated, by participants, with developing bad habits and not being exposed to new practices.

"If people are still underperforming and not hitting the numbers with the numbers of procedures they're doing then I think you would say, "Well is this really right for you to continue doing endoscopy? You're not committing to it… I think what tends to happen with that if there is a natural dropout if that person has reached that stage of their career" (P1)

"I think one of the things that happens when you start independent practice, the longer you go on, you do get into bad habits and you do sometimes get set in your ways and resistant to change and I think these things are a prompt to continually want to improve and to continually want to monitor yourself … the older generations might not feel the same, maybe that's an assumption I ought not to make." (P8)

"I think you see that isolation in endoscopists across the spectrum. And I think it's probably most notable in senior consultants who have been doing the same thing for years, and often aren't exposed to new ways of doing things, or different ways of doing things, or evolutions in technology or whatever." (P9)

Participants identified critical incidents, such as *"a run of perforations where there's concerns about technical performance"* (P9), acting as prompts for endoscopists to reflect on their wider performance and gave them motivation to stop and "*step back*" (P1) from their endoscopy roles.

"A surgeon had a complication and actually it was a surgeon that didn't do very many procedures and because of that complication, I think reflectively decided, "I'm not

going to do more endoscopy," which was probably the right thing for them. So again, critical instance feedback, that person wasn't dreadful, didn't do as many as they should have done and that wasn't changing and then had a complication that meant, "Actually we're going to stop that." But I don't think that person necessarily had... I don't know why they did the endoscopy. I presume they were doing endoscopy because they enjoyed it at some point in their career. I think they got to a point where they probably felt obligated to do it and then there was a chance to step back and they did. They do other things in the trust." (P1)

"If it dropped [KPI] then I guess there is always a worry of whether they will stop me doing this or what will that mean if there is a problem looking at my overall performance if a specific incident occurs. It's not been in the back of my mind but that's how I see it. I don't necessarily see the GMC as a positive thing because the minute you hear the GMC as a medic I think you just panic." (P15)

4.10.2 Self-efficacy and knockbacks

Participants described how negative feedback, without a plan to improve performance, could reduce confidence, worsen performance, and increase the risk of quitting colonoscopy. There were concerns data *"might end up being a little bit negative and a bit destructive"* with the risk that *"you think 'I'm not very good here. I'm not benchmarking very well' … that might be quite demotivating"* (P1). Two participants from nursing professional backgrounds described receiving negative feedback when on a course and a low caecal intubation rate causing them to question continuing practicing.

"It was all quite negative feedback and all not positive, which I came back from the course seriously reconsidering whether I should actually continue in endoscopy. I lost a lot of confidence and I think by giving that sort of feedback without any positives … can actually destroy your confidence and I think to do this job you need to be confident in what you're doing … [since the feedback] I struggled with a lot of different things. Things I had been doing naturally, I had been doing what I had been taught I was very hesitant to do, because it had not worked on the course, and all the crappy feedback I got." (P2)

"Or you get a run, which you tend to, of incomplete colonoscopies, and you think, 'What am I doing here?'" (P14)

Participants described that having confidence (pg. 101) in their own technical ability protected them from the "*knockbacks*" (P14) of underperforming in KPIs and decreased their risk of quitting. One unit-lead participant described an endoscopist who stopped scoping because of low confidence.

> "*[It] wasn't because of any technical ability, it was just [their] confidence … confidence, not necessarily competence because every time they were watched, they were great and they could do it. What I used to find in that when I used to watch that person scope, they would often get to a difficult point and they'd look to me. My tack would always be just to say, 'Well sort it out,' and not actually tell them anything and they always did. So, they just needed that pat on the back.*" (P1)

The participant went on to say that they felt the endoscopist's professional background as a nurse increased the psychological pressure of feedback, as the nurse endoscopist role was more endoscopy focussed and they were more "*self-critical and criticised*" (P1) about endoscopy performance.

> "*I guess we recognise [demotivation] and I guess of the endoscopists that we have in the unit, the nurses probably do feel, just by nature of the fact that they're nurses, they do feel a little bit more self-critical and criticised. Obviously, it's what they do … if you go back to the nurse endoscopists because I think they're the group that do a lot of our work, most of the work in the unit and therefore that is their raison d'être, whereas a lot of us, we have other things that we do. I think when they get that feedback, it's about that individual being able to deal with it and change as an individual or with a bit of direction from myself*". (P1)

4.10.3 Consequences of stopping scoping

One unit-lead described the decision to ask someone to stop scoping needed to be seen by endoscopists as "*proportional*" (P9), and that being below a detection rate alone was not sufficient without significant attempts to help improvement.

> "*Stopping people scoping, I think as long as you're clear, right from the outset, that it's proportional, that your response is proportional. … [Low adenoma detection rate] It's not sufficient to stop that person scoping until they've been off on a course. It's not a run of perforations where there's concerns about technical performance. As long as your response is proportional, I think they get that.*" (P9)

One participant described that stopping endoscopists from scoping had significant consequences for individuals including feelings of failure and "*financial*" (P1) consequences. The participant described the endoscopy centre "*felt it massively as a unit*" (P1) including an increased workload pressure on other endoscopists.

> "… *That individual knew, and it must have been really high pressure, that if this wasn't successful … then we couldn't really maintain [them] as an endoscopist and therefore there would be a big salary hit. So there was a big financial background to that … But I also think it was more [they] regarded [themselves] as a failure and all this kind of stuff. So there is loads of negative things …for [them] as an individual but I think we'd have felt it massively as a unit as well. It would have been dreadful to have been in that situation*". (P1)

One unit-lead described their experiences in another country, with more endoscopists than rooms available, allowing a "*panel for quality*" (P9) to stop people from scoping for underperformance without impacting centre pressures.

> "*Because it was such a big unit, it gave the Quality Panel the power, the upper hand… if you say to somebody, "If you don't perform I won't re-credential you and you won't be able to scope in my unit in six months' time." You can be pretty sure they're going to do something about that performance.*" (P9)

The participant described the work pressures on UK endoscopy units and high demand for endoscopists limited the possibility of stopping people from scoping for underperformance, and only "*significant*" problems in performance would prompt stopping scoping.

> "*I'd actually worry now that people are a bit too comfortable as endoscopists. Because they know they're so in demand, because we spend so long begging them to do more lists, I actually worry that they might feel a bit too complacent. And they know fair well that we haven't got the manpower or the flexibility to stop people scoping because we can't get the quality. … I worry that that might affect me and my reaction to KPIs, or to things that happen because I can't afford them not to be scoping. And I have to check myself every now and again … if there was a significant performance problem, you'd have to do it.*" (P9)

4.11 Theme: Eliminate the gap through gaming

In this theme participants described behaviours to circumnavigate performance indicators through inaccurate documentation or behaviours which improved KPIs without any benefit to or even risked harm to the patient (Figure 4.12).
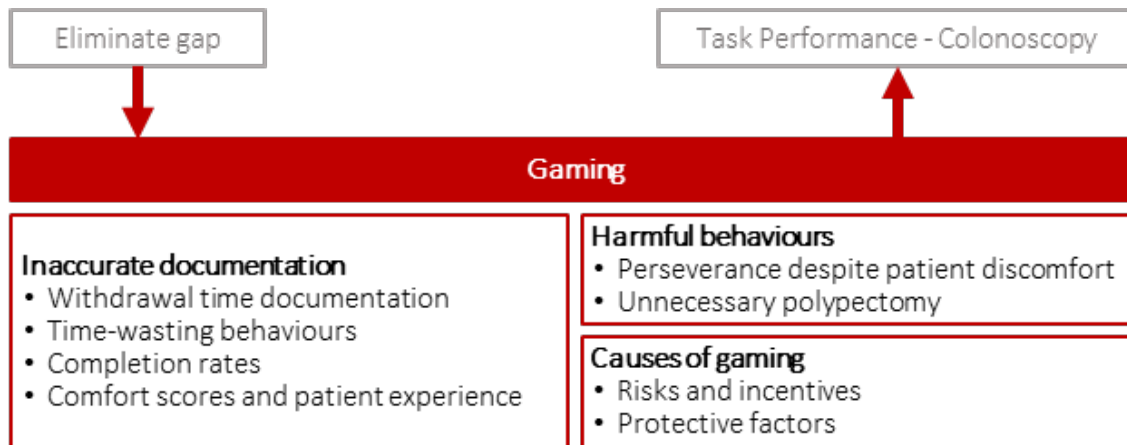
Figure 4.12 Gaming sub-themes and codes

4.11.1 Inaccurate documentation: Withdrawal time

A minimum withdrawal time of 6 minutes is set by the British Society of Gastroenterology[11]. There was a perception that this was not taken seriously by some [other] endoscopists who would document 6 minutes on the report without accurately noting the time. *"'So, for the purposes of a quiet day I'm going to say this is six minutes and I really don't care if anyone around me knows it isn't'. I think that does happen, I'm sure it happens in every department"* (P5).

In three centres nursing assistants were trained to note the withdrawal time on behalf of endoscopists with the goal of improving withdrawal time as demonstrated in previous trials.[159] This was initially perceived as intimidating external scrutiny by participants but they had come to consider that it reduced fudging withdrawal time. *"I would like to think I wouldn't [game withdrawal time] but it is hard for me to hide now because the nurses are documenting it so… [Laughter]"* (P15). When assistants noted the withdrawal time participants described others engaging in time-wasting behaviours, such as starting the withdrawal timer early and *"hanging around"* (P5) in the rectum at the end of the test; these behaviours prolong the length of the test without improving colonic inspection or benefiting the patient.

"That's always one of the things that you worry about is are you just going to take off a load of rectal polyps in the same way that you could just withdraw and sit in the rectum for five minutes, couldn't you, and then say your withdrawal times." (P3)

"When it comes to withdrawal times … some people will say, "Start the clock," and then [the nurses] say well, "Are you actually at the caecum?" … "some endoscopists who had then kind of hung around the rectum for a couple of minutes saying, 'I'm staying here around the rectum for a couple of minutes because I have to'". (P5)

"Of course, you have to be wary of withdrawal time. I hear anecdotally from the nurses that: 'So and so has a long withdrawal time but eight minutes of that [they are] sitting in the rectum talking'". (P19)

One participant assumed that endoscopists who undertake time-wasting behaviours did not appreciate the clinical importance of withdrawal time on polyp detection, *"a lot of people just see it as getting the scope out. And maybe aren't as aware that it's a really key part of the examination, especially if they trained quite a long time ago"* (P12).

4.11.2 Inaccurate documentation: Completion rates

The participants described examples where bowel preparation and procedure documentation could artificially inflate completion rates. Participants reported that some endoscopists who were unable to complete a colonoscopy would change the procedure documentation from a colonoscopy to a flexible sigmoidoscopy. Flexible sigmoidoscopy (or *"flexi sig"*) do not have the same completion KPI.

"People have changed what was an intended colonoscopy to a flexi sig because of poor prep or that's as far as they've got and you can see the nursing documentation, the original referral." (P7)

"I know some people kind of falsify figures and I always put if it's a colon it's a colon. If it's a failed colon it's a failed colon. It's not a sigmoidoscopy it's a colonoscopy and I know that people do not always follow that... That skews the figures as well... It's very common." (P10)

Bowel preparation was not perceived to be under the endoscopist's control, *"you can't change bowel prep"* (P17). Participants attributed low completion or detection rates to poor bowel preparation; one participant suspected that if the insertion was difficult, endoscopists

may inaccurately document inadequate bowel preparation to later justify a low completion rate.

> "I do understand that some endoscopists could potentially fudge their figures and are feeling tired, "oh poor bowel prep, let's just come out". So I do understand that, so I don't know what the answer is but it is hard because you do get poor bowel preps." (P12)

> "My caecal intubation rate is lower than it should be perhaps, mainly because of poor bowel prep." (P2)

> "Well part of the problem with [detection rates] is some that will be down to poor prep. I can think of a number of cases recently where the prep in the right colon is fairly smeary. If you had better prep, you'd probably have [detection]." (P19)

4.11.3 Inaccurate documentation: Comfort score and patient experience

Comfort scores (pg. 103), although perceived as important were described as variable and having "*no consistency*" (P5). One participant described their experience as a training lead, reviewing a trainee endoscopist's portfolio and their comfort scores. The participant noted all patients were documented as being comfortable, which would not be possible, and inferred that to mean that the accuracy of the comfort score was unimportant to the trainee and their previous trainer.

> "I was signing off a colonoscopy portfolio for somebody for JAG certification and I just said, "You've done your 230 or whatever." I said, "Why is every one of your patients comfortable?" … I hadn't done individual training with this person. And I just thought, "Oh my God. What on earth." They said, "Well that's what the consultant's put on the thing."... But it just wasn't important to him. I just thought, oh my goodness, throughout his training, where has that perception come from. And I was really worried … I said, "I'm not signing you off until you go back and we do some more work and have a look at sort of these comfort scores with patients and whatever." But it was through no fault of their own in some ways but I was absolutely horrified." (P7)

4.11.4 Harmful behaviours: Perseverance despite patient discomfort

Participants described that patient discomfort should limit colonoscopy (see Meta-task processes pg. 101). Participants described being "*frightened*" (P7) by their completion rate performance figures causing them to "*drive on and cause [patients] discomfort and pain*" (P14) to achieve a complete test. One participant highlighted inappropriately completing procedures with poor bowel preparation and being aware that the behaviour "*was unsafe, I'm going to miss loads of pathology here*" (P12), due to perceived pressure to have a high completion rate to achieve a BCSP accreditation.

> "*I know sometimes people persevere with things that they shouldn't be persevering with because they're frightened of their figures, performance data. And I think that has become a bit of a danger.*" (P7)

> "*If you're going to have bad bowel prep, do you then fight your way through the bad bowel prep to get to caecum. So then you get your caecal intubation high or do you actually say, look this is unsafe, I'm going to miss loads of pathology here, let's call it a day. But then obviously recently, because I'm going for bowel cancer screening, caecal intubation rates is very important to me. So I have been fighting against poor bowel prep, where normally I would just call it a day, rebook, give enhanced bowel prep.*" (P12)

> "*If you're looking at completion rates it's different. Because people then drive on and cause people discomfort and pain*". (P14)

4.11.5 Harmful behaviours: Unnecessary polypectomy

Detection (pg. 103) and removal of colonic polyps was important to all participants. However, participants described polyp detection and polypectomy KPIs as incentivising the removal of clinically insignificant lesions such as distal colon diminutive hyperplastic polyps.[8]

> "*I guess if you're always slightly under you'd say, 'Well do I need to start thinking about looking a bit harder or taking off something, rectal hyperplastic ones?'*" (P3)

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[8] International guidance does not recommend the removal of such lesions.[117,249]

"The goalposts have moved. So, I think initially, it was just, as I say, when we first started, people were leaving the small stuff in the 74-year-old whereas now you're just accepting that you're taking everything off." (P7)

"Simply a polyp detection rate isn't good enough because you can always find metaplastic polyps in an elderly population". (P19)

Although it increased the recorded detection rate, this was recognised as having no clinical benefit to the patient, *"snipping those off isn't going to help a patient"* (P8), and potentially increasing the risks of complications particularly in the "*elderly and frail*" causing them "*more harm*" (P7). Removing or leaving a polyp was not always a clear decision, and assessing the risks and pragmatism was recognised as being important.

"In a [frail elderly] patient where you find the diminutive polyp and are you really going to risk that patient having a perforation by taking off a small polyp which is not going to ever have any effect on their life span? … I think the [endoscopy] standards are potentially causing risk in those two areas. … the wrong incentive is there." (P5)

"More senior gastroenterologists will be more pragmatic … if I actually take that [insignificant polyp] off and make a hash of it and they're elderly and frail, I'm doing this [colonoscopy] to prove that they haven't got a big cancer … taking something little off, that could cause them more harm, they're not going to do it". (P7)

4.11.6 Causes of gaming

Participants described potential risks for gaming behaviours. These included a perception of over thinking about figures, causing performance anxiety (see Cognitive interference pg. 179). This anxiety was perceived to be worse if there was pressure from departments to achieve targets or punitive consequences for not achieving them, such as stopping scoping (see Prompts to quit pg. 130).

"I think the danger is not having people get too bogged down in it [performance data] so they start gaming their numbers." (P3)

"I mean that a lot of my biggest concern about these KPI's is they're either encouraging people to lie, or they are encouraging people to attempt to do something which is maybe to the detriment of the patient, because they are concerned about their outcomes. … We didn't want [endoscopists] to feel that they

were under pressure to do these or to go the extra mile if the patient had comorbidity or was finding discomfort …" (P5)

One participant noted that when gaming behaviours were not undertaken their performance dropped, which raised the question of whether they were acting for their performance figures or for the patient.

"When you are getting performance figures … at times you've got to think are you doing this [behaviour] for your figures or are you doing it for the patient … when you do it more for the patient, then you do notice your figures drop. So it is a hard one, to manage that." (P12)

Participants felt that, if endoscopists were made aware of targets "*but they're not showed down our throats*" (P8) or had the opportunity to document why KPIs were not achieved in individual procedures, this would help reduce gaming.

"We're all aware of the goals of the unit but they're not shoved down our throats, so we're not made to do things that make us feel uncomfortable to hit these targets. We're told what our data is and have the opportunity to discuss that with the endoscopy lead and if there are any concerns, that would be raised but it's not rammed down us all the time, this is what you have to achieve, not at all." (P8)

"… What I've been trying to do over the last few years is make it [the endoscopy reporting system] more sophisticated so that you are able to have a drop down menu of reasons why you didn't achieve something … whether it's rectal retroversion, whether it's not reaching the caecum, whether it's not taking off a polyp, or any of the other of those ones, … I had been saying to them [endoscopists] in advance of this that we did not want them to try to reach all these targets if they felt there was a legitimate reason not to, that we didn't want this to happen, … do what's the best for the patient and record why they had been doing something on the software". (P5)

4.12 Theme: Eliminate the gap through personal actions

This theme describes the actions undertaken by endoscopists independently to try and reduce the gap between their performance feedback and a standard (Figure 4.13).
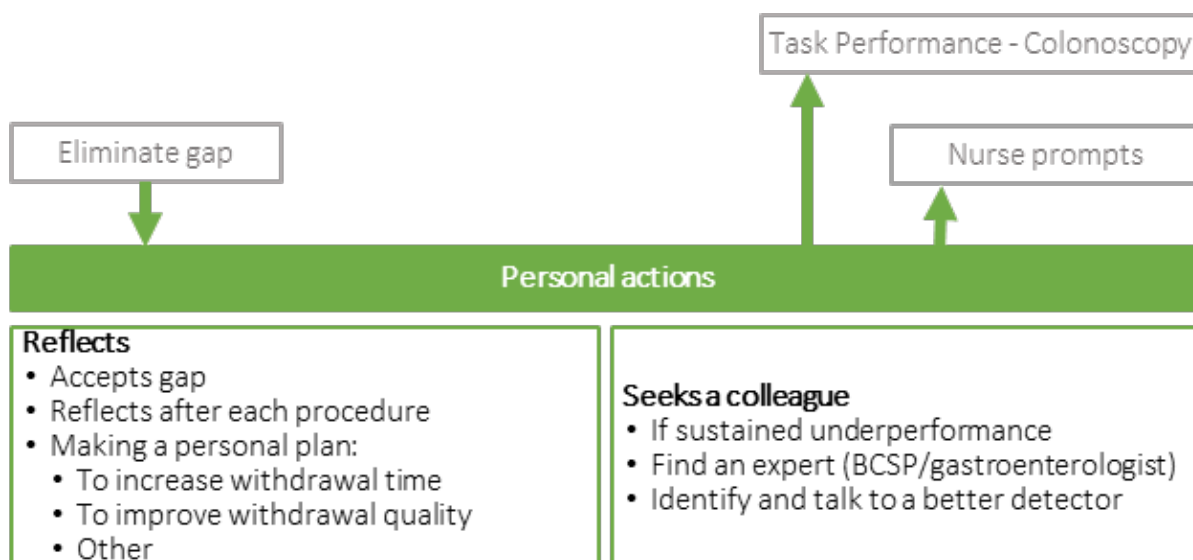
Figure 4.13 Personal actions sub-themes and codes.

4.12.1 Reflects

Participants described a "*culture of openness*" (P6) to feedback identifying a performance gap and recognised being receptive to negative feedback was "*really important*" (P17). The UK was perceived to have training systems normalising feedback, without this being perceived as "*criticism*" (P17).

> *"I've never felt threatened by data, I have to say, … and I think as you grow older, I think as I'm doing more around sort of being more aware of human factors and kind of safety and trying to have that culture of openness".* (P6)

> *"I know people from different countries because of my background and you see some people if you tell, they take it as criticism, when feedback is not criticism, it's feedback, and it's two separate things. But the mentality which is created by going to lots of training lists and having feedback written down makes it almost normal and it allows you to accept more freely without getting offended, if you know what I mean. So, I think it's really important actually. So, the way the system works in this country, works really well from that point of view because it creates that mentality that feedback is normal, but in some places, it's not like that."* (P17)

> *"No, I think it's all part of quality improvement isn't it? I think in this day and age people have to accept that you have to look at what they're doing".* (P19)

Most participants described reflecting on their endoscopic practice to improve (n=13). Four endoscopists (P1, P6, P14, P17) described reflecting after each individual procedure on how

they could improve their performance; these reflections were not generally documented and plans involved small changes to scope handling *"to make a little difference, because I know that the big changes have already happened"* (P14). Three of these endoscopists were BCSP endoscopists.

> *"I will self-assess every procedure afterwards and I'll always, and so I'll always ask myself at the end of every procedure, 'How did that go? How could that have gone better? What could I have done differently during that last procedure?'"* (P6)

> *"I guess just what drives me is doing better every time, that's basically what my motto in doing an endoscopy, you're just trying to improve every time you do a procedure and learn something and improve... I think what I've really tried to work on recently the endoscopy withdrawal technique"* (P17)

If their detection KPIs were low, seven participants described that they would plan to increase their withdrawal time. Endoscopists described aiming for a withdrawal time between 7-10 minutes, and this was achieved through paying attention to the clock and *"dividing the colon"* (P13) into segments to ensure *"2 minutes"* (P13) in each quarter.

> *"I started to time myself by looking at the clock when I got to caecum and them I tried to withdrawal dividing the colon into quarters and then tried to spend at least two minutes in each quarter and if I got to somewhere a bit too fast I would go back in and have another look round. … trying to remember that the key part of the examination is the looking on the way out and not the, 'I am at caecum! Yay! Let's just get out of here.'"* (P13)

> *"I went back through all the KPIs again, to see why my numbers could have dropped and what I drew from the KPIs is that I'd sped up on my withdrawal time… I put the withdrawal time back into my priority"*. (P16)

> *"Increase my withdrawal rate or increase my withdrawal time. So, that's about all you can do really … that was reasonably well shown in the flexi sig trial, where there was a direct correlation between adenoma detection rate and withdrawal time."* (P19)

Endoscopists described using this time for task-motivation behaviours to improve the quality of their withdrawal, including clearing pools of fluid and irrigating the bowel wall, looking

behind folds, and "*turn[ing] the patients*" (P19) on withdrawal to improve colonic distension and "*maintaining a view at all times*" (P17).

> "*Patients weren't coming in and I was thinking, 'I must find a polyp. I must be here all day' but it was more just a general awareness of, 'Remember to look properly. Remember to look behind folds.'*" (P15)

> "*[I will] look at the clock and make sure I actually spend the six or eight minutes... Make sure I use maybe the pedal to just make sure everything is clean, like the water and pump. To make sure that the bowel prep was good. I know that I could change position to look at different areas of the bowel*". (P18)

Other personal behaviour-change plans suggested by participants included increasing access to endoscopy lists and the number of procedures performed in a month, "*reading the guidelines*" (P11), using hyoscine butylbromide, taking off smaller polyps (see Unnecessary polypectomy pg. 138) and improving documentation to improve performance.

> "*Number one, are people having enough endoscopy lists, I think that's a big thing and I would look at, am I doing enough endoscopy, why aren't I finding the polyps.*" (P12)

> "*So, the main process is, well I need to consider am I taking long enough on withdrawal, is there other things that I could do, I've started giving Buscopan once I hit the caecum, in order so that that gets a greater distension of the bowel, so I can have a better look around. I've started putting patients on their backs when we're coming back through the transverse colon. So I've taken some measures to try and improve that as we've gone along.... it's just from picking up and reading the guidelines and other suggestions I've picked up along the way.*" (P11)

> "*Well, I spent more time looking at the colon on the way out and I took a lot more smaller polyps than I ever used to. Now... 'cos I mean small metaplastic polyps. If there'd been a few I may have left them but now I tend to take them off.*" (P10)

> "*You have to take random biopsies in diarrhoea and I always do but I don't always tick the box on the computer and so it looks like I never did it [indicated now ticks the box].*" (P15)

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4.12.2 Seeking a colleague's help

Prompts to consider seeking advice from a colleague reported by participants included sustained underperformance or a lack of improvement after implementing their own plan.

> *"If I had a consistent series of polyp detection rates, whatever, that were out with the expected range, then I might think there perhaps might be an issue here and let's talk with someone about it."* (P11)

> *"[Describes withdrawal time, irrigation and position change plan to improve detection] that would probably be the main things I would do, myself, to start with. After that, I guess I'll ask people"* (P18)

Participants described if they were "*struggling*" (P19) they may identify an expert colleague to explore reasons for underperformance. This was usually a gastroenterology or BCSP endoscopist and could lead to observation or advice about how to improve detection.

> *"I would probably speak to my colleagues and say, 'This was my polyp detection rate. I have tried to do this and this and it hasn't got better. What do you think? What should I do? What do you do? Is there something I am not doing?' That would be one step."* (P13)

> *"I also spoke to my BCSP colleagues as well to say, "What do you do that I'm not?" And one of them in particular was really helpful, and he sat in on me scoping".* (P14)

> *"If people feel they are struggling, they will go to [gastroenterologist expert] and say: "Could you come in and give me a hand?" I aware of a couple of my [surgical] colleagues that have done that."* (P19)

Named centre data allowed participants to target "*better detectors*" (P18), to discuss with that colleague how to improve their own performance. However, named data also risked anxiety and cognitive interference (pg. 179).

> *"We had a bit of a discussion the other day with another colleague who is doing very well, he's got like a 97 (% caecal intubation) something…. As long as I'm good myself I don't necessarily- it's good and aspirational".* (P18)

> *"Well I mean there's certain consultants like [a local gastroenterologist] … he's just fantastic, I could never compete with [him] but yes, you look at his figures and you*

see how far you're off [his] figures because my figures tend to be higher than some of the consultants anyway." (P12)

"You might be an average performer in a high performing unit. You've got the opportunity of going to your colleagues and saying: 'How can I get as good as you.'" (P19)

4.13 Theme: Eliminate the gap through nurse prompts

This theme describes the use of endoscopy nursing team prompts in personal plans and the training and support they depended on at a centre level. Participants described different types of prompts used, how they were requested, and the impact of the complex social and empowerment-dependent relationships between the endoscopy nursing team and endoscopist; these are summarised in Figure 4.14.
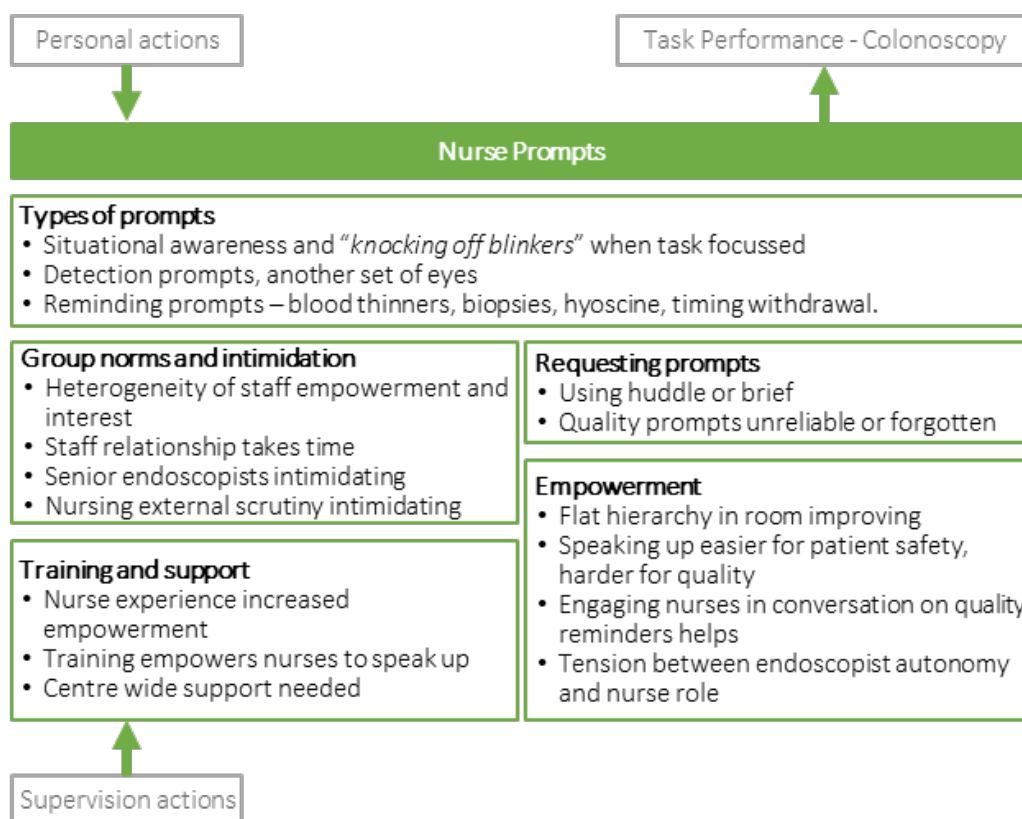
Figure 4.14 Nurse prompts sub-themes and codes

4.13.1 Types of prompts

Participants described the endoscopy nursing team as important for a wider "*situational awareness*" (P4) in the room; there was an expectation that the nursing team would flag

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potential patient safety problems to the endoscopist without being requested, "*knocking off our blinkers*" (P15) when the endoscopist was task focussed.

> "*I've had lots of situations where a scrub nurse has said to me, why are we not doing this and it's purely because I'm in a situational awareness situation, where I've focused on one problem and not seen the greater situation. So yes and I think that can happen when you're doing any procedure, including colonoscopies, so yes.*" (P4)

> "*So yes, certainly, our nurses are encouraged to, particularly on safety concerns, to stick their hands up and say, 'Not so happy about this, what do you think about this?'*" (P5)

> "*They don't usually prompt me unless the patient isn't looking very unwell or the pulses or vital signs are dropping.*" (P10)

> "*I guess there is a role there as well where can they speak up if they think that someone isn't doing things properly? … I had an overbooked list, a patient who was quite frail and I found a big sigmoid polyp. I thought, 'I will get round the caecum' and found a big polyp in the caecum so I took that off and came back to the sigmoid and looked at it and looked at it. I asked for the EMR solution and the nurse said to me, 'Is this the right time?' and that's all she needed to say to me. I needed someone to knock me out of that tunnel vision of, 'I must take all of the things off today and I must treat all of the things today.' It was someone saying, 'This patient has had enough. This doesn't feel that safe. You have got another three colonoscopies to go. Why don't we bring him back on another day?' So, … there is definitely a role of nurses guiding us and knocking off our blinkers a little bit.*" (P15)

Participants perceived nurses provided "*another back-up and another set of eyes*" (P16) for detection of pathology.

> "*I've had this happen, was that a polyp over there and I would say, where and then I will go back and have another look and there have been a few times where we've found a small polyp that I've overlooked. So, yes, I would listen and actually it might be something that we could all think of, let's have two pairs of eyes watching the screen, instead of just the one.*" (P4)

> "*I always do, always do and also at the beginning of every list, I say to all the endoscopy staff, remember this isn't just my eyes, I want all eyes on the screen when*

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we're coming out and do you know what, often oh what's that and you go and have a look and it's a bubble. But do you know what, I love that, I love it when the staff are engaged and they're actually looking at that screen with you." (P12)

"I quite like the nurses to be involved in what I am doing and will quite happily say to the nurses, 'If you spot something, let me know.' Quite frequently the nurses in the room will say, 'What was that there?' I will say, 'It's just a little patch of inflammation' or, 'It's a diverticulum' … but I think that's good to have that interaction but not all of them will do it." (P13)

"But if you're on the way back through the bowel and it's all relaxed and everything, but they spot something, then saying to me, "Was that a polyp there?" then… And I never make that explicit, but it seems to happen". (P14)

Participants described "*using*" the endoscopy nursing team for specific prompts, generally requested to remind them of behaviours. These included reminding endoscopists about blood thinning medications before attempting polypectomies, taking biopsies, giving hyoscine butylbromide and timing withdrawal. Prompts were perceived as beneficial and used in all centres.

"So, if we've got a patient who comes in who is on blood thinners and obviously they are still taking them I will say remind [emphasised] me not to do anything like that [polypectomy] and … they [the nursing team] are good and they do do that." (P2)

"(I: Do you ever use the nursing staff as reminders or prompts at the moment?) Yeah, all the time. Especially for biopsy. Remembering biopsies, remembering rectal biopsies, … informing the room about this patient is on rivaroxaban, we can't take polyps off. So, these are all kinds of things that help you, because if you've got so many things going on in your mind, I think the more people you've got around you to help and remind you, then I think it's best. I do it all the time." (P17)

"Yes, usually they remind me if the patient is on a blood thinner and things like that which I might forget about. They are normally quite good at that". (P10)

"Because occasionally, if it's been a difficult colon and I've not given Buscopan, the nurses will say, 'Did you want to give the Buscopan?' you know. And that's fine, that's good, because they know that I don't remember everything [Laughs]." (P14)

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4.13.2 Requesting prompts

Participants described detection and specific behaviour prompts (if explicitly requested) as being requested at the start of an endoscopy list. Nurse endoscopist participants described using a formal "*huddle*" (P16) or "*brief*" (P12) to request these.

> "*In my WHO briefing at the start, I'll always say, 'Yes, join in.' Three sets of eyes are better than mine, yes.*" (P7)

> "*Brief at every list, every list I do, we do a brief and we'll have a look at the list, we'll see what's on the list, what equipment we've got, make sure we've got everything there, are they happy with the diathermy settings and then we look at the data. So I'll explain, that I'm now recording my withdrawal, this is what I want you to do*". (P12)

> "*We have a huddle, well I suppose all units do now, at the beginning of the list. And so that's when I'll say, 'If you do see anything that, you know, let me know.'*" (P14)

> "*I try and use my room as a team room, I try and … I do quite an extensive huddle at the beginning of the list, we'll work through every patient of why they're coming, what we're looking for. … So yes, if there was something, I needed prompting on, I would say in the huddle, I would highlight things that I don't want to forget and to remind me this, remind me that.*" (P16)

One participant described requesting prompts as an assertive conversation "*tell[ing] people what I like to happen*" (P15), which they described as difficult and related to gender.

> "*So, there is a new nurse starting in the unit, because we have had a few incidences of that [new members of staff] recently and I guess it's…firstly I tell people what I like to happen. I find that very hard. I don't know if it is because I am a woman and I am just a bit generally apologetic for my existence in medicine anyway [laughter].*" (P15)

Prompts about performance (timing withdrawal and hyoscine butylbromide), were described as less reliable than patient safety prompts, with one participant describing these prompts as "*monumentally unreliable*" (P11). Participants described nurses not remembering to time withdrawal, as they had "*quite a bit to do*" (P3) already and with different lists with different requirements they may not "*remember about the timing issues*" (P14).

"Unfortunately, I found that [relying on nurse prompts] a monumentally unreliable method of actually getting what you're after, in that my usual thing is, "Please remind me to give the Buscopan when I hit the caecum," and I think I can count the number of … remember on one hand the number of times I've been prompted. … It's not to say that the nursing staff aren't trying to be helpful, at all. I'm not denigrating them in any way. I'm just suggesting that they've got their minds on the patient. They are doing other things and, in the milieu, it gets forgotten." (P11)

"It's only a small thing but I think just having more things to remember for them [endoscopy nursing team] makes it harder. They don't really like it. (I: Did you think it was reliable?) No, not particularly because you would say, 'I am at caecum' and two minutes later they would say, 'Oh, are you at caecum?' 'Yes!'" (P13)

"I think maybe I don't trust the nurses enough but I don't think reliably, short of having a stop watch that they can press or something like that, I don't know that they would remember what time it was that you started at. … I think they've got quite a bit to do, haven't they, at the minute. …. Anything that comes in is an extra. I think you drop something else off the list of things that they're capable of, … that's not very fair … unless it was something really simple". (P3)

4.13.3 Group norms and intimidation

Participants described that in every endoscopy list the staff, their relationships and the endoscopy equipment available were different, as endoscopists rarely work with the same endoscopy nursing team in the same room. This heterogeneity made prompts and nurses knowing who and how they should "*speak up*" (P15) variable. Similarly, some members of the endoscopy nursing team were perceived to be "*less interested*" (P17) or "*don't want to be involved*" (P13) in prompts or looking for pathology.

"I think each room develops its own culture and the staff drive that and the kits. There's a bit of variation in the endoscopy kit quality across the sites, but set-up otherwise should be fairly standard … I think that there's so many variables and there's so many, I wouldn't, for one minute, claim to understand what goes on in rooms with different endoscopists and different nursing teams. But I think it would be more realistic to expect them to say, "Would you like me to time your withdrawal?"

And the endoscopist to say, "Yes." Because it's hard to say no to a question like that." (P9)

"I think the problem is that everyone is different so my relationship with the nursing staff is different from one of my colleagues so how do the nurses know to get it right? How do they know how to approach each person? I think that's where the difficulty is. They can speak up easily with one person but not with another and I don't know how you change that culture." (P15)

"I think a lot of that probably depends on who you have got in the room with you and how empowered your nurses feel about speaking up… I think that's good to have that interaction but not all of them will do it. Some of them don't really want to be involved in that side of things so I think it very much depends on your team and if you have got the right team then having them involved in that process would actually be really helpful." (P13)

"I always encourage [the endoscopy nursing team] to look and some of them are on the fence or they're less interested, but some of them actually do look and I think it's difficult because you can't really say to them, it's our responsibility to find polyps and you need to start looking. There are some people that are interested and some people are not, and I don't mean you can really ask people". (P17)

Over time working in a centre, the consultant participants described building up relationships with staff members; their habits were known by the endoscopy nursing team, and the nursing team had a metaphorical "*file"* (P11) of what they preferred.

"I think over time I have always said to them at the start, when they get the drugs ready, 'Can you make sure there is some Buscopan because I will ask for it.' If they don't get it out, I will often say, "I will ask this for every patient' …. I do try and get that thing of saying, 'I always give that. I always do that. I always like the irrigator on.' So I think over time, being a consultant somewhere, they get to know what it is that you like … I don't normally say, 'I will be turning them over.' I guess I just, rightly or wrongly, assume that they know we'll turn people around quite a lot. I suppose they probably know that I'm a turner." (P3)

"I think in a unit where you always have the same nurses in your room, that would be lovely, wouldn't it, because over time you can build up that relationship. But I don't…

It doesn't tend to happen here. You say that, but a lot of them will work with the same nurse week in, week out. So it might work quite well. But yeah, wouldn't it be lovely if you had that continuity and you didn't have to go over it at the start of every list." (P9)

"When you start as a consultant people tend to ask 'Well, what do you like?' You can say, 'Well, I do this, I do this,' and then it gets put into your file, so to speak, and then that's … it's just there." (P11)

One participant described a key tenant of the relationship between endoscopist and nursing teams as trust, and mutual confidence in the others' performance.

"I think there is a trust element there as well. If nurses know they are working with a good endoscopist it strengthens your working relationship I think and so the way that I am seeing it is with taking a polyp off you need to know you trust that nurse to tell you if she has got too much in the snare or to not cut through too quickly on coag. I wonder if it works the same way for them that they need to trust us that we will keep the patient safe and that we will find things and that we will keep people comfortable." (P15)

Participants described that the endoscopy nursing team was less likely to engage in prompts if the endoscopist was a consultant or perceived as senior in the department, "*I think sometimes nurses might not feel that that they can always do that with consultants which is a shame*" (P7). This was hypothesised to be "*depend[ent] on the personality of the endoscopist*" (P5) and the need to "*show respect but also not overstep*" (P15).

"I think what we've done, we've got the nurses geared up now for stop watching for withdrawal times and that's been a big cultural change and that even now they're sometimes frightened to suggest to some consultants, "Actually, I'm putting the stopwatch on." You just have to say it really." (P7)

"Think if you are looking at someone who is a lot more senior and esteemed and established where they don't maybe have that…not banter but that back and forth and that they are seen as someone who is an expert then I think that's when it would be really difficult for nurses because I wonder if there is a feeling of them having to show respect but also not overstep. What you don't want to do is question someone

and look like you are telling them they are rubbish basically. I think that's a hard bit for nurses." (P15)

"(I: Have you any experience of working with consultants where [nurses have] said less?) Yes. … I think inevitably, perhaps, they create a barrier. It's almost like a consultant has a barrier, interesting. I'm not sure if everyone comes like that or it's just certain people." (P17)

Intimidation was also described by participants in centres which had initiated nurses measuring withdrawal time. Participants described feeling "*vulnerable*" (P8) to scrutiny initially, before the practice became normal.

"Like all these things, when you have external scrutiny like that, it does make you feel vulnerable but very quickly and it's such a benign thing, very quickly we all got used to that. It's not been a problem since." (P8)

"So, we have recently got a new digital…our hospital is going digital and I now know that the nurses record me and my time and I think for some people that can be a bit intimidating because that is something that is tangible and another thing that can be captured about your performance. I don't think it is something that has bothered me because I record it anyway in my head but I think probably I will start using them as well rather than having to worry about it." (P15)

4.13.4 Empowerment

Participants in most centres described a relatively flat room hierarchy, and that nurses would be comfortable to speak up about patient safety matters, with a positive "*grateful*" (P17) reaction from endoscopists.

"They have become bolder. We're doing much better with hierarchy than we used to." (P5)

"The hierarchy in the room is quite flat, I mean, that's how I feel anyway, our team." (P14)

"I've had an ASP [nurse] challenge me, saying that they felt I'd missed a polyp before and it did shock me that they challenged but in a good way, it shocked me, oh good on you, I hope you do that with everyone, not just with me... I'd rather you tell me

now than as I pull the camera out and then you go, oh did you miss something. You can't do it retrospectively." (P16)

"So, the example I'm thinking about, is where I lost a polyp and then [the nurse] said oh, it's there and so we found it again… I was just grateful actually". (P17)

Participants described improvements in the endoscopy nursing team's empowerment was greatest with patient safety, such as safety huddles and comfort issues, where they would *"have no qualms of challenging"* (P16). However, the endoscopy nursing team was *"a long way off"* (P9) speaking up about colonoscopy quality.

"I'd love to think that our nurses were empowered enough to do that [mention a fast withdrawal time], but I don't think they are. The level we're working at, at the moment, is empowering them enough to make sure that their time out happens at the start of each procedure, and they have a huddle at the start of each list. And if they pull an endoscopist up and tell them that they're not starting this list until they've done the huddle, that's music to my ears. That's the level we're working at. I think we're a long way off the nurses feeling empowered enough to call somebody up on a speedy withdrawal time." (P9)

"I think it is maybe easy for nurses when they think there is a safety concern or when it's a comfort issues when it's about if this patient has had enough and you think, 'Could you give them more sedation?' but if it is more of, 'With what you are doing you might be missing something as you are going too quickly' I wonder if they would find that difficult because it becomes that bit more personal about that individual's practice." (P15)

"They [the nurse endoscopy team] definitely have no qualms of challenging on patient comfort or if they feel like the thing [colonoscopy] should be stopped. They'd have no qualms in that because I feel we've empowered them a lot for that but they probably don't know what our KPIs, necessarily are, to know to challenge me on a withdrawal time". (P16)

Participants described how *"engaging the nurses"* (P17) in conversation about colonoscopy quality, clarifying *"their responsibilit[ies]"* (P13) and making sure they are *"comfortable with that"* (P13) may encourage speaking up.

"I think there's ways you can probably engage people in the room to do that is by just bringing them into the conversation. I guess there are ways you can do that. A lot of the time you're concentrating during the procedure so I find it sometimes difficult to speak and concentrate at the same time. So, it's a bit difficult, but I think, for sure, engaging the nurses does help." (P17)

"I: How would you feel about the nurses saying, 'You are only at two minutes [withdrawal] and it looks like you are already halfway out.'

P: [Laughter]. I would probably roll my eyes and sigh and then go back in again.

I: Do you think your nurses feel empowered at the moment to do that?

P: If I ask them to, yes, they would.

I: … Why do you think your nurses have got that empowerment which is good?

P: [Pause]. I don't think all of them have but the ones who I am thinking about and who I think do… I think once you have involved them and they know what their responsibilities are and they know that is their responsibility and they are comfortable with that then they would speak up." (P13)

Two participants, both consultants, described tension between the endoscopist's personal responsibility for their practice and the role of the endoscopy nursing team using prompts. Both participants reflected on their "*responsibility*" (P8) for and "*autonomy*" (P15) in their actions around colonoscopy quality versus the nurses' role as "*an advocate for the patient*" (P15). This created a perception that nurses "*wouldn't interfere*" (P8) with problems in the quality domain. These contrasted with the description of one participant, who did not believe there was a "*hierarchy in the room*" (P16) and who had a "*team room*" (P16) approach to quality and problem solving.

"So I if have a problem with my retroflexion, I mean you work with a different team every week, so I'm not going to go round telling everybody every week, remind me. It's my job to remind myself to do these things. … It's my responsibility, as the endoscopist to ensure my withdrawal times and it's not just about the times, it's about doing the quality scope that you're not missing anything. So no, they [nurses] wouldn't interfere and tell you that." (P8)

"I think the first couple of times a nurse spoke up to me I thought, 'Who are you?' and I think there is a careful balance, isn't there? I remember very specific incidences of a

nurse who was quite difficult to get along with questioning the order I gave sedation … I found there is a line between me having autonomy as an endoscopist and doing things in the correct manner to actually needing the nurses to feedback to me… I think [pause] it's not nurses policing us. I think it is nurses being an advocate for the patient and that when you look at it as an advocate for a patient in terms of safety and in terms of detection then I think that will be a positive thing … At the end of the day anything that you do in an endoscopy is your responsibility. As the endoscopist you are in charge and you can outsource this…that's terrible but you can ask people to assist you with that but it's not the nurse's responsibility to say, 'Oh by the way you are in the rectum and that was a minute.' You know if you have gone too quickly".
(P15)

"I try and use my room as a team room, I try and … I like to have everyone actively involved in the room because it just another back-up and another set of eyes and if I was struggling in a room, I would ask the team, any ideas, any thoughts on what we can do. I don't like a hierarchy in the room, I like everyone to be part of the room."
(P16)

4.13.5 Training and support

Empowerment to provide prompts and speak up was perceived to be dependent on the individual nurse's experience, with junior staff less able to "*anticipate*" (P10) problems or "*know what to challenge me on*" (P16). This made one participant "*feel more vulnerable*" (P10). One participant perceived the specialist screening practitioners (SSPs), nurses employed in the BCSP and trained in colonoscopy quality, were more empowered to monitor withdrawal time and "*slow down*" (p14) the endoscopist.

"The endoscopy team changes all the time. Sometimes we have very experienced staff in the room with you and sometimes you have very junior staff. I always feel more comfortable in a room with more experienced staff because they watch out for and anticipate things that might happen whereas junior staff don't always do that or aren't aware of the possibilities or what is actually going on. I always feel more comforted with staff that stand behind me when I know they have got the skills they need to help…. I do feel more vulnerable if I am with junior colleagues who don't have them skills." (P10)

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"I think that was more to the SSPs in terms of slowing down and monitoring my time. And they often would say, 'It's less than six minutes,' possibly, something like that, to obviously slow down. I think the nurses in the room, again, just being aware to shout, to let me know if they see anything I don't. The SSPs always do that anyway, as well. (I: Do you think SSPs are more empowered to interrupt you to give you instruction …?) Yeah." (P14)

"It totally depends on the staff member, doesn't it, in the room. … Yes and with me working mainly at [Site 5b], it's a very, very junior staff, we've had a massive change in the staffing. So I don't necessarily think they would know, a lot of them would know what to challenge me on, they're going off my guidance." (P16)

Participants suggested training sessions with nurses and endoscopists could help "*empower*" (P16) the endoscopy nursing team to engage in prompts and "*be able to speak up*" (P9).

"I think there are individual, there are certain individuals who, I mean, I would love to be introducing human factors training rather more prominently into endoscopy because there are certainly some people who definitely need a better understanding of their situation and a better insight into how they impact upon their non-medical colleagues. … It's a combination of empowerment of the other staff which we try to do by the nurse meetings and by me, as the endoscopy lead, meeting with those nurses and actually talking to them and when I'm on a list with them". (P5)

"A *lot of what the non-technical human factors work we're doing with the unit, slowly, is about empowering the nurses to be able to speak up.*" (P9)

"it's a slow process to get things implemented in relation to wanting to empower and the newer staff members, … there was a training session aside for the newer staff members to go to." (P16)

Participants highlighted that for prompts to be effective there needed to be agreement from the whole "*set of staff*" (P1), the "*nursing hierarchy pyramid*" (P9) and "*leads*" (P9) that prompts were important and supported. One unit-lead described prompts were easier to implement as they "*very much marr[y] up with what we try to do within the department*" (P5).

"(I: what happens in your rooms in terms of prompts and things?) I think we've been good at making changes… We do have a short pause at the beginning now, part of

the WHO checklist. So I think we have actively made changes as a team. I think we do have a receptive set of staff that we can do things. I mean if you told me something rubbish, that wouldn't change but I think if we all agree it's going to be important, we would change it. So I think we would change that." (P1)

"So over time, I think it [nurse prompts to time withdrawal] will only work if we give ownership of it to the nurses…. What we'll do is we'll disseminate through the nursing hierarchy pyramid the, what you click on [the endoscopy reporting system]. And hopefully, if the endoscopists are then going in and saying, "Can you time my withdrawal?" they'll meet in the middle … I do think there's something there about it being supported by a lead, or somebody who can highlight which are the key things to do. Or give them a bit of support in how to do it. Or to say, 'It's okay to do that.'" (P9)

"… Teaching people to speak up so maybe it's something to discuss at a unit level and say, 'Right, this is what we need to achieve. How can we as nurses and endoscopists or nurse endoscopists or whatever work together to achieve that and how can we make an open environment and all the rest of it?'" (P15)

Field notes from Site 2 of informal conversations with the endoscopy nursing team revealed the perception of a hierarchy in the room, and that training and a formal WHO checklist could help facilitate nurses to "*interject*".

"Informal chat to nurses in the unit on the tour, nurses talked about changeover, staff retention and people leaving. … They had a "good buddying system", amongst the nurses, regarding those training to do procedures and the technical aspects of endoscopy nursing. In the room that there is a bit of a hierarchy still within the unit, although there is less of a hierarchy amongst the nurses to nurse endoscopists, however they feel relatively able to speak up in lists to most endoscopists. They have a robust training system for the nurses to actually receive training to feel like they can interject, and people know, and they have two good systems of the WHO checklists, that they can easily involve prompts about withdrawing etcetera. So it seems the behavioural prompts are well suited." Field notes Site 2.

4.14 Theme: Eliminate the gap through supervision actions

This theme describes the actions of unit-leads or others to improve performance (Figure 4.15).
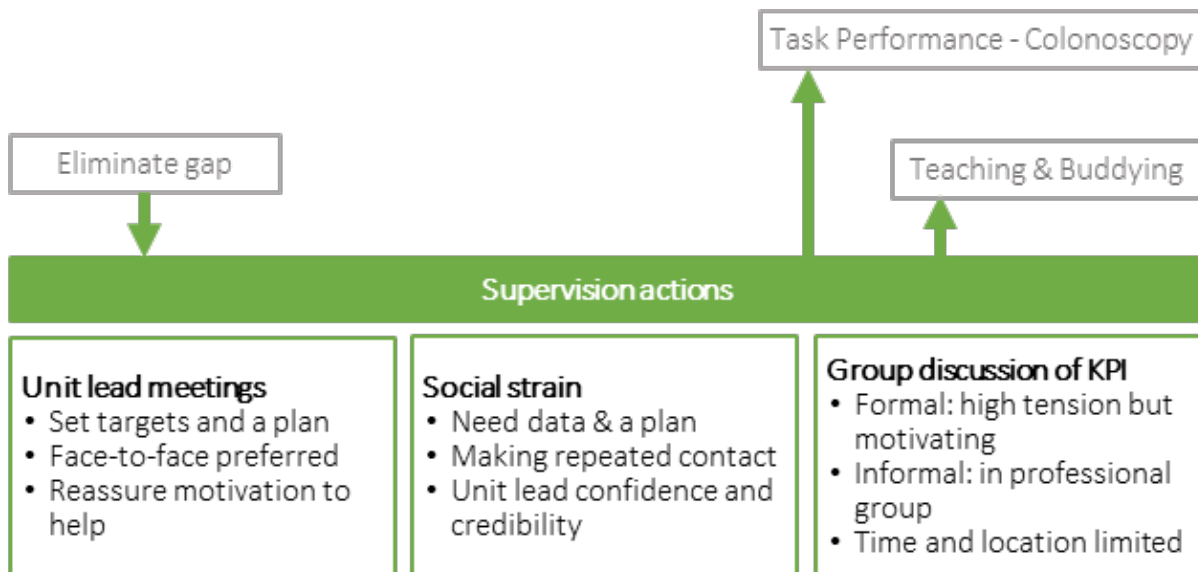
Figure 4.15 Supervision actions sub-themes and codes.

4.14.1 Unit-lead meetings

Participants described local endoscopy leaders instigating a face-to-face discussion if an individual had *"significant deficiencies"* (P1) in performance in KPI. These were used to discuss current performance, assess understanding of behaviours, set targets and a plan to achieve them. Plans included increasing the number of lists and buddying or supported endoscopy activities.

> *"We do try and encourage people, if there is significant deficiencies in performance, to see the endoscopy training lead and work out how we can look at improving their performance through some more extra supported lists... So we would look at the numbers and then the KPI. So obviously if someone's KPI has dropped a bit, the first thing would be we need to do a few more numbers with support."* (P1)

> *"We talked through what the problem was, checked a bit about him understanding why polyps are important, and why adenoma detection rate was how we measured it. And just made sure he wasn't of the mindset that polyps don't matter ... stuff came out about timing of the lists and how long he was taking and feeling rushed. And the length of time he spent doing the intubation as opposed to inspection. And we talked*

a bit about withdrawal time and making a kind of compartmentalising withdrawal

time." (P9)

"If anyone is falling low, the clinical lead will hold meetings and set some kind of

targets, going forward, so it's addressed" (P16)

When addressing meta-task level behaviours such as the detection mind set (pg. 103), one participant described a face-to-face or *"one to one"* (P1) meetings generating a niche plans, difficult to communicate by email.

"So from that meeting, he told me to do a ninja stance." (P12)

Face-to-face meetings were used to educate about behaviours to improve detection, but also address cognitive interference. Endoscopists and unit-leads preferred a face-to-face discussion about underperformance (*"it probably would be better to sit down"* (P4)), as emails with no offer of support risked being perceived as *"impersonal"* and *"aggressive"* (P5).

"I think if that were to happen it would probably be best not coming in an email. It

would be better if they sent out your data and then maybe they tried to give you a

call or arranged to meet with you" (P13)

Participants described needing reassurance of the motivation of feedback to help them (see Ulterior motives pg. 129). Verbal discussions addressed *"understanding of why you are doing it"* (P5) aiming to improve engagement in A&F processes; this was perceived to reduce endoscopists engaging in *"uncomfortable behaviours"* (P8), or gaming to achieve targets.

"'We aren't having a go at you. We are just trying to help you and support you and

improve things' and I think that would have to come…it would definitely need to be

constructive and I think face to face rather than email based." (P13)

"People don't like receiving them and people don't read them, but if you try and do it

by example and talk to people … if you start producing meaningful data for people,

with an understanding of why you are doing it, then I think they are more likely to

engage." (P5)

4.14.2 Social strain: Need data and a plan

Unit-leads descriptions of *"significant performance problems"* (P9) were variable, and in part this was related to the social strain of *"making a particular move"* (P5) on an endoscopist.

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Unit-leads tried to ensure their interventions for underperformance were perceived as "*proportional*" (P9) by endoscopists (see Consequences pg. 133). One unit-lead participant described *"actually trying to find the time to see people personally, without raising their hackles, is quite difficult, I have to say so"* (P5). They described the importance of having data to support underperformance and a practical method of improving performance, before making contact.

> *"Do you need to really go guns blazing when it's only a couple of percentage points below the BSG standards? … I don't want to make a particular move on individual endoscopists, as long as their score isn't way off, until I've got decent data …and 'till we've got some practical methods of trying to improve it." (P5)*

4.14.3 Social strain: Making repeated contact

Social barriers were identified when repeatedly making contact about performance with the same individual over long periods of time, particularly when the underperformance was perceived as being "*low level*" or not *"particularly bad"* (P9). Unit-leads described an emotional toll and concern about impact on working relationships, particularly when the individual was perceived as being senior in a department.

> *"I wouldn't call then serial offenders because that would imply that is particularly bad…it's just this sense of dismay oh no, 'I'm going to have to have another conversation with this person again,' who is someone who clearly can still do the procedure so it's not an issue about whether you are stopping the procedure, but you are just going to, again, have to have that discussion with them, again knowing that you've had something similar in the last two years and you really do get concerned about your personal, or about your professional, relationship with these people".* (P5)

> *"I think what's potentially a bit more challenging is a lower-level performance management. If you've got an established consultant who's been doing the same thing for years, and you identify a drop in their comfort scores, or something like that, then it can be quite challenging to take that on, or raise that as an issue with someone. … I kind of feel like there might be projected hang-ups about doing it, because you're more junior than them".* (P9)

4.14.4 Social strain: Unit-lead confidence and credibility

One unit-lead participant described social stigma in being the unit-lead, risking alienation of colleagues.

> "*As a lead, it's always been difficult. I mean one of my colleagues has nicknamed me the headmaster, which he's actually spread around the department over the last ten years, I think, and so, you know, it's easy for me to alienate my colleagues by appearing to be too draconian and dictatorial*". (P5)

When this was discussed with other participants, leads were generally perceived very positively, and the lead's goals of safety and quality were aligned with other participants' goals.

> "*We're all aware of the goals of the unit but they're not shoved down our throats… We're told what our data is and have the opportunity to discuss that with the endoscopy lead and if there are any concerns, that would be raised but it's not rammed down us all the time*". (P8)

> "*I think that probably my goals and the clinical lead are probably similar.*" (P3)

One unit-lead participant described approaching a senior endoscopist colleague with performance that was "*poor enough and sustained enough to warrant us doing something about it*" (P9). A face-to-face meeting was organised and there was concern the endoscopist would be reticent to engage in the meeting:

> "*A bit of kind of anticipation beforehand that it would be met with defensiveness and poo-pooing the data, and what have you.*" (P9)

The participant was surprised that their previous conceptions were mistaken; the endoscopist was receptive to the meeting and made significant improvement though a plan.

> "*Often, when you go to them and have a conversation, they're sometimes quite glad that you think they're going to shout at you, tell you to bugger off. But actually, they're often quite pleased to have somebody showing a bit of interest.…the face-to-face meeting was fine, very receptive and responsive… Anyway, he was very receptive and his numbers picked up over the following three and six months, and have stayed that way.*" (P9)

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This lead's experience and confidence in their own credibility reinforced their view that the social barriers of intervening are outweighed by the benefits of improving performance.

> *"So if it was a performance issue or a concern about somebody's performance, and it's a senior surgical or medical consultant, then you can't have hang-ups about treading on people's toes or upsetting people. You've got to deal with it and take the bull by the horns. That's okay, that just comes with the territory… I'm quite comfortable doing the endoscopy lead job is because I kind of feel like I know what I'm talking about. And I feel like I've got a little bit of authority from that pointer".*
> (P9)

4.14.5 Group discussion of KPI

Participants described group opportunities to discuss performance with colleagues. These were formal departmental meetings or informal meetings of colleagues.

Regular formal educational meetings discussing general endoscopy were only described at Site 2 and Site 3. These monthly meetings or "*away days*" (P12) involved group discussion of cases, educational topics and service improvement. At other sites, educational meetings were described as valuable but limited by group time constraints.

> *"So if I said … all endoscopists are going to come and sit down together, that would just be impossible. So I don't think you can do that as a group, even though I think it will be very valuable."* (P1)

> *"We have a monthly nurse endoscopist meeting with three key, so we have a surgeon and two gastroenterologists and we'll just save cases, upper or lower, and just images or difficulties or management… sometimes we'll have a little bit of education about something."* (P7)

Participants described formal meetings where group and individual performance was discussed, as part of EUG meetings at Site 5 and Site 6, and regional BCSP meetings at all sites. These meetings were generally described with negative emotive language initially, having high tension, being "*dreadful*" (P7) and feeling "*horrified*" (P15) when seeing performance compared to peers in the same room. This pressure created anxiety - "*the first few months I was a bit nervous about it*" (P15). All participants using negative descriptors then described this as motivating and improving performance. Strong beliefs that the

targets were important for patient care, camaraderie and competition were motivating, having "*a little bit of a shake and wake up*" (P16) effect.

> "*When we sit down to look at the screening data, when I sit down with the consultants, the first thing, because it hadn't normally been sent to me in advance, you're just there and you're looking, and it's dreadful [whispered] but that's why you just think when you're actually, it's great when you sit like this and you get that*". (P7)

> "*All of our data would be projected and we would see where we were in terms of adenoma detection and completion. … I dipped down over quite a couple of cycles, and looked very hard, because I did not like to be that person who was, you know, near the bottom of the pile.*" (P14)

> "*I remember it wasn't anonymised and we would get it at these monthly meetings. I remember being horrified at the start at people seeing all of my numbers and thinking, 'What if I am rubbish and aren't good enough?' But, actually it was really helpful I think … It didn't bother me after a while. I think probably the first few months I was a bit nervous about it but after a while actually if we are transparent… the worst-case scenario is that if we are performing badly in an area that's something you have got to improve on and demonstrate that you are improving on. There is no point in trying to hide that from people.*" (P15)

Informal supportive relationships and meetings between endoscopists were described by participants; these were usually within identified professional groups. Nurse endoscopists in three units described talking to each other about performance and critical incidents, and providing support through reassurance, sharing similar experiences, offering "*tips and advice of how to improve*" (P16) and observing each other.

> "*Us nurses talk all the time, so we talk and I'll ring them up … 'here I've had a swine of a list this morning and blah, blah, blah' and then they'll say 'yes, I have that all the time'. So, we have quite good respect for each other anyway and wouldn't judge anyone, if we had missed a cancer, we would just, as an endoscopy nurse team, just completely hone in and support each other … we're similar, there's not much between us but yes if we did see each other drop, we would support each other, definitely.*" (P12)

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"Within the [all nurse endoscopist] bowel scope screening team … when the data comes through, oh yes, we're all scrutinising it and, yes… I think it's good for us all. I really, it's healthy and if somebody's had a bit of a dip and then as team leader it is offering reassurance and just putting, and again, sometimes as the team leader, I've said, "Right, well I'll come in and have a little look." Or we'll go and watch each other." (P7)

Consultant speciality groups described similar informal "*conversations with people that might tell me, we've looked at that, you're doing well*" (P18). Participants discussed barriers of time and location limitations of informally meeting with colleagues to discuss performance. It was suggested an "*issue that we've got bugging us*" (P1) would be required to prompt interaction.

"It's just creating time to do it, so when would you do it? We don't all sit in the coffee room after our lists. The lists are absolutely bunged and massive and work to do and therefore you do your list, you leave. You might have a vague chat in the corridor. So I know that with certainly the bowel cancer screeners, we often have a little quick chat in the corridor or in the office over five minutes… we wouldn't let an issue that we've got bugging us about endoscopy not go. You would challenge it amongst the other people but that's because we've got that ability to do that on an ad-hoc basis." (P1)

"I haven't been able to make it recently [meetings about performance]. I think one of my surgical colleagues now tends to go". (P8)

4.15 Theme: Teaching and training

This theme describes the phenomena of teaching others and attending courses to improve performance (Figure 4.16).
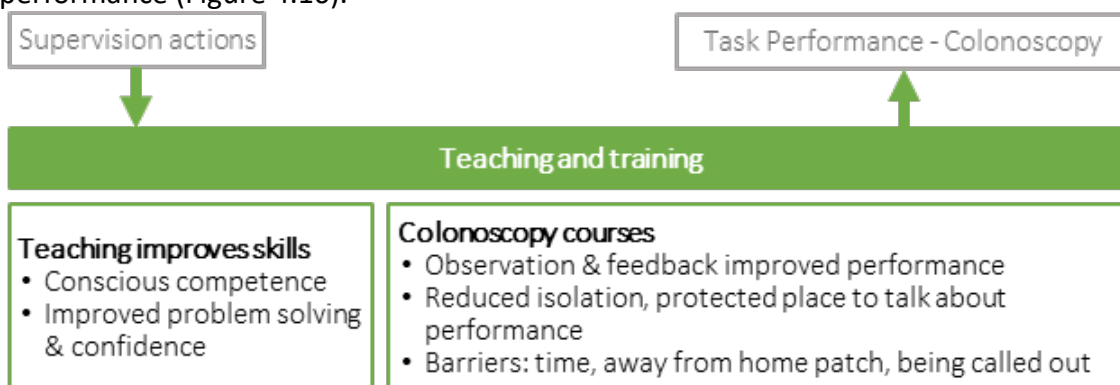
Figure 4.16 Teaching and training sub-themes and codes.

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4.15.1 Teaching improves skills

Participants described that being a trainer, and teaching others about endoscopy, improved their own endoscopy performance. One unit-lead described increasing the training commitments of endoscopists as an intervention to improve their performance.

> *"Interestingly, watching [a nurse endoscopist's] performance since they've become the key trainer, there's definitely been a 3 or 4% nudge up in the caecal intubation rates that that person is demonstrating… So we've used that technique with others".* (P1)

Participants described the mechanism behind this improvement was conscious competence, that is being able to break down the complex tasks of colonoscopy into their constituent "*methodological steps*" (P13) to explain them to a trainee. This improved *"my technique"* (P18) and problem-solving skills including "*awareness of what I do and why*" (P3), which was described as improving confidence (pg. 101).

> *"It wasn't until I started to train [others] in colonoscopy that I really thought about what I was doing. I was just doing a colonoscopy and wasn't thinking about the skills involved … it wasn't until I started to break it down so that I could explain that to somebody else that I really thought about the actual motor skills and what you are actually doing and what that means. Once you start breaking it down like that and breaking down colonoscopy into its finer technical points it massively improves your ability as a colonoscopist because you aren't just trial and error and trial and error. You are thinking, 'What's the problem here and what are the methodological steps I would use to solve this problem?' I think it massively improves your technical skills".* (P13)

> *"[To train] I needed to start reflecting on my practice of how I'm going to explain what I'm doing."* (P16)

> *"I'm also involved in training quite a lot, has helped me a lot to improve my technique and try to think what to do next when I struggle".* (P18)

4.15.2 Colonoscopy courses

Participants described attended colonoscopy courses or local training sessions, as either participants or faculty, where endoscopists undertook endoscopy and observed each other.

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Participants described performance "*getting better*" (P3) and "*changing practice*" (P14) after attending courses, through "*learning new things off other people*" (P10) and having the opportunity to for "*face-to-face, real-time*" (P4) feedback from expert endoscopists. One participant described increased confidence in their own performance from "*get[ting] a trainee round*" (P3) a difficult colonoscopy.

> "*I definitely think every time I go on the course I think I probably perform better afterwards as a result of, even if it's just thinking more about stuff or having watched other people scope. Sometimes the approach of if I can get a trainee around all the colons on the course and they're difficult but we can always get to the caecum, then there's no reason that, on my own, I can't do that as well.*" (P3)

> "*I think we learn all of the time, I think the training never ends, even when I've taught on basic skills courses, you're always picking up things that make changes in your practice.*" (P14)

> "*I think I got that from when I went to the train the trainers' course at [another local trust] … I learnt a lot like that. I'm always learning new things off other people.*" (P10)

> "*The best feedback I've ever had was face-to-face, real-time feedback, in situ feedback from an experienced colonoscopist, right there, watching me as I'm doing it. In situ feedback and then post-procedure feedback, that's the best way and I think during the colonoscopy course, I'd already performed more than 300 colonoscopies but I improved more in two days, than I did in the year before.*" (P4)

Participants described working in relative isolation from other endoscopists (see Isolation pg. 195). Courses reduced isolation through "*watch[ing] other people scope*" (P13); this provided a comparison and a protected "*time for talking about colonoscopy*" (P1) away from clinical responsibilities. One participant described training course conversations promoted endoscopists to use "*the same language*" (P14) around endoscopy which "*drives the quality*" (P14).

> "*You don't get that feedback on what you do or how you break it down until you are in a scenario with other experienced endoscopist like on a course or whatever. Once you are independent, nobody watches you scope or train so you don't really know what you are doing in comparison to other people and then when you are on a course and you watch other people scope and you think about the technical aspects of what*

they are doing and why they are doing things you can then bring that back to your own practice." (P13)

"I think the time we do talk about endoscopy and how we do colonoscopy is on the courses. I think that's a really good place, for my learning anyway. I think most senior endoscopists in the training courses do learn a lot so I guess that is a bit of a time for talking about colonoscopy." (P1)

"I've been faculty on the polypectomy course [at another site] … if we're doing these courses, we need to all be speaking the same language and saying the same things, so that the techniques are the same. And so it kind of drives the quality in what we're doing as well." (P14)

Participants described *"just getting the other consultants to come"* (P3) to courses was difficult; limited by their available time and motivation to attend. Regional courses involved performing endoscopy outside the normal *"home patch"* (P13) which could be *"a very challenging environment"* (P2). Observation by expert endoscopists was perceived as potentially daunting with a *"fear of being watched and being called out"* (P15), with a risk that an endoscopist struggling with their own performance may *"feel too out of [their] depth"* (P13).

"I think being faculty on a colon course is quite stressful and it really takes you out of your comfort zone because you are in a room with lots of very experienced colonoscopists who…and you think, 'What am I bringing here?'… I think if you were struggling with what you were doing it would maybe not be a good place to then try and learn from. I think you would feel too out of your depth. … I think it is quite stressful going into an environment where you don't know anybody and don't have the room to set up and are all set up differently, … it does make things much more difficult than if it is your 'home patch'". (P13)

"When I did my colon course I did it in [another city], and that wasn't a very good experience. It was very much, it was a very challenging environment." (P2)

"The colonoscopy course where you are in the room with trainee and…firstly your teaching skills are being watched and then if you take over the scope your actual endoscopy skills are being watched …I think fear is the main one, the fear of being

watched and being called out on something and being told you are doing something

wrong." (P15)

One participant described the positive experience of teaching on a course made them more

likely to engage in buddying with a colleague if they *"detected [a performance] area I could*

improve on" (P4).

"I've taught on a course with [the unit-lead] recently and I felt again, that was really

useful, just being on the course and watching other people scope and there were

things I learned. I learn every time I'm with an experienced colonoscopist. So if we

continually detected a red area, I could improve on, I would be more than happy to

invite a senior person to come in and watch me scope." (P4)

4.16 Theme: Buddying

This theme describes *"buddying"* (P9), to *"buddy up"* (P1) and *"one-to-one"* (P5), terms used

by participants and unit-leads at all sites to describe supported endoscopy sessions, where

an endoscopist is observed by another endoscopist, with the aim of improving performance,

over multiple sessions (Figure 4.17). This is similar to the term *"coaching"* used in the

medical education literature and by Rees et al.[22,160] Forms of guidance described by

participants are mapped to definitions from Marcdante et al. in Table 4.5.[160]
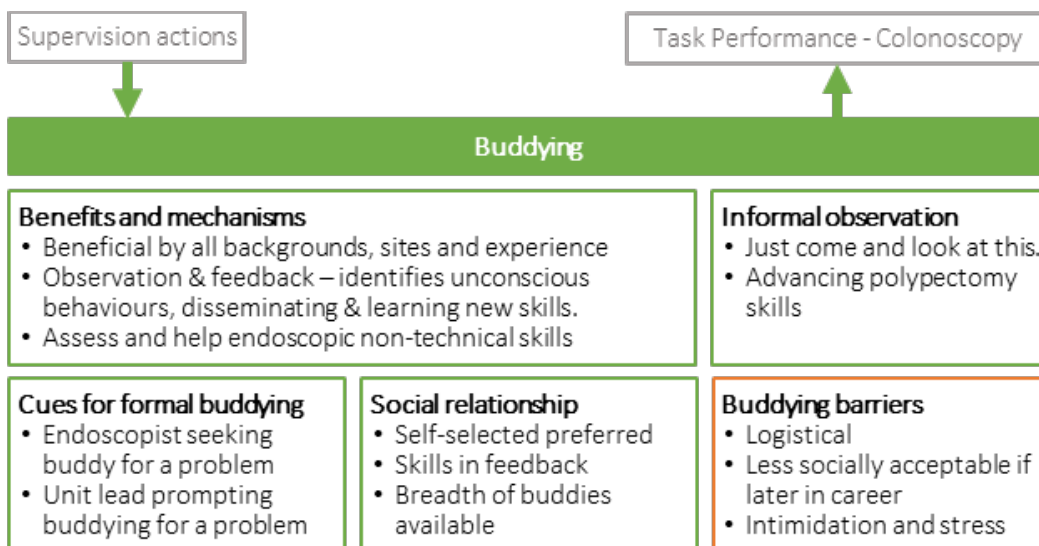
Figure 4.17 Buddying sub-themes and codes.

4.16.1 Benefits and mechanisms

Participants perceived buddying as being beneficial to endoscopists at all career stages, from all professional backgrounds and at all sites.

> *"I think we all benefit from being observed and watched and critiqued".* (P1)

> *"The 'buddying up' experiences have been great. I quite enjoy scoping with other people and again, it's part of that learning curve".* (P2)

> *"We joined on their lists for two or three lists I think and …They appreciated it actually. No, no, it went very well actually."* (P5)

> *"A few years ago I invited [a consultant endoscopist] in to come and watch me for a list and I watch him for a list, as we both regard ourselves as experienced endoscopists. That was quite useful, having somebody from the outside saying: "Well I would have had the patient on their back a lot more than you." That sort of thing."* (P19)

Participants described observation identified unconscious behaviours *"you think you're doing them and then you're not"* (P14) and *"pick[ed] up on little things"* (P4) to improve. Buddying was described as important for learning and disseminating new *"techniques or tips or tricks"* (P9) (see Task-learning processes pg. 100). Participants described learning new skills required being observed which *"you can only do that in the room"* (P19).

> *"He sat in on me scoping, and just gave me some tips about mucosal cleaning and changing position. And it's the things that you know but then in practice you think you're doing them, and sometimes you think you're doing them and then you're not. So, having that feedback is good".* (P14)

> *"Someone watching your performance live and just picking up on little things; why don't you hold your hand this way, why don't you stand this way, why don't you move the patient in this position a bit earlier. Little bits of advice that only come from a very experience colonoscopist are the things that make a big difference".* (P4)

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Guidance	Participant term	Description from findings	Focus	Aim	Time	Illustrative Quotation
Advisor	*"Come and look at this"* (P7) *"Pop-in"* (P10)	A peer observing all or part of one procedure aiming to give advice regarding a specific task or finding	A specific event	To give advice	A single session	*"Occasionally, if there's somebody in a room next door, just come and look at this"*. (P7)
Coach	*"Buddying"* (P9) *"Buddy up"* (P1) One-to-one" (P5)	Regular supported endoscopy sessions with direct observation of procedural skills aiming to improve performance	A task or skill	To find a strategy to solve a problem	Limited sessions, current	*"One way of addressing that would be by buddying up or just freeing up a bit of time from the more established consultants, to go in and just drop in with a few lists for somebody."* (P9)
Mentor	*"Mentoring"* (P13) *"Mentor"* (P15)	Discussion with peer/supervisor over a longer period aiming to provide support around performance	Career development	Discussions and sharing experiences	Longer term	*"Mentoring would mean that you could do that at various points in your career which would be helpful … like an intermittent process where you would have it for a couple of months and then you go off and scope yourself and come back and do it again because your practice develops all the time and the things that you find challenging change all the time"*. (P13)

Table 4.5 Forms of guidance described by participants based on Marcdante et al.[160]

"I'm sure there's any number of other techniques or tips or tricks or skills that, unless they're going to go on a skills course or happen to take part in a research study, it's quite hard to get that across. … One way of addressing that would be by buddying up or just freeing up a bit of time from the more established consultants, to go in". (P9)

"You're watching the scope and you're thinking: "I would do this now." You see what sort of manoeuvre they do. … You watch other people's techniques and you can only do that in the room. You can't look at a video of a colonoscopy. You've got to be alongside the guy and watching what they do with their hands and the patient." (P19)

Participants described how buddying could assess communication and management skills, *"how you work the room"* (P3) and *"the soft approach to endoscopy"* (P2) (see ENTS pg. 103). Buddying was instigated by one participant to develop non-technical skills in a struggling colleague, although this had limited success.

"So like watching those scope and that's kind of like … I was always taught, I was always told as a student nurse, pick a nurse and try and emulate them like … one of the other nursing endoscopists was pioneering in this hospital because she was one of the first to do it as a nurse endoscopist so, and gosh, she's got a wealth of experience and I think, you know like people like them are who you look up to. … I think what I was talking about there was more to do with sort of skill, aspirational type – soft data, I suppose, the soft approach to endoscopy like so how they conduct themselves, how they work the patient, how they work the problems out, how they do the skill level, but I think you do need to have [other benchmarks]". (P2)

"So I had a couple of occasions where I've been watched scoping by a consultant colleague and have made comments but there's not been about necessarily anything technical that I've done but I guess more about your body language and how you work the room and that kind of thing". (P3)

"So then there's a staff grade where we've instituted buddying up with an experienced trainer. A lot of that was more about non-technical skills and communication, and a bit about technical stuff, but more about communication. So

that was reasonably effective for a short period of time until they relapsed to their

old ways." (P9)

4.16.2 Informal observation

Seeking an informal clinical opinion and asking a colleague to *"just come and look at this"* (P7) at the time of colonoscopy was described by participants as a potential way to get feedback about lesion recognition and technical skills. One experienced participant *"[made] myself available to go into lists"* (P6) for opinion during others' endoscopy sessions, although due to time constraints one participant said *"there's' not the opportunity to wander in"* (P19).

> *"I think I'm old enough to realise that if I need to go and seek help, I will do.*
> *Occasionally, if there's somebody in a room next door, 'just come and look at this', or*
> *perhaps …you might be asking a surgeon to do a [surgical procedure for a polyp] then*
> *to actually get the person in if they're available… there was a culture in my previous*
> *hospital that you would just nip into each other's rooms and trying to initiate that*
> *here".* (P7)

> *"Some of our endoscopists… Like you know when they have reviews and things they'll*
> *ask for me to pop in and just, can you watch me and just give an assessment. How*
> *you think I'm doing… That's not uncommon."* (P10)

Participants described informally attending other endoscopists' lists to improve advanced polypectomy skills, either observing *"just to make sure that I'm not missing new practices [and] techniques"* (P16) or being observed. This was also used to assess wider colonoscopy skills *"informally"* (P1).

> *"As I'm progressing my polypectomy skills to increase the size of the polyps and the*
> *difficulty of polyps that I'm taking on. One of my colleagues will come in with me, one*
> *of the other BCSP endoscopists. It's about polypectomy, but it's also about the whole*
> *kind of colonoscopy".* (P14)

> *"In terms of when we've done it with colleagues, we do encourage people, we try and*
> *do what's called a polyp list to get people along to do polyps … Consultants would*
> *tend not to come and do it but a lot of the nurse endoscopists have, a lot of the*
> *fellows have and a lot of the registrars and trainees have come along to do that.*

That's always been quite a nice way of just gently looking at how everyone's technique is. So we have done it informally." (P1)

4.16.3 Cues for formal buddying

Participants described seeking buddying if they perceived they were "*having problems*" (P15) or "*getting concerns*" (P2) about their endoscopy performance or identified a drop in a KPI such as "*detection rate*" (P10). One participant described self-directed buddying in preparation for further accreditation such as in the BCSP.

> *"If I was having problems then I would go to someone who was a mentor as a trainee so why wouldn't I do that as a consultant? I think that's probably talking to the endoscopy lead or someone that I trusted to say, 'I am worried about this. Could you watch me? Could I come to one of your lists? Am I doing something wrong?' … if I was stuck with a patient on the ward and I didn't know what to do and I didn't think they were getting the best care I would get a second opinion, so why wouldn't I do that for my colonoscopy practice?"* (P15)

> *"If I was doing everything and things were going wrong, I would be getting concerned and I would want somebody to watch me what I was doing."* (P2)

> *"[If low detection] I would have to look at maybe taking on some additional training or maybe observation from peers to maybe spend some time with me in the room to give me some ideas and better ways to view the colon and anything like tips they might use in order to get my detection rate up."* (P10)

> *"The first time I did [bowel cancer screening accreditation] I failed. The second time I did it, I went along to do the bowel cancer screening with colleagues and actually I did about ten, fifteen, twenty lists and really got ready to the point of doing the exam and getting that feedback. That was brilliant because it just validated my good behaviours and things that I could do differently. It was very open. There was good feedback. Subsequently we've used the same thing for another consultant colleague who is now a bowel cancer screener."* (P1)

Unit-lead participants described prompting buddying for endoscopists to disseminate new skills, to develop "*non-technical skills and communication*" (P9), or to address underperformance of KPIs which had not improved after reflecting on "*feedback*" (P1) or "*a*

few months" (P5). This was described as an "*offering*" (P5) or "*suggestion*" (P1), and not "*coerced*" (P1).

> "*My initial plan is to write to them individually and say, '… this data is now a bit more reliable, it's only a few points off there, but have you considered this, this or this?' I shall write that and then say well, you know, 'We'll look at it again in a few months,' and then I think if we are having that problem where it hasn't been addressed then, I think we would be offering one-to-one*". (P5)

> "*Many people have a slightly low caecal intubation rate and you give them the feedback, I would hope that they would use that and reflect. … So we might make some suggestions. So I think what we would do is if someone's [pause] we might say suggest you come to a colon course, suggest you meet the endoscopy training lead, suggest you buddy up and you get someone to watch you … As I said, it's an offer and if they come, I don't think anyone has come where they felt coerced to come.*"
> (P1)

4.16.4 Social relationship and formal buddy qualities

One participant described buddying relieved some of the social isolation associated with independent endoscopy practice (see Isolation pg. 195).

> "*I think you work a lot on your own in this job. You do work a lot on your own when you're scoping on your own and I think it is beneficial to be able to scope with other people because it does confirm perhaps what you either already know, or it can highlight new things to you, which you may not know about how your scoping yourself*". (P2)

The buddying relationship between endoscopists was complex and the choice of buddy was perceived as important. Participants believed a buddy should be self-selected by the endoscopist, "*rather than us to foist somebody upon them*" (P9). A chosen buddy needed the right skill set and "*the most experience*" (P4) for the aspect of performance needing to be developed.

> "*Yeah, I suppose, choosing someone yourself … I chose a person who I know has the skills to be able to increase my skills. If it had just been anybody they might have*

different skills that you're not looking to improve … so yeah, choosing yourself might
be a better way." (P14)

"I would probably go to those that I feel are the more experienced and probably my
bowel screening colonoscopist because obviously they're at the top of their game, so
I would probably want to spend some sessions with those". (P16)

Personalities and previous working relationships were important, to avoid reactions such as
"'I don't really like them. I don't want them.'" (P13). One participant described having a
buddy chosen for them who was a close friend; the buddy relationship felt pressured and
intimidating on both sides.

"It was one of my friends who happened to be a consultant colleague when I was a
registrar so I think I felt intimidated and probably felt a bit more under pressure and
felt like I couldn't quite be my normal self if that makes sense … I think they actually
found it quite intimidating. [Laughter]. They found it hard I think to give me pointers
when I had done a bit more than them so it was a really odd situation actually". (P15)

Participants described skills in providing feedback and training were important but varied
amongst endoscopists. Feedback should be given using a *"framework for discussing"* (P3)
this and clearly identify *"what are the steps that I should take to improve"* (P18). There was
a belief endoscopists who had undertaken training recently would have more experience of
feedback compared to endoscopists *"trained in a slightly more old school way"* (P3).

"I suppose it is a little bit variable, just depending on who you're with and how
they've been trained and … well they've all done [a course], but some of them have
different techniques. So there's a bit of variability, but generally, as a whole, I found
it fairly good, one-on-one training". (P8)

Participants gave examples of observation that was *"not really that helpful"* (P13); this
includes things such as broad negative feedback, not providing a plan and being *"very*
controlling" (P17).

"I went to someone's list and I had a patient with a really difficult [colonoscopy] and
it took me ages to get through the sigmoid [first part of the bowel] but I got there
and they were comfortable and I wanted to pat myself on the back … but at the end
of the list the consultant said to me, 'Well, you're obviously still finding colonoscopy

hard so you shouldn't really be signed off.' [Laughter]. So, I think that's probably an example of bad feedback. … It's just totally deflating … what I needed was someone to say was, 'Okay, that looked hard. Here's what you could have done next time' rather than say, 'You are clearly not ready.'" (P15)

"One of the trainers was overseeing me and his feedback to me at that point was, 'Go in faster. Come out slower.' That was it. [laughter] I was like, 'Okay.' … it's good advice but it's not really that helpful. … it could have been presented in a slightly more…in a way to actually tell me what would be better rather than just say, 'Do this and do this.'" (P13)

"[Training was] very variable in terms of the different people that were training you. I had one trainer who was very controlling and I think partly because he didn't want to miss anything, so I can understand why … but some people are more (pause) let you be more free and that's probably when you learn the most." (P17)

With breadth of technical and training skills amongst endoscopists, participants suggested different observers should be available to help solve difference problems, to share the responsibility and ensure quality of assessment across a centre.

"You need to train with different people because everybody has a different approach and a different way to solving different problem". (P2)

"That's the benefit of having different trainers that you take something from each of them". (P13)

"It would have to be done across the board really. You can't have just one person as the Gauleiter passing judgement on people. You need a group of people and you need to assess the assessors". (P19)

4.16.5 Buddying barriers

Participants described logistical barriers to buddying, with timetabling and organisation hurdles. Access to experienced endoscopists was limited by their numbers and their other commitments, therefore the opportunity to buddy was only available to those with a perceived need and departmental organisational support was important.

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"I think we all benefit from being observed and watched and critiqued but given how the NHS is at the moment, one thing we're not given is any slack or spare time to do that." (P1)

"What we're not very good at is pre-emptive buddying up or just offering time with an experienced endoscopist, just to top up your skills. ... We've offered [informal budding] a couple of times but, like I say, not many people take up the offer. I don't know why they don't. But the main limitation to that is time, so none of us really have time to. Of the established endoscopists to the more experienced trainers, don't even have time to train, let alone offer ad hoc buddying up lists. ... it's a lovely thought and a romantic notion, but we've never really got round to it formally. But done well by the right person I'm sure it's very effective." (P9)

"If for instance a department felt that assessment of endoscopists was of benefit to the patients and the unit, then that would have to be factored into people's timetables so that they had a regular session to do assessment". (P19)

Participants believed these logistical and social barriers limited the number of endoscopists using buddying, and that *"if it's necessary then you have to kind of enforce it"* (P9). Starting *"yearly or two-yearly"* prompted buddying was suggested to *"give permission"* (P14) to endoscopists to ask to be observed, although, this was perceived as potentially burdensome.

"It probably shouldn't be for everyone because I do wonder whether some people would feel like it was another hoop they have to jump through". (P13)

Although participants at all stages in their career described a benefit from buddying, buddying was perceived as more socially acceptable for endoscopists earlier in their career. Buddying during the first couple of years of independent practice, of provisional accreditation, was expected.

"Particularly in line with the fact that I'm not fully qualified, as it were and ask, can someone just come in and watch me for a bit .... I think that's acceptable to do that." (P8)

"it does worry me actually, especially when you become independent initially about that feedback area because you are not- in my opinion, I wasn't a good endoscopist

when I was classified as provisionally certified. So, therefore, you have to think about a way of how you're going to bridge these people and improve them further". (P17)

"As training lead, would be happily to go in and some of the more junior consultants and things then I'll go in and just a few tips and hints and try and improve people". (P7)

One late career participant described an informal buddying opportunity with an expert colleague as "*a great idea, but I haven't been on one*" (P19).

"I think they're a great idea because some of my junior colleagues are struggling a bit both in numbers and in thing. So, I think it's very good that they've been offered that, and they have accepted it." (P19)

Other participants described late career buddying as less socially acceptable, "*I shouldn't be asking for help*" (P14), and endoscopists "*would always have excuses*" (P7) to avoid buddying. One participant described a fear that feedback about performance would be difficult to implement after a long period of independent practice.

"I think, because some people think perhaps, 'Oh, I'm signed off now, I don't need that." Or, you know, "I shouldn't be asking for help because…'" (P14)

"That should be an open, honest culture. But the culture doesn't form, doesn't go right across the board, some people are more reluctant for [buddying]. … I think that's because it's perhaps where it's not the best, their practice is one of the lower ones and we then always have the excuse, 'Well I'm better in the private sector'." (P7)

"I have been doing this for quite a while. If I am doing something seriously wrong it's like six years of undoing. [Laughter]" (P15)

Participants perceived buddying as being potentially intimidating and stressful, "*people feel threatened, I think, by being observed, scrutinised*" (P6), particularly if instigated as "*concerns have been raised*" (P19). One participant described that knowing "*it's going to do good*" (P14) relaxed these fears.

"I do stress more especially when particular people are watching me, just because maybe I think they are much higher or more expertise than I do. Then I think I find it

more intimidating scoping in front of him and I find it a bit stressful so I might not think as clear when I'm there just because I'm stressed". (P18)

*"It feels quite threatening really but I'm old enough and mature enough that I'm not too threatened about it by … as long as it's done in the right manner. I think it would be more threatening if somebody said: 'Concerns have been raised about your endoscopy performance and we're putting so-and-so in to formally assess you',
because I think that's a very stressful environment."* (P19)

"I suppose you want that feedback, so then you invite an expert endoscopist in your room and you just have to kind of, it feels a little bit uncomfortable. But you know that it's going to do good. So you just kind of, and the more you do it, the more relaxed you get with it." (P14)

4.17 Effectiveness and clinical context

The following themes describe the phenomena impacting the effectiveness of A&F processes in colonoscopy, and the clinical context's barriers and enablers. These are summarised in the grey box in Appendix G.

4.18 Theme: Cognitive interference

This theme explores the phenomena of anxiety and competing goals described by participants at colonoscopy (Figure 4.18). Participants have described how confidence was perceived as an important meta-task in performing colonoscopy (see Confidence pg. 101), and that feedback about underperformance with low confidence was associated with

hesitancy and a higher risk of quitting (see Self-efficacy and knockbacks pg. 132).
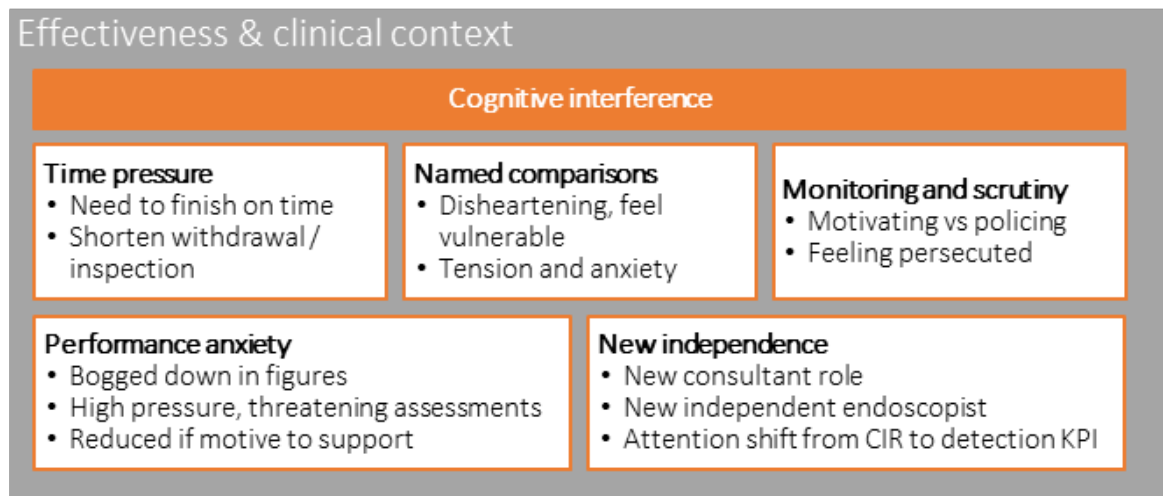
Figure 4.18 Cognitive interference sub-themes and codes.

4.18.1 Time pressure

Endoscopists described being under psychological pressure to complete lists in a timely manner, for themselves and nursing colleagues, saying "*they want to be finished on time*" (P14).

> "*I think what affects my performance in endoscopy is work pressures and time pressures. So yes, it's time pressures, I think when the time pressure is on you, for example, if you do an afternoon list and the morning lists run over, you're immediately half an hour behind*". (P12)

> "*It [sigh] can sometimes feel a bit rushed especially if you… pick up anything urgent that needs to be done before the next … there is just so much pressure on endoscopy departments everywhere that I think [fewer procedures is] not really an option at the moment.*" (P13)

The time taken to intubate the colon and manage pathology were not under perceived control of the endoscopist, although time taken for inspection on withdrawal was. Therefore, participants described when there were a large number of points on their list or a difficult intubation, they felt pressure to rush withdrawal.

> "*You know if they're putting five or six colonoscopies on a morning list you are on time constraints. I know you shouldn't rush the procedures but you do have time against you and you want to make sure you finish on time to start your lists and*

things. That does happen. Subconsciously you are aware of that... But you shouldn't be really. You should take as long as it takes. (I: Is there pressure to speed up the withdrawal?) Without a doubt. If it's a difficult procedure going in as well. … my lists were stretched to capacity. As I say it has an impact on me psychologically before I even start" (P10)

"Stuff came out about timing of the lists and how long he was taking and feeling rushed. And the length of time he spent doing the intubation as opposed to inspection." (P9)

"I think not overbooking your list is also key because last year, for me, I think, when in and around the time when I missed the cancer, I was upping my lists to 12 and 13 points. I managed it and it was fine, I finished on time, however was my withdrawal rates within recommended times? Probably not. Did I look behind every fold? Probably not. You like to think you are but now that I'm actually timing myself and I'm coming out, taking my time, looking back on last year, probably I wasn't as slow as I should have been, coming back." (P12)

4.18.2 Performance anxiety

Endoscopists described that thinking about A&F data could impede performance, and risked endoscopists getting *"bogged down"* (P3) in figures. Thinking about figures was described as *"probably not brilliant ...I mean I find it can be really emotionally draining"* (P1).

"Probably I would but I don't want to bog myself down with [KPI]. Because I know there are some endoscopists who get bogged down with completion rates and things like that and you know at the end of the day if you can't manage to get where and you've tried every avenue to get that caecum you have to accept that" (P10).

Participants described high-stakes feedback and assessment of performance as *"threatening"* (P19) and *"high pressure"* (P1) (see Buddying barriers pg. 176), and is related to the *"financial"* (P1) and psychological (*"failure"* (P1)) consequences of stopping scoping (see pg.133).

"It must have been really high pressure, that if this wasn't successful with the flexi sigs then we couldn't really maintain her as an endoscopist". (P1)

Participants suggested anxiety about performance was reduced if the motive of feedback was made clear, stating that "*help [was] offered*" (P9) and "*support*" (P1) from the team was available.

> "And I think the key things were that, right from the start, it was very clear that it was non-judgmental and flexible, and there was a bit of help offered. And that was fine. I think if you went into it bullishly and came off getting defensive, I think it wouldn't have worked." (P9)

> "They just need to know in the background they've got a team that will support them enough that if they're really worried about this they can come and speak to us as well, which I would hope that people would." (P1)

4.18.3 Named comparisons

Participants described a normative comparison could be disheartening (see Centre data pg.115). Named comparisons were perceived to be positive for being transparent but brought a perceived guilt for judging others and making endoscopists "*vulnerable*" (P1). One unit-lead described using this process to "*shame people*" (P1) into improving performance.

> "I think you could slam this straight out to the team and just say, "Have a look at this," and you slightly shame people into doing things and improve things". (P1)

> "I quite like it being transparent so that you see everybody else's although that does always make us a bit guilty of seeing what everyone else does and seeing what other people's numbers are." (P3)

Participants described tension increasing anxiety when named data was shared and discussed with colleagues, although this was motivating (see Group discussion of KPIs pg. 162). One unit-lead participant chose to anonymise their data as this was "*kinder*" (P5).

> "I think that there is a difficulty sometimes with being too open about what everyone else is doing … why should you be seeing other people's data? I don't think you need to, and I think it's kinder to not to give people unnecessary information about other people. I think that's just it's just more civilised really, that's my feeling about it." (P5)

4.18.4 Monitoring and scrutiny

Thinking about performance being monitored by others was generally accepted as part of quality improvement by participants. This was motivating for some endoscopists, encouraging them to review their own performance data. There was a perception that "*policing performance*" (P18) was not appreciated by all endoscopists but was an important aspect of patient safety.

> "*I think it's a brilliant thing and I love to know that my performance is being checked.*" (P12)

> "*Just because the figures had gone round … you scrutinise them because you feel that you're being scrutinised and so you do want to see what your performance is*". (P16)

One participant starting as a new consultant in a new hospital described such policing made them feel "*uncomfortable*" (P11) and worrying about performance during a difficult transition period felt like "*persecution*" (P11) and did not seem to benefit anyone.

> "*I think it always makes me feel slightly uncomfortable to know that somebody is watching you. Do I accept it as a part of what we do? Yes. We are in a world now where you are constantly being monitored about everything so I accept that that is a part of, … I think what you need to be very careful of is that you don't move beyond monitoring to ensure safe standard and to drive up and improve standards into persecution. … I think if you introduced a significant additional worry it's making a tough time even tougher, not necessarily to anyone's particular benefit.*" (P11)

4.18.5 New independence

Anxiety around starting in a new consultant role was described by other participants. Consultant participants described a reduction in observed feedback since starting as consultants, compared to being a trainee, despite some difficulties in undertaking colonoscopy during this transition.

> "*I'm not watching other people scoping and that's the strange thing about once you start, as a consultant, you don't have a reference point anymore because you don't see other people operate or scope that often… So most of the face-to-face feedback I've had as a junior and senior trainee.*" (P4)

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"As a new consultant, in fact I don't think, I very strongly feel it takes you a couple of years just to settle in. [I: Yes] It really does. It is, certainly for surgeons, surgical training is a massive shift from registrar … Massive. You're going to have dips". (P11)

"Once you are independent, nobody watches you scope or train so you don't really know what you are doing in comparison to other people". (P13)

"I think when I first started as a consultant I probably had a bit of a…I found colonoscopy slightly difficult and…I don't know. I had a two-month sabbatical and I think it took me a while just to get back into the rhythm of doing it… I have had someone come in and help me with a big polyp but on a day to day basis no one has come in and watched me, you know, just whizz through some colons if that makes sense." (P15)

As well as transitioning to a new consultant role, participants described difficulties transitioning to become independent endoscopists, moving from training where all procedures are observed, to independence and making decisions alone, "*like when you pass your driving test*" (P16). This was associated with isolation, anxiety and a "*deteriorating*" (P17) performance. To bridge this gap, it was considered acceptable for newly independent endoscopists to reflect and undertake buddying or ongoing training lists (see Buddying barriers pg. 176).

"We work a lot in isolation I don't think you kind of get that validation … When you're in training it's different, you know, you get that feedback all the time." (P2)

"Well, that's interesting because you become independent but then the training kind of drops off, so you're often just left to get on with it... There's definitely a point when you get signed off and you're cast out there to get on with your independent list, there's definitely a plateau, at best, and maybe even a drop in your performance." (P9)

"It's like when you pass your driving test, isn't it, you don't learn until you've got no-one to turn around and look at for reassurance … So when you're first signed-off, there is that little dip at the beginning because you haven't got that person to take

over from you anymore, so you have to battle it through yourself and work it out but it only lasts that first year". (P16)

"I think it's actually quite a lonely place when you're scoping independently and you can end up in your own world. If you're someone, in my opinion, if you're someone who doesn't reflect or think about improving, you can end up probably deteriorating and getting worse." (P17)

The transition to independence was also associated with a gradual change of attention from caecal intubation rates to detection KPI, as trainees and early independent endoscopists had an "*I must get to caecum*" (P13) focus and were given less feedback about detection KPI.

"I mean independent endoscopists [are] still in a training environment, so you have some trainers … you have to get time to get your own opinion about what works and what's not working." (P18)

"Because as a trainee you don't get a lot of feedback on KPIs and things like that but… [then] you have got monthly figures about our ADR and our comfort and things like that". (P15)

4.18 Theme: Critical incidents

This theme explores participants' descriptions of critical incidents and their impact on colonoscopy performance and A&F processes (Figure 4.19). Critical incidents in this chapter as defined as both:

- events during a procedure that directly affect patient care adversely, referred to by JAG as patient safety incidents.[161] These include adverse reactions to medications, and immediate complications of the procedure such as a perforation.
- delayed adverse events, such as missing pathology or post-colonoscopy colorectal cancer.[162]
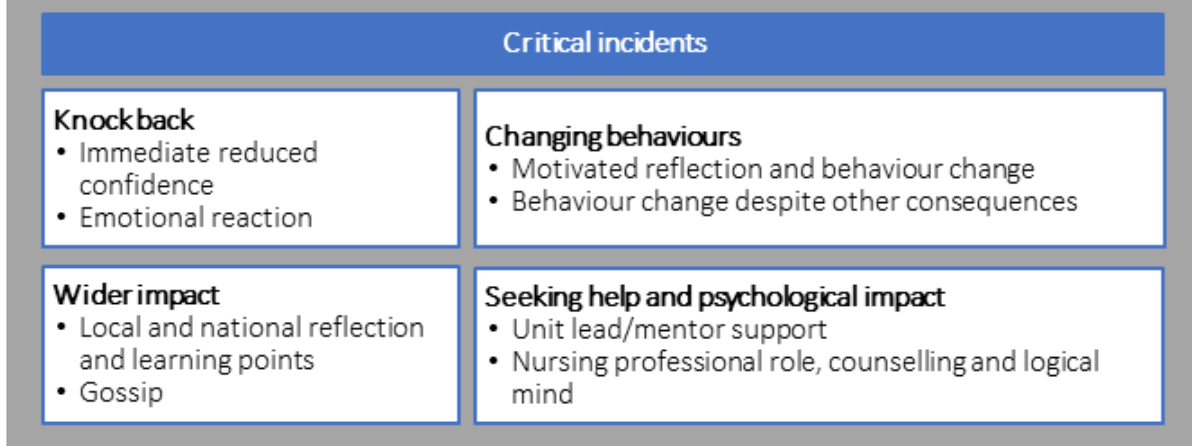
Figure 4.19 Critical incidents sub-themes and codes.

4.19.1 Knockback

Being involved in a critical incident was initially described by participants as being a "*knockback*" (P12) to endoscopists' confidence. Strong emotional reactions (e.g. devastation) were described. These events caused participants to question their self-identity as a good endoscopist or feel "*threatened*" (P6) by feedback immediately after a critical incident.

> *"The only time I feel kind of threatened by feedback is when colleagues perhaps are investigating a death on the ward or perhaps maybe some aspect of care which they were perhaps critical of, but that's more of a sort of generic gastroenterology."* (P6)

> *"I did have a little bit of a knockback, just a few months ago where I'd found out I'd missed a cancer and that was a real … it was devastating to be honest with you because I liked to pride myself as being a good colonoscopist and I have missed a transverse cancer. Good bowel prep looked at the report, there was nothing, no reason why I could have missed this cancer but anyway I did."* (P12)

> *"If you have an incident or something doesn't go quite right then that kind of knocks you a little bit. … and you think, 'What am I doing here?'… [Missing a cancer] can happen, you know, it's not nice, not for the patient and certainly not for me. [I: How long ago was that?] It was a couple of years ago. The patient had come through BCSP and had a normal scope, and then came back two years later, actually it was, with an abnormal FOB [a test for blood in the stool], again. And then I went into sigmoid*

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colon and saw this cancer. And quite obviously, that had been there and it had been
missed two years before. And it was an awful feeling." (P14)

4.19.2 Changing behaviours

Critical incidences and negative feelings subsequently motivated participants to engage in
reflection to identify behaviours and to avoid similar negative outcomes for other patients.

"I do think there has to be a critical event almost for you to actually have a big
learning curve... So I think that's what hit me … that is actually what has made me sit
down and really look at everything because [missing a cancer] is awful." (P12)

One participant identified withdrawal time as being low at the time of a missed cancer and
focussed on timing withdrawal to improve inspection of the mucosa. Another identified a
lower adenoma detection (ADR) at the time of a missed cancer and used this to motivate
them to engage in behaviours to increase detection such as slowing down and team
prompts. This was despite reassurance from peers.

"So since [missing a cancer], I've changed my practice, where I actually record my
withdrawal times, so on the NED, you should start, over the last two, three months,
with withdrawal, rate which … it's surprising since I have started recording my
withdrawal rates, actually the pathology that I've been picking up, it's interesting
and it is a lot more transverse that I've been finding but I don't know whether that's
because I'm just … my nemesis now is the transverse and I just think I'm going to miss
things." (P12)

"I have been in a position of missing a cancer, and I do not want to be in that position
again. So if ADR is a marker of how closely we're looking then I want to make sure
that that marker is there for me. That I am having as best look as I can possibly do,
and reduce the chance of that patient coming back on my list in three years' time
with cancer …[Missing a cancer] cemented in my mind that what I'd seen, the dip in
my performance, the dip in my ADR, was the fact … people say, you know, I kind of
engage the endoscopy team as well to say how my polyp detection's gone down, help
me, you know, look for polyps slows me down, whatever, it needs to be done. And
they'll be, 'Oh, you always find lots of polyps, you know, maybe they're just not
there.' But the figures are there for a reason, and if you're not meeting them it's

because you're not looking properly. Which I certainly wasn't, and that's why that

happened." (P14)

Two participants described avoiding behaviour they associated with past critical incidents, even if these potentially increased pathology detection and the adverse events were recognised as rare. One participant described prescribing hyoscine butylbromide, used to improve inspection; however they believed two patients had responded badly, and so they stopped prescribing it regularly. Another participant described causing trauma performing retroflexion, turning the endoscope back on itself to assess the very last part of the bowel. This caused them to be more cautious and less likely to perform the manoeuvre.

"I had two patients respond badly when having Buscopan before, so that put me off

the use of it. … They might have been two complete one-off instances. [I: Two cases is

enough to change practice?] Yes, so I used to give it at caecum, I used to give 10mg

at caecum but then, like I say, two people responded very badly to it and it put me

off. So now I don't use it very regularly at all." (P16)

"The retroflexion, recently, I don't know. I'm just very cautious. I had one episode

where I've retroflect someone and then it caused quite a lot of trauma and it was a

bit of a torn area so I had to clip it. It wasn't a perforation, it was just a trauma from

it. So, I think since then, I'm just very cautious on how to do it. So, I've tried and my

threshold is probably a little lower, like if I can't do it three times or so, then I'll just

leave it". (P18)

4.19.3 Wider impact

Critical incidents were described as having a wider impact on behaviours, beyond the endoscopist directly involved. Participants described "*thinking more*" (P13) and reflecting on others' critical incidents and to generate learning points for their own practice. This included hearing about missed pathology increasing "*focus*" (P13) on detection, share critical incidents to avoid perforations ("*leaks*" (P8)), or reading about and promoting cases with critical incidents to "*improve our quality nationally*" (P15).

"I think…well, just things that you hear. When you have done a procedure and you

have found a polyp or something that has been fairly sizeable and they have had a

colonoscopy before fairly recently and it's not been seen and then we hear about

missed cancers and people who have had recent colonoscopies and I think it just…
you then start thinking more of the procedure as a whole rather than just [caecal
intubation] focus and for the patient the most important part is the detection". (P13)

"We had a leak in a patient several years down the line, who had a retroflexion
where the anastomosis ... Yes, because it was just fibrotic and fragile, it just leaked
several years down the line. So we don't do that now in patients." (P8)

"JAG they have done so much work recently on complications in endoscopy and
publicising that and making it normal to talk about complications that actually I
don't find the JAG intimidating at all and I think their goal has always been to
improve our quality nationally." (P15)

These demonstrated that promoting discussion of critical incidents with the intention of
sharing a narrative to improve care was generally positive. One participant highlighted these
are emotional events for endoscopists, risking causing shame for individuals if perceived as
being exaggerated as gossip.

"I'd come back to work to be informed that people are now saying I've missed two
cancers. So I'm in the middle of addressing that because I want it nipped in the bud, I
don't want people talking that I've missed two cancers when I've actually only missed
one and one is hard enough to deal with." (P12)

4.19.4 Seeking help and psychological impact

Critical incidents prompted a discussion with the unit-lead or a mentor to provide support.
This involved reassurance, attempts to rebuild confidence, and to help the endoscopist
"*move forward*" (P12).

"I thought I had a missed cancer. … I went and spoke to [the clinical lead] about it
and he had a look at it. He looked at it but he said, 'Well first of all it's not a missed
cancer because it's over three years,' and secondly, he felt the guy was lucky that he
had me scoping him again, not because I had scoped him previously, but because of
that [indicates high detection rate]." (P2)

"Well first of all, obviously the consultant who the patient was under, they fed back
to me immediately, so I knew before I heard on the grapevine and the feedback was

very positive, we looked at the national data figures and realised, I think I've done 5,000 colonoscopies to date, or in and around there and the national figures are about one in a thousand and it is on the consent form and it's all going to happen with all the endoscopists." (P12)

One participant had a difficult time managing the *"absolutely devastating"* (P12) psychological effects of missing a cancer. They perceived their professional role as a nurse and considered that the nurse-patient relationship made them more likely to have an emotional response to critical incidents. They were supported by their unit-lead, but also sought psychological counselling, which they found useful for approaching reflection with a *"logical mind"*.

> *"But when it actually does hit you, it's absolutely devastating. Not that it should make a difference but it's actually a local patient and obviously I'm going to see them in the hospital and things. It was bad as well because for the patient to be biopsied, they put them on my list to be biopsied. So then I had to think about what I was going to say to the patient, did I address it, did I not address it and I'll be honest with you, I got someone else to scope them because I felt that was just too much for me, to be honest with you. …it's been quite tough. It's been tough personally as well. (I: That's quite … you take on the emotions of that as well.) Yes and I mean I've spoken to the doctors because obviously, our head of endoscopy, he explained, obviously doctors tend to be a little bit more, how can I put it? Nurses have that more connection with the patient, maybe there's a little bit more, it's a nurse thing, do you know what I mean? … And he was explaining that yes, it would affect a doctor, blah, blah, blah but then it's getting your logical mind and your wise mind to get centred into that so you can move forward with your practice. I found that really useful because I also saw the psychologist about it because it did affect me so badly and she explained about that, about how probably us nurses tend to be more on the emotional state at times and it's getting your logical mind around, actually everyone is going to miss a cancer, what do we do about it, let's move forward. Then you get your wise mind."* (P12)

4.20 Theme: Enablers and motivation

This theme explores participants' descriptions of the enablers to engage in A&F processes and motivation for considering changing behaviour (Figure 4.20); these included the patient, personal responsibility, competition and praise. As described monitoring and scrutiny (pg. 183) of performance was also motivating.
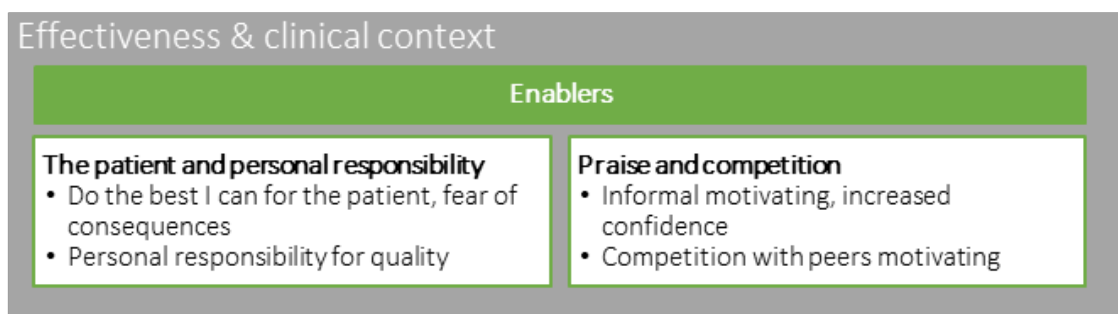
Figure 4.20 Enablers sub-themes and codes.

4.20.1 The patient and personal responsibility

Participants described doing "*the best I can for the patient*" (P18) and a good patient experience as an important motivation (see The patient pg. 118). Fear of missing pathology and the "*consequences to the patient*" (P17) motivated endoscopists to maintain good detection rates.

> "*We have friends and family tests questionnaires that people get. So if you get named in those, you tend to a copy of that lands on your desk … two patients, both mention me by name in their clinic, just saying how good their colonoscopy experience had been and that they'd had no qualms of coming back and if they did need to come back, could they go on my list … (I: Do you find that positive patient feedback really motivational?) Yes, definitely, especially if you've just had a bad list or a bad day or something, it reminds you why you decided to do this in the first place*". (P16)

> "*If you're completing a procedure and then you miss a polyp, that's going to have a consequence to the patient. So, that's why it drives me the most. … I can think of numerous examples, [interviewer], where there was a fold and you think should I look behind it or should I not and I've seen big polyps that I cannot believe they're around there and that's why it really bugs me, so that's what drives me the most.*" (P17)

"He said he says he was lucky he had got you because you see your polyp detection rate is quite high so therefore, he was less likely to have something missed anyway. So, that is why that is quite important to me from that point of view, because it's like if I keep it and maintain a high level, then I'm not going to miss things and people aren't going to suffer as a result. So, that's how I rationalise it." (P2)

Participants described wanting "*to be good at my job*" (P11) as important, and the "*personal responsibility*" (P9) of managing their own performance was part of this. One participant described being "*gutted*" (P14) if they did not notice underperformance themselves.

"Number 1 [the most important thing is] seeing your detection rate, I'm increasingly feeling like you've got a personal responsibility for your own performance and your impact on the people around you, and what you're doing." (P9)

"Don't think I'm the best endoscopist, not part of my job I get enjoyment out of, doesn't mean I don't want to be better at it, I want to be good at my job." (P11)

"If I've got that email and I hadn't picked [underperformance] up myself then I would be gutted that I hadn't picked it up. I'd be gutted that I wasn't performing, not that I'd got the email." (P14)

4.20.2 Praise and competition

Participants described competition with local peers as motivating, as described in centre data (pg. 115). Participants described praise and positive feedback from colleagues as motivating, this was described in informal settings by respected peers. This boosted meta-task beliefs of confidence and validation through being held in high regard by peers but was not associated with any changes in behaviour.

"One of the consultant's felt that, as I said earlier, I was, in his opinion, I was a very good endoscopist with my approach to how I deal with the patients and how I scope, and with polypectomies I took and, you know, the management of the patients. It seems quite informal, but it's sort of kind of nice to get a positive stroke now and again … it's nice get that kind of validation from your peers". (P2)

"You know to be valued and people to think that you're good at what you do. That kind of boosts your confidence because although we all get on with it it's nice for

*someone to actually say you did very well. Or even other staff said you know if I had
to come in and have a test done, I would definitely have you do it. So that's kind of…
you know it's nice to hear that."* (P10)

*"Yes but my good experience of feedback wouldn't be that perhaps the feedback was
particularly good in terms of feedback but it is just that it was positive feedback so
from a colonoscopist that I really respect. He said, 'That was a brilliant procedure'
and I was like, 'Yes! Thank you.' …It made me feel good."* (P13)

4.21 Theme: Barriers

This theme describes the barriers to engaging in A&F processes and changing behaviours
that participants had identified (Figure 4.21).
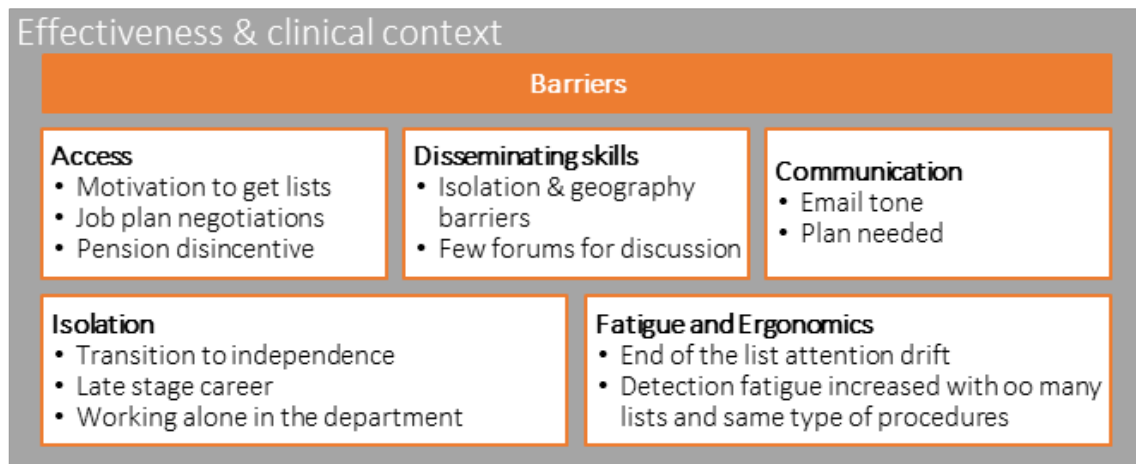
Figure 4.21 Barriers sub-themes and codes.

4.21.1 Access

Participants have described the importance of number of procedures (pg. 105) for
colonoscopy quality, other clinical commitments limiting consultant endoscopists'
availability to perform endoscopy and a "*natural dropout*" (P1) of consultant endoscopists
because of this later in their careers (see Prompts to quit pg. 130). Participants believed
endoscopists needed to be motivated and "*make a real effort*" (P1) to create availability for
endoscopy.

> *"I'm guessing a lot of units around the country, certainly here, we're getting a lot pull
> for our medics to do more general medicine and our surgeons to do more surgery and*

therefore there is not the number of sessions to get endoscopy unless they make a real effort to jiggle their timetable". (P1)

"(I: Have you ever had a specific behaviour targeted by that email?) Only in terms of numbers, so only in terms of saying, "Actually this is something that you want to pursue as a more specialist skill, you might want to bump your numbers up," … So I guess it's something that I already had thought about doing and it just pushes you every now and then because it's easy to drift on months and months and think, 'I must pick up some more lists.'" (P3)

"I try to ask to get mostly colonoscopies, to keep my numbers up, to keep them as near to 100 a year as I possibly can. I struggle obviously with only doing 35 lists a year, to get near 100 and I think that's one of the things I'm going to have put into my job plan review, this year, is to try and get some more endoscopy lists, to keep my numbers up." (P4)

Gastroenterology and surgical consultant participants described creating availability to perform endoscopy was dependent on job plan negotiations, a process that occurred "*once a year*" (P11). Feedback evidencing a low number of procedures was potentially helpful "*as leverage"* (P3) in this negotiation.

"So at no point was I expected to change my job plan but it allows me the leverage to go and say, 'Actually I need to change my job plan because this is something I want to do.' So at no point has it been, 'You're not doing enough, [P3], you need to up your game.' It was, 'You're not doing that many. Is it something you want to look at? Please use it as leverage when you go to the clinical director for your job planning.'" (P3)

"It's really down to your annual job plan review, identify areas in your job plan that aren't as necessary. So for example, if I've got a clinic that's never filled on a particular day, could I convert that into one list in a 12-week cycle and that would generate another four lists a year. Then as I've already done, going to the booking staff and saying, look guys, I hardly ever get colonoscopies, can you please put more colonoscopies and they've been really good. … So that has been plenty and that has increased my numbers." (P4)

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"I think I would probably have to look at my job plan and look at changing it around, and that's not something I'm against, you just need to look at it in the list of everything else that your employer wants you to do. You then get into the very difficult situation of, well, 'You're just not doing enough, I want you to do more.' 'Okay, fine, but when?' ... That can become a very difficult conversation for all involved. ... So, I mean clearly you have a job planning session once a year and I think actually". (P11)

However, one consultant participant described if extra endoscopy lists were additional clinical sessions there was a financial disincentive, due to problems with overall earnings and pensions.

"There is the scope for increasing the number of lists anyway because there's so many WLI's [Waiting List Initiatives], I'm sure that's the same with so many Trusts at the moment, there are lots of WLI's. ... and the list of when they are, just gets sent out to all endoscopists and you can just pick and choose which ones you want to do. A lot of people have stopped doing them because of the pension problem". (P8)

4.21.2 Isolation

Participants have described isolation in endoscopists from all professional backgrounds, particularly the newly independent and late-stage career endoscopists (Buddying barriers pg. 176). Participants described feeling stressed or isolated if they were performing colonoscopy in a department alone, especially if an endoscopist's assistance was required urgently for a complex polypectomy or a complication. One trainee participant working at a single endoscopy site in a large centre believed support would be quickly at hand, this contrasted with a nurse endoscopist participant in an endoscopy centre spread over different geographical sites.

"(I: Do you ever feel isolated when you're independently scoping?) Very rarely. Sometimes, out of hours, like five to six, everybody's gone and I might, ... so that is probably the times- and again, if I call a colleague, they'll come. It's just that I might be alone in the department so it's just stressful when you do something, or might do a polyp and there might be no one around, at that point. But I have a lot of support, so if I can call someone, I can definitely get someone here." (P18)

"Do you mean do I feel quite alone in endoscopy as an independent practitioner? … No, I never feel alone because I have got the team around me. … (I: Does it ever matter in your head as to who else is in the department endoscopist wise?) Yes, all of the time. Since [an acute hospital site] opened I now find I am quite a lone endoscopist in this unit so whereas I would have been supported by colorectal colleagues who might have been through the doors operating or maybe downstairs sitting in the office we are spread across all sites now and so I am quite a lone worker sometimes. Because I can be scoping, I know for a fact that if I need some help or urgent help it's not available. That does concern me sometimes because I do have second thoughts about removing large polyps when I know I might run into a problem and there is nobody around who can help me." (P10)

4.21.3 Disseminating skills

Isolation brought challenges of disseminating new skills which may require observation to initiate. One unit-lead, in a centre spread over many geographical sites, reflected on the challenges this brought when disseminating a new under water insufflation technique and engaging with endoscopists who are not involved in training events or research.

"So for instance, I think a good example of this would be, a lot of the nurse endoscopists have started doing under-water endoscopy here. But off the back of the WASh study [a national clinical trial[163]] because they all got trained to do it. And a few of us who go to courses and that kind of thing have absorbed it into our practice. But the majority of colonoscopists aren't using it. And actually, disseminating a skill like that to them is quite hard. So that's under-water colonoscopy as an example but I'm sure there's any number of other techniques or tips or tricks or skills that, unless they're going to go on a skills course or happen to take part in a research study, it's quite hard to get that across. And through the Endoscopy Users Group kind of contact, again, it's quite hard to get people in the room to learn that sort of thing… So it's delivered across five sites, nearly six, which has six different sets of staff. And endoscopists are quite itinerant and tend to pool around one site. So disseminating stuff and delivering training is challenging because of that." (P9)

Difficulties cascading new skills and information to endoscopists was recognised by endoscopists from other centres, who described limited fora for discussion of new practices.

"… You suddenly find that people were doing underwater here without it really being cascaded and I think that perhaps here we've got improvements to make that your expert consultants, we haven't always got the right forums where practices are changing". (P7)

"I think it's more informal I would say. So, I'm trying to think of something in particular, but we have obviously, little meeting and you can discuss things there but it's not a formal forum so it would be like an informal thing or if you want something in particular then maybe one will go to the other, like informal and say I need to learn how to do this, what do you think? … So, there's not necessarily a space for everyone to interact or discuss." (P18)

4.21.4 Communication

Participants have described the challenges of email communication, engaging colleagues (see pg. 126) and their potential for being "*impersonal and appear[ing] quite aggressive*" (P5, see Defensive response pg. 129). Email communication tone was perceived as important, to reduce anxiety, and participants recommended offering a plan to improve or support in a non-judgmental tone.

"The first year of my training, my caecal intubation was just at 90[%]. So I got a letter through from the clinical director at that time, to say … it was a very nice letter, to be fair, saying well done on achieving your sign-off, blah, blah, blah, obviously your caecal intubation rate is just at the right numbers, let me know if you need any additional support but I imagine this will pick up with your practice, going forward." (P16)

"It's [feedback is] delivered in a way that if you did this wrong, but if you did this, this and this you would do it that way rather than saying, you did this really wrong and it was awful and you shouldn't have done that, more of a telling off, I suppose, to something more positive". (P2)

4.21.5 Fatigue and ergonomics

Participants described fatigue and ergonomic considerations, which limited the quality of their examination, impacting on pathology detection. Psychological fatigue and

concentration drifting was described, particularly towards the end of the list, impacting on detection performance. This is related to the meta-task of detection mindset (see pg. 103).

> *"When you're by yourself, half past four in the afternoon, you've got two more colons to go, you might find performance is just dipping off just slightly then."* (P6)

> *"I find that the challenge for BoSS [bowel scope screening] is that the majority of them [colonoscopies] are normal. So your brain just automatically switches off a little bit, and it shouldn't because then you're kind of risking missing something, yeah."* (P14)

> *"I think tiredness especially and the main issue for me when I started. I was exhausted after lists. (I: Did you find that affected your performance in the list?) 100% yeah, without a doubt, yeah."* (P17)

Participants described performing too many endoscopy lists a week increased this detection fatigue, as well as risking joint injury, with participants suggesting between four and eight lists a week "*becomes just a bit much*" (P15).

> *"I pick up some waiting lists but I try not really to do more than six a week because I'm just conscious of joints."* (P7)

> *"I do think eight [endoscopy lists as week] is too many. I mean I think to get your eye in, I think you really need, really one endoscopy list a day. I think that's ideal".* (P10)

> *"I think two lists a week is fine. I think I have worked when I have been doing maybe four or five and that becomes just a bit much. I think that might be different from nurse endoscopists and people whose soul job is endoscopy".* (P15)

Detection fatigue was perceived to be worse if the same type of procedure was performed repeatedly, described as "*monotonous*" (P16); similarly lists with a variety of procedures improved concentration. Consultant participants suggested this "*might be different from nurse endoscopists and people whose sole job is endoscopy*" (P15) or their "*raison d'etre*" (P1). However, nurse endoscopists similarly reported detection fatigue.

> *"…generally I need…not to be entertained but I need variety and so I think it would become very monotonous if I was just doing colonoscopy after colonoscopy after*

colonoscopy. I think maybe then I would find it more difficult to try and keep looking because you almost feel like you have been there before." (P15)

"[I get] annoyed at myself, that maybe I had become a little bit lax in my practice. But you do get complacent at times and that's what these things [performance feedback] are there for, to give you a bit of a reality check to push yourself again because 54 in one week is a lot of sigis [sigmoidoscopies]… So when it's bowel scoping, it's a monotonous kind of process of the same lists, same limitations, same outlook. It can get a bit much ... Yes, because there's a varied list, I think, it's always varied and the patients are all different. So you do get different things from different patients as you're scoping, so it's very varied with a mixed list." (P16)

Participants described increased reliance on the room's nursing team for prompts and cues during periods of fatigue.

"You do get stuck in the moment, you know, you get stuck in the moment and especially when you've had, you know, it's the last patient on your list of six and, you know, they all kind of like merge into one and you're like, 'Oh right, clopidogrel, oh yes, okay'. So yes, they [the nursing team] are pretty good at doing that [cues] and they would time you. They're a good team." (P2)

"But the team in the room as well, I always encourage them to speak out if they see anything that I haven't because, you know, we're only human. So occasionally, your concentration drifts, especially at the end of a list. So yeah, ask them to just have a look outside, and if they do see anything, shout up." (P14)

4.22 Discussion: Summary of principal findings

This work demonstrates for the first time the use of a FIT model for analysing and understanding a thick description of the A&F processes in colonoscopy, including analysis of intended and potential adverse effects in a logic model.

4.22.1 Identifying performance

Participants described confidence and detection mindset as meta-tasks required for colonoscopy. They identified detecting polyps, performing an adequate number of procedures, achieving a high caecal intubation rate and patients being comfortable as

important goals for colonoscopy quality. A&F emails identified these KPIs with a social comparison of peers in the same centre. National standards[11] for these KPIs were used as targets in A&F emails, these were perceived by participants as a minimum standard. Participants identified social comparisons as motivating and named high-performing colleagues as aspirational targets. They wanted their performance to align with those in the same professional group, and reassurance reduced motivation to improve. Participants believed endoscopists with persistent underperformance should stop scoping, particularly if late in their career. Confidence and staff shortages were described as reducing the chance of endoscopists stopping scoping.

Endoscopic non-technical skills (ENTS) were identified as important, although participants received limited feedback about these behaviours. Informally ENTS feedback was provided by the endoscopy nursing team, who were described as advocates for patient safety and comfort. The patient's perception of performance was rated as important, particularly by participants from professional nursing backgrounds. Participants' perceptions of others' beliefs about performance were described.

4.22.2 Eliminating the gap

Participants reflected on A&F data and devised a strategy to improve. Participants made plans to improve detection focused on task-motivation behaviours of withdrawal time and withdrawal technique. Participants with competing clinical pressures and low procedure numbers planned to increase access to colonoscopy to improve. Participants with high procedure numbers described psychological detection fatigue with long or too frequent endoscopy lists. Underperformance prompted participants to informally discuss performance with an expert colleague or a peer group. Formal group meetings discussing social comparisons of performance were motivating but associated with tension.

Participants described adverse effects and gaming through inaccurately completing documentation so that completion rate and withdrawal time targets appeared to be achieved. Harmful behaviours described included perseverance with the colonoscopy procedure despite patient discomfort and unnecessary polypectomy. These behaviours were motivated by anxiety about underperformance.

Unit-leads contacted individuals with significant underperformance personally to assess understanding and set targets in a plan, however the threshold of significant underperformance was heterogenous. Unit-lead participants described challenges of monitoring centre wide performance, responding proportionately, managing serial underperformers and endoscopists not engaging with A&F messages.

4.22.3 The endoscopy nurse team

Participants used nursing prompts for patient safety and situational awareness; these were believed to be most effective in a flat hierarchy for speaking up. For prompts around colonoscopy quality, such as timing withdrawal, variable nurse empowerment was described, depending on nurse experience, and perceived intimidation of senior endoscopists. Using pre-list huddles to request prompts, engaging nursing staff in discussion about prompts, human factors training and nursing leader support was perceived to encourage speaking up.

4.22.4 Cognitive interference, enablers and barriers

Participants described sources of cognitive interference included pressure to complete lists in a timely manner, getting bogged down thinking about performance and the consequences of stopping scoping. They described the perception of performance being scrutinised as motivating, however some participants suspected negative feedback had an ulterior motive, reduced confidence and may worsen performance. Participants described isolation increasing the risk of developing bad habits and brought challenges in disseminating new skills to endoscopists. Isolation and cognitive interference were more likely to be significant at transitions into new independent practice or new consultant roles.

Participants were motivated to engage in A&F processes by the patient and responsibility for their care. Critical incidents, particularly missing colorectal cancer, caused an initial knockback to confidence to the endoscopist, but then prompted personal and centre-wide reflection and behaviour change.

4.22.5 Teaching, courses and buddying

Buddying was perceived as beneficial for all endoscopists and cued by underperformance or to develop specific skills. Buddying was perceived as necessary for newly independent endoscopists, however social barriers were identified for more experienced endoscopists.

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Teaching others, attending colonoscopy courses and buddying were perceived to improve performance through developing conscious competence and confidence. To be effective participants believed an endoscopist should be involved in buddy selection. Courses and buddying offered direct observation and feedback, and dedicated time to talk about colonoscopy. Courses were potentially challenging if an endoscopist was struggling or undertaken in a new working environment.

4.23 Discussion: Strengths and limitations

4.23.1 Reflexivity

Participants were frank in their discussion about all behaviours. One participant only talked about gaming behaviours and fears about the motive of the feedback in more depth after the tape had stopped, however was happy with a written summary of this conversation being included and analysed in the transcript.

As described in Chapter 3, on reflection rapport was built quickly with participants which encouraged open and frank discussions. JC's shared role as an endoscopist, understanding of participants' experiences, use of the same language and references, and previous acquaintance improved this. The interviewer was aware that three participants had higher research degrees involving qualitative work; reflective logs noted this was intimidating to start with however JC relaxed into the interviewer role quickly. Occasionally the discourse tone with unit-leads had vestiges of a trainer-trainee relationship; this did not impact the honesty of the verbose descriptions of their experiences but led to longer interview times.

Removing some TDF domains from the topic guide improved the flow of the interview and rapport. As described in Table 1, most domains of the TDF were naturally explored within the FIT, TPB and bucket themes. However, this may have reduced clarity and depth around environmental context and resources (one of the TDF domains that was removed from the guide), as these were explored in ethnographic observations but not well described by participants. The availability of physical spaces and time for group discussion were described as limitations by participants, but details of where and when people met to talk about performance were sparsely described. Addressing the barriers to improve group discussion in the future is harder without descriptive information about where and when people currently choose to meet.

4.23.2 Purposive sampling and generalisability

The purposive sampling criteria was met at the 19th participant, with a diverse range of professional backgrounds and length of endoscopy experience, increasing the likelihood the results are generalisable. A benefit of this was participants' frankness regarding gaming behaviours. Although the prevalence of gaming is unknown, examples were described by endoscopists from all professional backgrounds and varied length of experience. Participants rarely described their own negative behaviours, but often described these as the actions of unnamed others. These were disclosed in a conversational tone, with an implied intention to prevent them from arising.

The participants' descriptions of gaming and inaccurate documentation included direct observations of others' behaviours but were also conceptions of other's beliefs and behaviours (injunctive and descriptive norms)[164]. These are at risk of misconception through pluralistic ignorance,[165] assuming personal non-gaming attitudes and honest behaviours are atypical. However, the gaming findings of this work were presented to unsuspecting disinterested endoscopy colleagues at an endoscopy meeting locally, who confirmed they recognised these behaviours in their own practice, and the pressures to undertake them.

As described in Chapter 3 there was a potential selection bias of participants interested in A&F. Five of the 19 participants (26%) held BCSP accreditation, higher than the current estimated 10% accreditation rate across NHS England (415 BCSP endoscopists [166] of 4099 NHS England endoscopists [111]). This increased the frequency of codes describing BCSP specific A&F phenomena such as group meetings discussing KPI. BCSP participants descriptions of these being socially intense but motivating may not be applicable to less experienced endoscopists. As described in Chapter 3 unit-leads were prompted to recruit 'regular' endoscopists from Site 3 onwards and purposive criteria may have been improved by considering participants further accreditations. Two 'regular' participants at Site 3 had misconceptions of the aim of the interviews and disclosed concerns they were selected due to problems with their performance. This led to an initial suspicion with P11 who described defensive reactions to identifying a performance gap. This led to P12 focussing on their experiences of critical incidents, and the positive impact on their practice. Although this

impacted the content of their interviews, these were their honest perceptions of A&F practice, and valuable themes which other participants described.

Some themes described phenomena unique to unit-leads, including leadership training, managing underperformance over time, and the complex social interaction of face-to-face performance management. Unit-lead management and leadership training has been associated with improved colonoscopy detection rates in Poland.[97] This work interviewed three unit-leads and themes relating to their unique phenomena may not have reached saturation in any themes or issues specific to this group.

4.23.3 Demonstration of a theory informed model of A&F in relation to other studies

There is a call for the more explicit use of theory to understand mechanisms of change in A&F and this is one of the first UK studies in the gastroenterology seeking to do this however is described in the A&F literature.[60] Theoretical mechanisms of underperformance are described in a recent performance management framework published by JAG.[30] This links colonoscopy performance to Bandura's self-efficacy theory,[167] a person's belief in their ability to succeed. This was drawn upon by Kluger and DeNisi in FIT,[69] and is described in this work in the meta-task theme of confidence. JAG also approached this from the perspective of a supervisory body using an Attributional Model, where an external supervisor attributes underperformance to internal ("*something about the subordinate*") or external factors (such as "*difficult task, lack of support, insufficient information*").[168] Such attributional personality and situational factors are used within FIT as task "*moderators*",[69] and although our model focussed on individual endoscopists and unit-leads perspectives of A&F, these factors are reflected throughout this work in effectiveness and clinical context, and task performance themes. Although the JAG work demonstrates application of theory to guidance, they make no reference to empirical data on the experiences of the undertaking such performance management, which this NED-APRIQOT work adds.

The use of FIT to map and design A&F programmes has been demonstrated by Hysong et al [59] in reducing catheter associated urine-culture ordering in a ward environment and improving guideline-informed management of hypertension. These interventions were effective; however, the underlying behaviours were less complex than colonoscopy.

FIT has been recommended for use in colonoscopy A&F in a narrative review of the literature, using caecal intubation as a motor task to develop a FIT logic model.[71] Qualitative interviews have been used to explore the use of a colonoscopy A&F intervention in Canada, and discussed their findings in the context of FIT.[144] The Canadian study used a similar single interviewer with a reflexive qualitative method, however used a grounded theoretical approach for analysis, with two qualitative analysts developing a coding framework from three scripts. This UK study used a theoretically informed FIT-based analysis framework and, due to resource limitations, a single researcher undertaking coding. However, codes, the use of a FIT framework and reflexive logs were all reviewed by researchers to develop the analytical framework after the eighth participant.

The Canadian and this UK study produced similar themes using FIT in different endoscopy settings, demonstrating evidence for the generalisability of these results.[144] Canadian participants had mixed perceptions of the potential benefits and "*threats*" of higher performance data transparency, and fears of data being used to police performance. Their work described cognitive dissonance of accepting underperformance versus participants' self-perception of capability, which risked them rejecting feedback data. This is similar to the cognitive interference and anxiety of competing goals described by UK participants, particularly the vulnerability and disheartening effects of a named comparison.

There were subtle differences in findings between Canadian and UK participants' experiences. Both described identifying experienced peers for advice, however unlike the UK cohort Canadian participants described not knowing how to improve their colonoscopy performance.[144] This suggests UK participants had a better awareness of A&F resources available to them through their descriptions of seeking opportunities to be observed and attending formal colonoscopy courses. Canadian participants held endoscopy administrators/mangers' perceptions of performance in higher regard than their UK counterparts including reference to risk of endoscopy privileges being revoked.[144] This likely reflects the UK unit-leads' descriptions of a high-demand for endoscopists limiting the use of revoking privileges to improve quality.

4.23.3 Demonstration of paradoxical effects in relation to other studies

Our logic model suggests that A&F interventions in colonoscopy are likely to be effective, but given the complex nature of the task of colonoscopy, may have a mixture of intended

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benefits and unintended paradoxical effects. This is in keeping with the Cochrane review and a meta-analysis of A&F in endoscopy, both finding A&F interventions were modestly effective, but had high variation in effectiveness.[85,86]

Application of behavioural theories, such as Clinical Performance Feedback Intervention Theory (CPFIT), have been used to retrospectively explain why feedback may not have been effective, but without prospective theorisation of adverse effects or potential harms described.[169] As described in Chapter 3 past research evaluating A&F harms has focussed on organisational effects such as the negative impact of on-off actions increasing variation in performance,[143] rather than individual practitioner behaviours and patient harms. The current study demonstrates a theoretical model can be used to map both potential benefits and adverse effects of A&F, in accordance to FIT, including patient harms.

4.24 Discussion: Mechanisms and implications for clinicians or policy makers

4.24.1 Social comparisons

Social comparisons were used by all sites and found to be motivating by participants. A recent metanalysis of social norms interventions in healthcare workers identified modest improvements with a social comparison (standardised mean difference 0.06, confidence interval (CI) 0.04-0.08, n=77) and high heterogeneity in their effectiveness. The effect of the normative referent frame and direction of comparisons was identified as requiring further investigation[170]. FIT describes that such feedback does not always improve performance as it may be psychologically reassuring[69]. National descriptive social norm interventions have been demonstrated as effective in changing healthcare behaviours when practitioners see themselves as an outlier, such as reducing overprescribing of antibiotics.[171] Psychology literature has described social norms having paradoxical "*boomerang*" effects on high performers.[79] The participants in this study did not describe being demotivated by their own high performance, but low performers were reassured by similar peers.

Social comparison theory proposes individuals draw on social comparisons to evaluate one's abilities and align with others in a group.[172] National standards were perceived as a low minimum target for detection, creating ambiguity as to what is an aspirational standard. Psychological studies by Crutchfield et al in the 1950s demonstrated the social influence of others increases in situations when the choice of action or answer is ambiguous, potentially

increasing the influence of social comparison with ambiguous aspirational targets.[173] Endoscopists seeing their behaviours aligning with other low performers was reassuring and, similar to a Bystander effect, reduced motivation to engage in behaviour change.[174]

Participants highlighted the importance of a social professional identity in comparing performance. In the Social Norms Approach [165] group identification occurs when individuals identify closely with a given social group and are more likely to adhere to the norms of that group. Proximal and salient referent groups potentially increase the influence of perceived social norms on behaviours. Participants described identifying others within a shared professional group with better performance motivating behaviour change or similar performance demotivating behaviour change. This highlights the importance of using an aspirational social comparison, as highlighting good or excellent performance as a target (Box 1). This is most likely to be effective if from a social referent group, in this instance comparison to those from the same professional background.

Social comparison theory may partly explain an interesting finding. The most profound phenomena of discomfort and awkwardness were described when feedback was delivered in a public setting. Public discussion of performance is not predicted to improve performance in FIT, as revealing underperformance to peers is likely to cause an emotional response and draw attention away from the task.[59,69] However, all participants describing these negative experiences also described increased motivation. The public feedback was a social comparison usually in a high performing BCSP setting and not to minimum standards, potentially reducing the attack on self-identity as participants had high confidence. Demonstrating individuals as an outlier amongst high performers was therefore motivating. Although public meetings discussing individual's performance are not recommended in FIT, if undertaken this work suggests they are best focussed as a social comparison of those above a minimum standard (Box 4.1).

Consider:

- Highlighting good or excellent performance of other endoscopists from the same professional background.
- Identifying excellent performers to approach for advice as a credible source. Consider patient perspectives as credible sources to change behaviour.
- Avoid group meetings discussing individual performance, but if mandated only discuss social comparisons of performance above a minimum standard.

Box 4.1 Social Comparisons clinical messages

4.24.2 Cognitive interference and anxiety

This is the first study to explore cognitive interference in colonoscopy. FIT suggests if feedback is provided about meta-task behaviours without a plan to improve it risks changing the locus of attention away from the task to the unmet goals of the self. This interferes with task performance by causing anxiety about underperformance. Anxiety draws attention away from undertaking tasks and increases pressure on performing tasks, called cognitive interference.[69] Sewell et al [175] has examined a similar phenomenon to cognitive interference in participants training in colonoscopy; these were explored using cognitive load theory and described as extraneous load. Their trainee participants described how thinking about emotional state, such as fear and anxiety, impeded performance.

NED-APRIQOT participants' described emotional responses of anxiety and getting bogged down when underperforming in perceived important targets emphasised in national quality guidelines, such as completion rates and polyp detection KPIs.[11] These colonoscopy KPIs are the outcomes of complex psychomotor skills requiring higher cognitive tasks.[176] Using criteria from the functional job analysis rating scale, colonoscopy scores highly in things, data, people, worker instructions, reasoning, worker technology, worker interaction and human-error consequences domains.[177] These higher tasks' associated KPIs are provided without a plan and are associated with both actionable task-motivation behaviours (see Process outcomes Chapter 3) but also meta-task behaviours of confidence and detection mindset.

Although highly complex, participants' familiarity and automation of the skill of colonoscopy allowed them to focus on individual task motivation behaviours to improve and avoid cognitive interference. This was most effective with low detection, when data about the underlying task-motivation behaviours to improve detection were provided (described in Chapter 3). To reduce cognitive interference, A&F targets should be set with a plan to improve, where possible, focussing on task-motivation behaviours, which practitioners can implement a known specific behaviour to improve performance (see Box 4.2). The Cochrane review demonstrated that improved effect sizes were seen in A&F when feedback contained both an explicit measurable target and a specific action plan.[85]

Where there is underperformance in meta-task behaviours, such as low completion rates due to endoscopist confidence, then addressing this is a complex social task. Participants described defensive reactions and suspecting ulterior motives of feedback as a source of cognitive interference, with performance being used against endoscopists, to stop them scoping. This attack on self-identity caused participants to reject the feedback or pressurised endoscopists to perform gaming behaviours. A qualitative study in Canada similarly identified cognitive dissonance between colonoscopy participants identifying underperformance and their self-identity as being capable and competent.[144] A qualitative study of experts in theories of A&F identified reducing 'attack on self-identity' as an important consideration in A&F design, stating that A&F needs to ensure defensive reactions do not take place through reassuring messaging (see Box 4.2).[60]

Providing feedback with a plan that is proportional and not perceived as an attack was described as a challenge by unit-leads and best done face-to-face. They described the required tasks of exploring underperforming endoscopists' understanding of KPIs and associated behaviours, the reasons for underperformance and developing a plan to improve. To reduce psychological pressure, the current study suggests unit-leads should clearly identify their motivation to provide support; this would help alleviate anxiety and maintain the focus on helping the endoscopist to improve. Management plans of buddying and training, for those persistently underperforming are discussed below (see Box 4.2).[22]

> Consider:
>
> - Providing a plan in all written feedback focussing on behaviours endoscopists can implement alone: accessing more lists, timing withdrawal, withdrawal technique, Buscopan etc.
> - Clarifying the motivation of feedback to support improvement.
> - Offering face-to-face support for complex problems: check understanding, assess causes of underperformance, develop a plan.

Box 4.2 Cognitive interference clinical messages

4.24.3 Gaming

Cognitive interference and gaming pressures are highest on behaviours with outputs perceived as being inaccurate or unmeasured, which may be sacrificed to achieve measured targets.[178] Therefore, the challenge for endoscopy A&F is to measure behaviours that are important well.

Participants described examples of gaming where endoscopists identified completion rates as an important KPI and expressed a wish to appear to reach the target. Documentation converting a failed colonoscopy to a flexible sigmoidoscopy, a shorter procedure without a completion target, is a recognised unintended consequence of A&F.[179] The inaccurate documentation falsely elevates performance and may cause a *ratchet effect*, where this creates future unrealistic targets and puts more pressure on endoscopists.[178]

Inaccurate colonoscopy documentation from A&F pressures is postulated in the literature, particularly for withdrawal time with the view that *"not all 7 minutes are equal"*.[180] The current study indicates that endoscopists identify a performance gap, with a withdrawal target they desire to appear to meet, but reject behaviours that increase inspection time. This may be related to factors reducing perceived control of withdrawal time such as competing time pressures or difficult prolonged insertion, which are associated with lower detection of pathology.[181] In sites with assistants timing withdrawal, participants identified potential educational needs around the importance of inspection technique, withdrawal time and documentation accuracy; educational interventions addressing these and supplementing A&F and timing may be effective for colonoscopy improvement (Box 4.3).[71]

Adequate bowel preparation is recognised as essential for high quality colonoscopy, and required for caecal intubation and polyp detection.[11] All participating centres used the Aronchick or Ottawa bowel preparation scales, however documentation remains subjective, using non-standardised criteria with poor quality assessment of these scales.[182] Blaming bowel preparation, which is not perceived to be under endoscopists control, offers the endoscopist an opportunity to protect themselves from a perception of fault for low completion rates. This incentivises inaccurate documentation, which improving standardisation of bowel preparation scores or encouraging bowel preparation photo-documentation may reduce (Box 4.3).

As was evident in this study, underperformance against detection targets risks incentivising removal of distal hyperplastic polyps, potentially risking patient safety. Increasing the accuracy of polyp detection KPIs could be achieved by assessing polyp histology to permit calculation of an ADR: future iterations of NED may link with histological databases to facilitate this.[121] However, ADR does not include significant non-adenomatous polyps. As described in the Delphi process (Chapter 2) and explored in cognitive interviews (Chapter 3) a proximal polypectomy rate in conjunction with traditional polyp detection KPIs was agreed to promote the removal of clinically significant right-sided lesions through better proximal colon inspection, and reduce the incentive to remove distal hyperplastic polyps (Box 4.3).[6,138]

Patient experience and ENTS were identified by participants as important KPIs for colonoscopy. Unlike detection, few simple task-motivation behaviours were identified for improving comfort, and participants who with further BCSP accreditation focussed on comfort. This suggests patient comfort is a higher-level skill, and feedback without a plan may risk cognitive interference. Comfort scores that are endoscopist reported have been criticised; patients and endoscopists have been shown to have different priorities around the endoscopy experience.[183,184] Patient comfort documentation was perceived as variable and its accurate documentation was not always important to all endoscopists. In the poor recording of the patient experience, A&F processes potentially expose patients to the risk of discomfort as endoscopists may prioritise achieving better-measured performance targets. Better assessment and recording of the patient experience with

validated patient-reported experience measures for endoscopy, such as the "*Newcastle ENDOPREM^(TM)*", may reduce this risk (Box 4.3).[184]

Consider:

- Implementing assistants timing withdrawal with educational messaging about the importance of withdrawal & inspection.
- Education on bowel preparation scores and encouraging photo-documentation when inadequate.
- Using an ADR or a proximal polyp detection rate to assess significant polyp removal.
- Using an endoscopy patient reported experience measures (*Newcastle ENDOPREM^(TM)*) to reduce perseverance despite patient discomfort.

Box 4.3 Gaming clinical messages

4.24.4 Endoscopic non-technical skills (ENTS)

Endoscopic non-technical skills (ENTS) were identified as an important part of colonoscopy quality and feedback was provided by the endoscopy nursing team; however, the feedback described was informal. A behavioural marker system for endoscopic non-technical skills has been published describing categories of communication & teamwork, situation awareness, leadership, and judgement & decision making.[185] Such descriptive ENTS systems support formal assessment of ENTS by the endoscopy nursing team using a multi-assistant rating scale of these behaviour categories. Such a scale and tool was developed and validated to measure ENTS and provide performance enhancing feedback to endoscopists.[186,187] However, the tool itself was not published, and its use was not described at any of the centres interviewed. Further publication and utilisation of this tool may support provision of more ENTS feedback to independent endoscopists (Box 4.4).

Addressing ENTS behaviours was identified as a challenge for unit-leads particularly around communication. Previously published ENTS interventions include simulation training, and have focused on and suggest effectiveness in improving patient safety and reducing error through human factors training and development of safety checklists.[188,189] Participants perceived patients expected safety, but emphasised the importance of professional communication. A qualitative assessment of patients' perspectives in endoscopy identified six themes, four were dependent on staff communication.[184] These were themes of

anxiety (discussing results after a test), expectation (descriptions of procedure and sedation effects), choice and control (discussing sedation options and being able to stop the test), and communication. Further work should develop training aiming to improving professional communication in these areas identified by patients (Box 4.4).

Consider:

- Using formal ENTS assessment tools for the wider endoscopy nursing team to facilitate formal feedback on ENTS.
- Development of training to address professional communication.

Box 4.4 ENTS clinical messages

4.24.5 The endoscopy nursing team: hierarchy, autonomy and commitment-based management

Questioning clinical practice has been suggested to prevent the occurrence of adverse events, to improve team performance and facilitate a learning environment.[190] One safeguard to patient safety and experience is the endoscopy nursing team, if they are empowered to speak up about patient safety and comfort. Two important factors described were hierarchy and autonomy.

Participants described conversations and tension between the endoscopist prioritising completing the test to achieve the test's goal and the nurses prioritising the patient's comfort. This tension may represent the potential negative social consequence for nurses speaking up and evidence of a room hierarchy. In JC's experience as a non-senior endoscopist, during a colonoscopy the patient, endoscopist and endoscopy nursing team will be weighing the balance between the clinical aim of the colonoscopy and the patient's comfort, and if there is significant discomfort the nurse endoscopy team are most likely to speak on behalf of the patient to stop the test. Speaking up and tension were not described by senior consultant participants; while potential explanations for this could include better management of patient comfort, participants identified endoscopist status and seniority as a barrier to speaking up. Previous studies have identified healthcare workers can be hesitant to speak up. When more junior in a hierarchy this hesitance prevented speaking up

even when they perceived a high risk of patient harm.[191] Training is required to reduce hierarchy in the endoscopy room (Box 4.5).

Participants described a heterogeneity of staff in the room during different endoscopy lists, and ever-changing teams in the endoscopy room may be a barrier to flattening hierarchy and inhibit using this strategy to improve performance. However, stabilising team members over multiple lists may pose a logistical impossibility for centres facing significant staffing challenges.[192]

There has been a culture shift in healthcare from clinicians working alone and professionalism being associated with autonomy and self-monitoring, to a team-based approach, with team empowerment and accountability. Mathews et al [193] argues a loss of autonomy to 'standardisation' of care requires that the standards developed should have an evidence base for their benefit to patients and be considered by a diverse group of stakeholders. Colonoscopy quality meets these requirements as evidenced in clear benefits to patients in reducing post-colonoscopy colorectal cancer (Chapter 1) with agreement of these standards by Delphi process (Chapter 2).[33] While this may have advantages, it could also lead to a perceived loss of autonomy, tension and may not be welcomed by the team.[193,194] Participants described tension between the team ensuring patient safety and the endoscopist having autonomy over performing colonoscopy, and a perception that the nursing team may not want extra accountability and responsibility for quality. This is reflected in qualitative work by Hysong et al examining feedback in primary care, showing ownership of clinical performance was largely retained by the care provider despite transitioning to team-based care.[195]

Participants described flattening the room hierarchy and empowering the nurses to speak up about patient safety was dependent on departmental support and the individual nurse's experience and training. A recent survey of nurses demonstrated that speaking up for patient safety was positively related to two factors: a 'climate for safety' and 'team psychological safety' (Figure 4.22).[190] Climate for safety is created through a control-based management style. This resembles FIT; the importance of safety rules is highlighted, compliance is monitored, and feedback is given. Team psychological safety is defined as *"a shared belief that the team is safe for interpersonal risk taking"*.[196] This is based on the premise that speaking up has potentially negative personal consequences and that a team

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shares the belief that the benefits of speaking up about safety outweighs these costs. Control-based management styles are hypothesised to highlight the consequences of speaking up and not engender team psychological safety. This requires 'commitment-based safety management', where leaders create awareness about, actively demonstrate, and encourage others in speaking up.[190] This style of management was described by the NED-APRIQOT participants in leadership roles to address the barriers of heterogeneity of empowerment and hierarchy; working to create a flat hierarchy for patient safety through endoscopist training in human factors and nurse training in speaking up about doing a safety brief or huddle. These huddles were used to encourage and demonstrate speaking up, which may engender team psychological safety (Box 4.5).
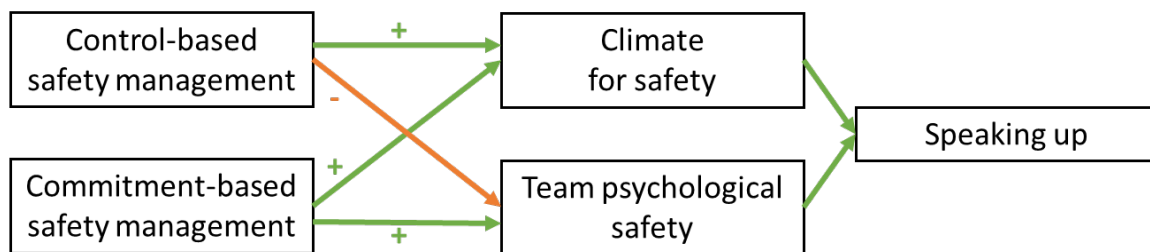
Figure 4.22 Hypothetical model of the relationship between control- and commitment-based safety management strategies in encouraging speaking up. Taken from Alingh et al.[74]

Consider:

- Patient safety and quality is the responsibility of everyone room.
- Training senior endoscopists in awareness of room hierarchy and using huddles to flatten this.
- Endoscopy nurse leaders should use commitment-based management and demonstrate and encouraging speaking up.

Box 4.5 Endoscopy nurse team clinical messages

4.24.6 Critical incident reflection, support and patients

Critical incidents, particularly when associated with a potentially missed cancer, led to an emotional response and knockback to the endoscopist's confidence. The phenomenon of patient safety incidents damaging the physical, psychological or professional wellbeing of healthcare workers is well described, and referred to as a 'second victim' phenomenon, although the nomenclature is debated.[197,198] Healthcare workers' responses to critical

incidents are described as multi-layered, with emotional trauma such as guilt, and challenges to professional identity through perceptions of professional incompetence and self-doubt. Physical symptoms of fatigue, insomnia and nausea are also described.[199] A survey of physicians who had experienced an adverse event or near miss showed 74% believed it had affected them personally or professionally.[200] A control-based safety management approach, with a punitive response to error and low levels of team psychological safety has been reported as contributing to such responses. Encouraging supportive supervisor and institutional interactions is suggested as a strategy to manage these experiences.[201] The NED-APRIQOT participants described receiving such psychological and professional support, however the literature suggests there is a need for healthcare organisations to invest further in support resources, as in 2014 only a third of UK physicians reported adequate support from their organisation (Box 4.6).[200]

Participants described immediate patient safety incidents of tachyarrhythmias with hyoscine butylbromide and a perforation. This powerful motivator to change behaviour prompted plans with potentially negative consequences: stopping using hyoscine butylbromide in all patients potentially reduced polyp detection, and stopping scoping, as described, had personal and centre wide consequences. These findings suggest that unit-leads should support forming plans for future practice which avoid negative consequences. It is recognised that coping strategies to adverse events are generally adaptive, but they may become maladaptive over time if adopted in a rigid and decontextualised way.[202] A recent assessment of endoscopy centres learning outcomes from adverse events suggested plans of developing systems and training were most common (Box 4.6).[203]

Consider:

- Avoiding a punitive response and tone to errors, focus on professional support.
- Meeting a supervisor to make or review a plan of action, to avoid negative consequences.

Box 4.6 Critical incident reflection clinical messages

Participants did not describe negative feedback from patients through complaints processes or 'first victims' of critical incidents. As part of endoscopy unit accreditation, endoscopy services should have systems in place to ensure patients can give feedback to centres in

confidence and that these are collated, analysed and disseminated to relevant parties to provide insights into safety-related problems within healthcare.[9,204] Participants may have not associated patient feedback with quality of colonoscopy performance; in a recent metanalysis only 8.9% of patient complaints described 'quality care' as the underlying issue[204].

4.24.6 Coaching: Social and logistical considerations

The phenomena participants described as buddying, attending training courses to develop skills, and the JAG recommended *"informal: coaching or mentoring by local colleagues"* [22] most closely resembles coaching in the medical education literature.[160] These are skill focused activities, finding a strategy to solve a problem, over a limited number of sessions (Box 4.7).

Our study highlights coaching was most appreciated and socially accepted by endoscopists during the period of transition into independent practice, where there were more perceptions of isolation and a paucity of face-to-face feedback. The phenomena of a dip in performance, particularly caecal intubation rate, during the first 100 procedure after procedural sign off is well documented,[205] and highlights the need for peer support during this period. The benefit or face-to-face feedback whilst undertaking colonoscopy has been described in colonoscopy training literature. The technique of observing each other practice, with verbal descriptions and guidance from a trainer are currently recommended for both trainees and experienced endoscopists (Box 4.7).[150,206]

UK endoscopy services are predicted to be under strain from the impending retirements within its workforce, therefore it is increasingly important to reduce the barriers to educational activities for later career endoscopists to help defer early retirement from endoscopy activities.[166] These barriers were both social and logistical.

Our participants described social barriers discouraging more experienced clinicians from engaging in coaching. This is a wider problem; Health Education England's commission on education and training for safety improvement highlighted the importance a culture enabling experienced clinicians to engage in continuing education and recognise when skills need updating.[207] The qualitative Canadian study participants similarly described fewer social barriers for early career endoscopists for engaging in further training to improve

performance, and an expectation that underperforming later career endoscopists were less motivated to improve and should consider retirement.[144]

In endoscopy the phenomenon of experienced clinicians needing to overcome established practice to engage in educational activity has been described.[206] The coach relationship and the development of conscious competence were described as mechanism for improvement by participants in coaching activities, and Peyton's conscious-competence model of learning has previously been applied to colonoscopy (Table 4.6).[150,208] Experienced clinicians are most likely to have unconscious competence, mastery of colonoscopy without conscious thought allowing them to manage difficult situations quickly. This may explain social barriers for experienced clinicians, as experience brings fewer incentives to engage in reflective behaviours, and new techniques may challenge these intuitive expertise and threaten self-perception as an expert.[206]

Unconscious incompetence	The subject is not aware of the skill in question
Conscious incompetence	The subject is aware of the skill and recognizes the need to acquire it
Conscious competence	The subject has acquired the skill but needs to focus their attention on its performance
Unconscious competence	The subject has achieved mastery of the skill and can perform it without conscious thought; other tasks can be performed at the same time.

Table 4.6 Peyton's conscious-competence model [85]

The coaching relationship was highlighted as important by the NED-APRIQOT participants, and suggests endoscopists should have choice of a coach, based on a skill set they wish to develop and their working relationship. A Danish case study of expert endoscopists engagement in educational activity described relationship-building between clinicians and trainers as an important factor for educational buy-in. The study recommended that trainers should be attentive to the current practice of the clinicians, approach with respect and ease tensions using humour. They recommend an 'asymmetry' between trainer and clinician in skill set, to allow authority in the coaching relationship and an intellectualisation of the process of colonoscopy using a shared vocabulary and logical arguments for behaviours (Box 7).[206]

Observing peers and coaching were not described as regular occurrences, with significant logistical barriers to organising time with another endoscopist, particularly at later career

stages. These opportunities have been significantly reduced with the impact of the coronavirus pandemic, with increasing demands on colonoscopy services to catch up on growing waiting lists for urgent procedures and reduced time for endoscopist training[209,210]. The move to online training events and live-streamed procedures is recommended for observing new techniques, developing non-technical skills and decision making, however directly observed high-quality training (now over shorter periods of time) are still required to develop technical skills.[211] All endoscopy centres should consider planning sessions and time for observation of colonoscopy for all endoscopists, to reduce both logistical and social barriers for experienced clinicians engaging in training activities.

Our participants highlighted the importance of training for trainers, to develop a framework for providing feedback and a shared language of colonoscopy. In endoscopy the TCT course has a well described educational approach for training, which can be applied to training experienced clinicians.[150]

To overcome logistical barriers participants described attending as faculty or learners on training courses to experience episodes of coaching with peers, although when in an unfamiliar environment this was described as challenging. Most endoscopy centres in the UK do not provide courses within their unit as each region has an allocated training centre. A recent Norwegian observational study demonstrated that centres providing courses had better centre-wide polyp detection and comfort rates.[212] Current centralisation of colonoscopy courses in regional training centres may have a negative impact on continuing development of endoscopists in non-training centres, and highlights the importance of a 'hub and spoke' approach with training centres delivering portions of courses in other units (Box 4.7).[17]

Consider:

- Coaching can be in the form of several joint lists with an endoscopy trainer or attendance of a training course.
- Offering coaching to all endoscopists to maintain clinical competence.
- Planning regular coaching for all endoscopists during their first 100 procedures after independence.
- Involving endoscopists in choosing a coach based on skill set and social acceptability.
- Continuing the hub and spoke model for regional training centres, to improve local access to endoscopy courses for all endoscopists in a region.

Box 4.7 Coaching clinical messages

4.26 Conclusion

This work demonstrates the use of a FIT-based logic model for analysing and describing the A&F process in colonoscopy, and key implications for clinical practice.

Social comparisons were motivating when highlighting good performance of endoscopist from a similar professional background and identifying an excellent performer to approach for advice.

Anxiety and cognitive interference occurred when feedback highlighted underperformance in complex tasks such as detection or caecal intubation rates, without a plan to improve. All written feedback should have a plan focussed on behaviours endoscopists can implement independently and offer face-to-face support for more complex problems. Cognitive interference pressured participants to undertake gaming behaviours, at the expense of the poorly measured outcomes of withdrawal time, patient comfort and polyp histopathology. Educational messaging, assistants timing withdrawal, using a proximal polyp detection rate when histopathology is unavailable, and patient reported experience measures may reduce gaming behaviours.

ENTS were identified as important for quality, but feedback from the endoscopy nursing team was informal, further development of an ENTS assessment tool for providing formal feedback is required. Endoscopy nurses speaking up was identified as an important safeguard to patient safety, but dependent on nurse empowerment and hierarchy in the room. Using huddles and requesting specific prompts were perceived to flatten this

hierarchy. Departmental support is necessary to empower nurses to speak up, through training clinicians in human factors and leaders using a commitment-based safety management approach.

Critical incidents prompted an emotional reaction with a knockback to confidence, departments should provide professional support. Plans made after critical incidents risked having negative consequences and should be reviewed with supervisors.

Coaching was perceived to benefit all endoscopists and should be offered to maintain all endoscopists clinical competence. Perceptions of isolation were highest at the point of transition to independent practice and later in careers, planned coaching may alleviate this.

The implication for these findings on future clinical research are discussed in Chapter 5.

Chapter 5 Discussion

In this Chapter the overall findings are summarised and the implications for future clinical research are considered in the fields of KPIs, development of behaviours theories, application to NED-APRIQOT and wider A&F research in endoscopy. A summary of research recommendations is shown in Box 5.1.

Statistical analysis of colonoscopy data should consider:
- Correlating selected procedure adjusted mean number of polyps (MNP) and proximal polypectomy rate (PPR) with adenoma detection rate (ADR) and centre level post colonoscopy colorectal cancer (PCCRC).
- Prospectively investigating the relationship between mean detection key performance indicators (KPIs) and clinical outcomes such as PCCRC to develop dichotomous minimum standards.
- Assessing the relationship between number of endoscopy lists performed in a week and detection to develop a recommended upper limit.

The process evaluation following the NED-APRIQOT should consider:
- Exploring the technical and logistical challenges of implementing timing proximal withdrawal and its perceived impact on PPR.
- Exploring if participants engaged in making their own plans to improve performance.
- Exploring the experience of unit leads in managing underperformance and identify potential training needs of UK unit leads for managing underperformance.

Future iterations of the NED website should consider:
- Providing national aspirational normative comparisons for different endoscopist groups by professional background and bowel cancer screening accreditation status.
- Developing the NED interface with unit-leads to improve assessment of centre-wide and endoscopist level KPIs.

Future A&F trials in colonoscopy should consider:
- Using case-mix adjusted KPI to reduce the impact of endoscopist gender on KPIs and the potential gender inequality.
- Following best practice in A&F trial design and intervention development.
- Using Feedback Intervention Theory (FIT) as a theoretical tool to investigate behaviour change interventions (BCI) including paradoxical effects.
- Comparing BCIs providing plans versus encouraging endoscopists to create their own plans for complex behaviours.

Box 5.1 Summary of recommendations for future clinical research

Future A&F trials in colonoscopy should consider:
- Designing and developing BCIs for nurses and nurse leaders, targeting safety management behaviours and training, and assessing the impact of this on team behaviours.
- Designing and developing BCIs for UK unit-leads to target leadership management behaviours and training, and the impact of this on team behaviours and detection.

Future research in colonoscopy should consider:
- Exploring the use of emerging artificial intelligence (AI) approaches to assess detection behaviours such as the percentage of the colonic mucosa observed.
- Assessing the impact of faecal immunochemical testing for patient triage on endoscopist detection behaviours.
- Assess psychological support and management strategies for endoscopists experiencing anxiety or knockback to confidence particularly after critical events and PCCRCs.

Box 5.1 continued Summary of recommendations for future clinical research

5.1 Summary of thesis findings

For the first time, a Delphi process demonstrated mean number of polyps (MNP), a mean detection KPI, was acceptable to endoscopists (Chapter 2), and the use of a proximal polypectomy rate was accepted as a secondary measure to reduce the impact of distal hyperplastic polyps on a polyp detection KPI. Participants in both the Delphi process and interviews (Chapter 3) described a case-mix adjusted detection KPI as acceptable.

This work described a FIT informed design and the iterative development of a BCI for the first time in colonoscopy. The BCI used a novel algorithm to provide 'correct solution' information targeting specific behaviours, which participants planned to use to improve detection (Chapter 3). Red, blue and green colour coding, and graphical displays of data eased interaction with the BCI and supported shifting the locus of attention to a feedback-standard gap. Those with low numbers of procedure perceived reports as having low credibility, but still planned to change behaviours.

Thematic analysis of interviews and development of a logic model (Chapter 4) showed national standards were perceived as minimum targets and social comparisons to high-performing local peers were used as an aspirational target. Peers were approached for discussion and advice if a feedback-standard gap was identified. Isolation of endoscopists

working independently was described, which impeded A&F processes and dissemination of skills; particularly for those perceived not to engage in emails.

Endoscopic non-technical skills (ENTS) were identified as important, but participants only received limited informal ENTS feedback from the endoscopy nursing team. Patients' beliefs about performance were described as important by participants. Nurses were used for safety prompts and situational awareness if the hierarchy in the room was perceived as flat; this finding lead to the development of commitment-based management and training recommendations as discussed in Chapter 4.

The application of FIT to colonoscopy suggested that FIT domains should be broadened to incorporate phenomena of gaming behaviours (inaccurate documentation, perseverance despite patient discomfort and unnecessary polypectomy). Confidence and detection mind-set were described as meta-tasks for performing colonoscopy, and participants described detection fatigue when too many lists were performed in a week. Time pressure, anxiety about performance and the consequences of being stopped from scoping caused cognitive interference, reduced confidence, and interfered with performance.

5.2 Implications for KPI clinical research

5.2.1 Use of mean detection KPIs

Mean polyp detection KPIs, such as MNP or mean number of adenomas per participant (MAP), are recognised to reduce the 'one-and-done' phenomenon,[36] but are not currently described in colonoscopy quality assurance recommendations.[11,33]

Mean detection KPIs have started to gain recognition as primary outcomes in polyp prevention trials in recent year.[213–215] This has been precipitated by quality improvement work in colonoscopy, particularly initial work in the UK BCSP.[27] Lee et al demonstrated MAP correlated with ADR, but endoscopists with an ADR around the mean had a broad range of MAP performance. MAP therefore provided further performance information by differentiating average performing endoscopists' (Figure 5.1). Similar findings were demonstrated in the Austrian and Thai colonoscopy settings, showing adenomas per colonoscopy (APC) and adenomas per positive participant (APP) differentiated endoscopists with ADR above a minimum target.[57,216] However, the Austrian group did not recommend using mean detection KPI, citing they a paucity of

evidence for the association between mean detection KPIs, ADR and post-colonoscopy colorectal cancer. This highlights the importance of future work investigating the correlation in UK endoscopy between our selected procedure adjusted MNP, ADR and centre-level PCCRC. The first step could be done within NED.
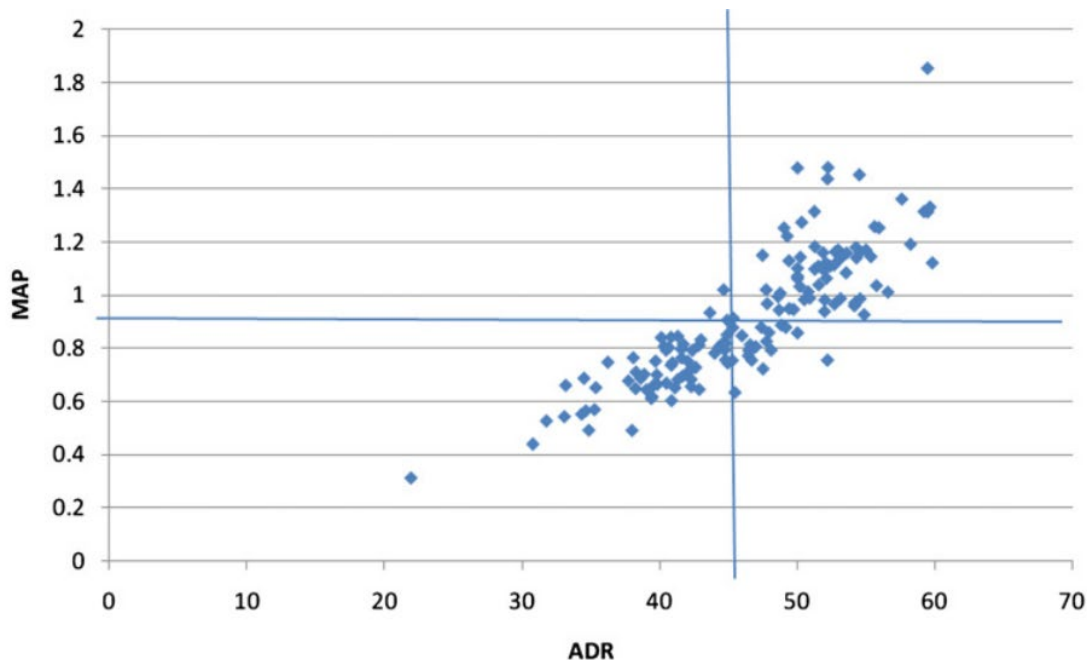
Figure 5.1 Extract from Lee et al 2012.[27] *Scatterplot of mean number of adenomas per procedure (MAP) against adenoma detection rate (ADR) per colonoscopist. Horizontal and vertical lines represent the means of the measures for the study population.*

5.2.2 Dichotomous targets

The Cochrane review of A&F suggested that dichotomous performance targets are more effective in changing behaviour.[63] Our final version of the BCI did not provide a set dichotomous standard; when a set standard MNP of 100 polyps per 100 procedures was originally used participants did not perceive this as achievable. MNP was a new measure, with higher values than previous percentage detection measures, and was therefore perceived as too high (Chapter 3). However, participants could accept a social comparison, even when the aspirational standard used was above the previously chosen set standard, as they could visualise what other endoscopists were achieving nationally. As familiarity with MNP and other mean detection KPIs increases, future work should prospectively investigate the relationship between mean detection KPIs and clinical outcomes such as PCCRC. This

may improve perception of the credibility of these mean detection KPIs and identify an appropriate dichotomous set standard.

5.2.3 Proximal detection KPIs

Proximal polypectomy rate (PPR) has been demonstrated here to be acceptable to endoscopists (Chapter 2) and in the BCI was associated with a task-motivation behaviour of increasing proximal withdrawal time to improve detection (Chapter 3). This was also a new detection KPI for participants. As described in Chapter 1, PPR has been shown to strongly correlate with proximal ADR (r=0.92),[49] and a similar proximal histology-based detection KPI, the proximal serrated polyp detection rate (PSP-DR), has been shown to correlate with overall ADR in both screening and symptomatic populations.[217]

PCCRCs are more likely to arise from polyps missed in the proximal colon. Baxter et al [4] demonstrated 12.4% of proximal tumours were a PCCRC versus 6.8% of distal tumours, and patients undergoing colonoscopy by an endoscopist with a higher polypectomy rate overall had a lower risk of PCCRC. A cohort of 10, 000 screening colonoscopies demonstrated a weak but statistically significant correlation between PSP-DR and mean withdrawal time, and suggested a withdrawal time ≥ 11 min was associated with higher PSP-DR.[218] Through drawing attention to a proximal detection rate and prompting endoscopists to time their proximal withdrawal, the BCI aims to improve detection of such subtle proximal polyps.

The NED-APRIQOT will assess the impact of the BCI on PPR and withdrawal time, complementary statistical work is undertaking analysis of the relationship between centre level PPR and PCCRC using retrospective data. However, timing proximal withdrawal was identified as having high dominance by some participants, being dependent on nuanced assessment of the colon to recognise the proximal versus distal landmarks or access to Scope Guide which was not available in all units (Chapter 3). The technical and logistical challenges of timing proximal withdrawal will be explored in the NED-APRIQOT process evaluation and future research should consider assessment of proximal withdrawal time, not currently recorded in NED, and its relationship to proximal detection KPIs.

5.2.4 Case-mix adjustment

A case-mix adjusted detection KPI was acceptable to participants, as participants held beliefs based on their experience and awareness of evidence that certain patient groups

have higher risks of polyps than others.[219] Female gendered endoscopists described having a younger and more predominantly female endoscopy case mix, and this impacted on their detection KPIs (Chapter 4). This has been demonstrated in the literature, as patients of a female sex have fewer polyps and require longer caecal intubation times than their male counterparts.[220,221] A recent study in the United States confirmed 71% of female endoscopists' patients were female, versus 51% for their male colleagues.[222] Such an impact on unadjusted KPI is unlikely to be trivial in combination with other barriers to advanced endoscopy that female endoscopists have reported in a recent European survey with representation from the UK.[223] Case-mix adjusted KPIs reduce this gender inequality in performance and should be considered in A&F processes and future trials in colonoscopy.

It is logical that endoscopists will engage more in behaviours associated with polyp detection in patients they perceive having a higher risk of polyps, particularly if these behaviours have safety control beliefs or higher dominance, such as Buscopan and turning the patient as described in Chapter 4. Since the participant interviews, due to the impact of the coronavirus pandemic on UK endoscopy services,[209] some UK endoscopy centres have introduced faecal immunochemical testing for symptomatic and polyp surveillance patients to assist in triaging procedures.[224] This has been suggested to be effective in identifying symptomatic patients attending for colonoscopy who have a higher risk of polyps or cancer.[225] This clearer high-risk classification of patients may encourage endoscopists to engage more in detection behaviours. Hypothetically, this may significantly improve polyp detection but also may increase the 'on-off' nature of these behaviour and negatively impact those presenting with a false negative faecal immunochemical test result. The impact of new triaging tools on detection and detection behaviours should be assessed in future research. Similarly, any case-mix adjustments to KPIs should consider a faecal immunochemical test result in non-BCSP patient populations.

5.3 Theoretical implications, fitting FIT to colonoscopy

FIT and the TPB complimented each other well as working theories in Chapter 3 and 4's framework analyses. FIT was required to hypothesise and map how intentions were translated into behaviours. BCIs using the TPB alone have been argued to only assess and address intention and perceived behaviour control which only account for a proportion of

variances in behaviour. [226] However TPB was useful for exploring normative, behavioural and control beliefs within FIT themes.

5.3.1 Changing standards and gaming

FIT allowed mapping of both intended and paradoxical effects associated with A&F. This is the first demonstration of such a dark logic model in an A&F context, and allowed evaluation and assessment of the mechanisms of these potential harms.[155]

Kluger and DeNisi's "*third strategy*" for discrepancy reduction through "*changing the standard, rather than abandoning it altogether*" was expanded in this work's programme theory to include gaming behaviours describing phenomena of changing what is included in the standard.[69] A more technically accurate FIT model may consider gaming behaviours within FIT's first strategy "*people choose to increase their effort*". However, on reflection, the interviewer identified gaming behaviours as separate to the other coping behaviours to improve detection, through participants' perceptions of them being negative. Simplistically separating these themes from other changes in behaviour aided their exploration at interview and analysis, and clarified their potential mechanisms and link to cognitive interference. Future qualitative research assessing or evaluating A&F and colonoscopy behaviours should consider using such a FIT model and should assess a mixture of intended and unintended paradoxical effects.

5.3.2 The role of participant reflection within FIT

FIT predicts that a BCIs' effects are "*especially augmented by goal setting when the feedback intervention message is not interpretable*", giving quantifiable data of goal and attainment. This is in keeping with participants describing process outcome data and a targeted plan as being effective (Chapter 3), and desiring such plans in their current A&F processes (Chapter 4). However, participants also described preferring to interpret their own data in their own way and considered their own plans to change behaviour through reflection (Chapter 4). This was incorporated into the FIT model as a personal action, and in the final BCI participants were encouraged to reflect on their results, how they could improve them and how they felt. FIT suggests encouraging such reflection away from quantifiable attainment data risks shifting attention away from the feedback-standard gap to other goals and reducing the efficacy of the BCI.

As described in Chapter 4, colonoscopy is a complex cognitive procedure. FIT treats all learnt task-motivation behaviours as similar, however the Reflective-Impulsive Model describes behaviours as habitual or reflective.[227] In healthcare some complex behaviours are effortful and involve complex decision-making without being meta-tasks of the self. These may require 'reflective' cognitive analysis of performance to guide behaviour change.[228] It could be argued that for more complex behaviours BCI, such as caecal intubation, encouraging participants to reflect and formulate their own action plan may be effective.

The Cochrane review of A&F suggest the role of participant involvement in setting targets and making action plans in BCIs is promising but uncertain.[85] Interventions asking participants to form their own plans are argued to create more inter-individual variance. This is hypothesised to be due to variation in adherence to forming a plan, varying content and quality of the plan, varying impact from baseline activity, and a perception of ownership of a self-formulated plan exerting additional motivational effects.[226] Further review of how participants engaged in plans provided, if they made their own plans, the role of supervision in making plans and their effectiveness should be assessed in the NED-APRIQOT process evaluation. Future A&F BCIs or iterations of NED-APRIQOT may consider testing providing a plan versus participants creating their own plan for more complex behaviours.

5.3.3 Literature developments: Clinical Performance – Feedback Intervention Theory (CPFIT)

During my qualitative study a new theory, CPFIT, was published.[169]. These authors undertook a systematic review of qualitative evaluations of feedback interventions, and used this to develop a theory for designing, implementing, and evaluating feedback in a clinical setting. This considered FIT, as well as similar programme behaviour change theories including Control Theory and Goal Setting Theory. Briefly, CPFIT identifies feedback, context and recipient variables which operate via mechanisms which in turn influence behaviour and intention via a feedback cycle. The themes identified have clear links to the FIT model described here:

- Feedback variables link to the FIT themes of goal hierarchy and identifying a feedback gap;
- Context variables link to FIT themes of effectiveness and the clinical context;
- Mechanisms link to control beliefs identified within the FIT model;
- The feedback cycle link to FIT themes of identifying a feedback gap and elimination strategies.

CPFIT recommends using its hypotheses to retrospectively model why interventions may not have been successful, in a similar concept to the dark logic model in this work. It considers some individual factors explaining paradoxical effects of A&F such as "*tunnel vision*" and "*non-acceptance*" of feedback, although the FIT model described here prospectively exploring cognitive interference, gaming, quitting and rejecting the performance gap allowed a thicker description of these phenomena. However, CPFIT provides a more in-depth framework to explore organisational and team characteristics. As described in Chapter 4 the unit-lead, buddying and nurse prompt themes were initially analysed in a "bucket" and then modelled to FIT's elimination strategies. CPFIT's themes of champions, leadership support and teamwork would have helped more easily map these themes into the logic model. Given these organisational hypotheses, CPFIT is being considered in the NED-APRIQOT process evaluation interviews to retrospectively explore team and organisational effects of the BCI. [169]

5.4 A&F trials quality and nesting in NED

Since the NED-APRIQOT project began in 2018 the use of behaviour change theories in A&F processes has begun to enter the UK endoscopy mainstream, with the publication of JAG's framework for managing underperformance using self-efficacy theory and the attribution model.[30] However, poor quality trials of A&F in colonoscopy continue, using interventions without considering theoretical mechanisms or empirical data on potential determinants of behaviour, poorly describing interventions either narratively or using the behaviour change taxonomy, and having single centre pseudo-experimental designs.[229–231] Such studies are easy to undertake using routinely collected data, often with small numbers of participants, and often demonstrating modest yet heterogenous effectiveness even with an underlying publication bias; however, they add little to the understanding of A&F in colonoscopy.[86] Future trials in endoscopy considering the use of "*simple feedback*" [229][9] should consider this as a behaviour change intervention, and apply recommended practices in A&F trial design as laid out by Ivers et al.[62] As this work has demonstrated, these include focussing on clear descriptions of the A&F components, considering the nature of

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[9] The audacity of putting this in their title.

behaviour change required, using clear targets and action planning, and applying relevant theory to improve design and contribution to the literature.

5.4.1 Nesting in NED

This A&F work in colonoscopy was nested within the NED. This was a great asset in providing access to large volumes of structured real time clinical endoscopy data which allowed development of a credible BCI at a national scale.[29]

The NED has some significant limitations in its use for developing A&F BCIs. The structured endoscopy reporting system (ERS) data sent to the NED is designed as a tool for documentation of findings. This focusses on patient outcomes and not the endoscopist or team's behaviours. Endoscopist behaviours associated with detection such as turning the patient, time spent observing the proximal colon, intubation time and using *Endocuff* are not recorded in NED. FIT suggests this limits the effectiveness of BCIs targeting these behaviours, being unable to provide quantifiable attainment data.[69] Early feedback to the NED-APRIQOT research team suggests this may be the case, as one participant complained about advice on turning the patient:

> *"I do it a lot anyway, in fact almost always unless the patient has severely limited mobility. It may be good advice, but I feel you probably shouldn't be offering it when you don't measure, record or audit the baseline."*

Future work should consider how to record these behaviours associated with detection. Increasing the number of tick boxes on the ERS is unlikely to be effective. Digital recording of colonoscopy procedures is reported to be perceived positively by patients surveyed in Canada, but with reluctance from the medical community.[232] Colonoscopy practice is at the dawn of artificial intelligence (AI) systems providing assistance in polyp detection with increasing availability of colonoscopy video footage for AI training.[233,234] In the near future behaviours occurring in the colon may be documented through use of colonoscopy video and AI being used to detect and automatically record withdrawal times, intubation times, percentage of the mucosa observed etc. Current AI development should consider assessing both patient detection outcomes and behaviours associated with colonoscopy quality,[10] and their acceptability to endoscopists.

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[10] Until our robot overlords learn to scope independently, and we can just put this work in the bin.

5.4.2 Trial timing limitations

The analytical framework in Chapter 4 was developed in parallel with the analysis and finalisation of the trial BCI described in Chapter 3. However, due to trial related deadlines for the BCI development, full development of themes in Chapter 4 and the wider logic model for A&F in endoscopy were completed after the BCI was finalised. This was not ideal as there is clear potential for the logic model to have further informed development of the BCI and trial set up. Particularly, emerging themes regarding unit-lead behaviours and unit-lead support could have been used to more effectively design a unit-lead facing BCI (See 5.6.3 Unit-leads, page 235). This is a limitation of the work.5.5 Wider team considerations in future research

5.5.1 Endoscopy room team behaviours

Colonoscopy A&F processes were dependent on complex team behaviours as described in Chapter 4. The findings suggest these behaviours are dependent on the beliefs and behaviours of other 'stakeholders' not interviewed in this work, including patients and the endoscopy nursing team. Endoscopy nurses were crucial for providing prompts for endoscopists to support detection behaviours, ensuring patient safety to combat gaming, and providing feedback on non-technical skills. Participants described complex group norms, training, and empowerment governing their use. Although out with the scope and resources of this work, future research should explore these behaviours and associated beliefs with the endoscopy nurse team directly to better inform centre wide A&F processes.

Participants described the use of huddles and safety briefs to request prompts from the nursing team. Safety brief information tends to be recorded in safety checklists in patient notes, and are not within the remit of routine ERS data or the NED. Increasing use of patient safety checklists in endoscopy internationally is associated with a perception of improved team communication, but a recent systematic review found limited evidence for measurable impacts on endoscopic processes or safety outcomes.[235] A tick box of undertaking a huddle or brief provides little valuable information about the format or content of discussions. As described in Chapter 4 creating team psychological safety and an

environment for speaking up is partly under the control of centre leadership and the use of a commitment-based safety management approach.[190] Previous studies have demonstrated centre-wide improvements in polyp detection when endoscopy clinical leaders are targeted with management training and,[236] in a systematic review of team based effectiveness interventions, training interventions were most likely to be effective.[237] Future studies should consider the design and development BCIs targeted at safety management training for nurses and nursing leaders and the impact on team behaviours and patient outcomes.

5.5.2 Patients and A&F BCI

The normative ranking exercise highlighted that the patient perspective may be a more credible (and the management perspective a less credible) source for norms (Chapter 4). A metanalysis of social norms in healthcare A&F found interventions with social norms from a credible source were the most effective.[170] The use of patient injunctive norms may be considered in future research addressing reducing gaming behaviours and other paradoxical effects of BCIs. One A&F trial used patient demonstrative norms through patient participation to improve healthcare professional handwashing. This trial demonstrated that a more traditional A&F campaign plus encouraging patients to actively prompt healthcare professionals to undertake behaviours was more effective at improving handwashing than traditional A&F alone.[238]

Although implementing patient participation BCIs in colonoscopy A&F may be possible through providing information about prompting behaviours such as withdrawal time, such BCIs would pose significant challenges and may not be acceptable to patients. Unlike hand washing, the targeted behaviours are more complex in colonoscopy and increases the information burden given to patients before a test. Patients undergoing an invasive medical procedure often with sedation already experience significant anxiety and communication challenges, which such an approach would complicate.[184]

5.6 Research implications for endoscopist subgroups

5.6.1 Shared perceptions and themes

This is one of the few A&F studies in colonoscopy with broad mix of endoscopist professional backgrounds, in keeping with the diverse UK workforce.[87] Most themes were

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described by participants across all professional backgrounds. In Chapter 4, although participants described a preference for a social comparison to their own professional background, they also described identifying high performance of others from any professional group as motivating. The role of social identity and effectiveness of normative referent groups on outcomes varies according to the social context and the behaviour under scrutiny[165], but participants still identified practitioners with the highest KPIs as an aspirational target, independent of professional background. A metanalysis of social norm interventions showed that using a credible source, specifically the speech of a high-status professional in favour or against a behaviour, significantly changed behaviours (standardised mean difference 0.30, confidence interval 0.13-0.47, n=7).[170] This reflects the findings here that participants sought out colleagues with good detection, acting as local credible sources for descriptive norms. The BCI (Chapter 3) was therefore designed with a social comparison including all endoscopists; the impact of which should be assessed in the NED-APRIQOT process evaluation. It is unclear if the impact of descriptive norms will be maintained over a longer period when participants are provided with national non-identifiable data; such anonymity may erode the perception of proximity of this referent group. Future iterations of NED could ask endoscopists which groups of endoscopist they identify with, based on professional background or further accreditations, and research assessing the impact of providing optional aspirational performance targets for these sub-groups would be of value.

5.6.2 Nursing background endoscopists

Participants from nursing backgrounds described spending the most time interacting with the BCI (Chapter 3), undertook the largest number of lists a week and were described as having a more endoscopy focussed role, therefore, increasing the relative importance of endoscopy performance feedback (Chapter 4). Nursing background participants also rated patients' perceptions of performance as the most important. In the UK, non-medical endoscopists have been shown to have similar colonoscopy quality KPIs as their medical counterparts.[239]

It is unsurprising that nursing background participants undertaking high volumes of work for long periods predominantly described experiencing rare PCCRC critical incidents and an associated psychological knockback to performance and confidence (Chapter 4). There is

little literature on supporting nursing background endoscopists through such critical incidents. The delayed nature of a PCCRC, up to three years after the index procedure, poses a challenge to debriefing these events and may decrease the effectiveness of feedback within FIT.[69] For the endoscopist, particularly those undertaking high volume work, recollection of a case and behaviours at the time may be difficult, and for the unit-lead there are logistical challenges of endoscopists changing departments.

Previous systematic reviews, surveys and qualitative work has identified stress, anxiety and knockback to confidence after critical incidents; however, there is limited evidence on how to implement emotional and supervision support systems.[240–242] Critical incident stress debriefing, using a group debrief of those who have had a shared experience, is postulated to be helpful in debriefing after adverse patient safety events.[243] However, a systematic literature review by the World Health Organisation of healthcare workers who have recently experienced traumatic events did not recommended the use of psychological debriefing.[244] This review (which largely included low and very low quality evidence) suggested debriefing is unlikely to prevent post-traumatic stress disorder, depression or anxiety symptoms at 4 months post-intervention and some trials showed evidence of harms. Future studies should assess other psychological support options for endoscopists, particularly from a nursing background, experiencing anxiety or knockback to confidence from PCCRCs. Postulated strategies include formal identification of a trusted mentor to provide supervision and collegial emotional support versus the use of skilled external psychology professionals,[240] and the potential of mindfulness-based interventions which have some evidence for reducing stress and burnout within healthcare professionals.[245]

Participants from all backgrounds described detection fatigue from too many endoscopy lists a week (Chapter 4), however only nursing background endoscopists described intentionally limiting the number of endoscopy lists they agreed to perform due concerns of fatigue. Examiner fatigue has been described as limiting colonoscopy detection rates in endoscopist focus groups,[246] and fatigue has been used to explain polyp detection being lower in the afternoon than in the morning.[123]   There are clear guidelines on minimum numbers of procedures to maintain competence, however no recommended upper limit.[11] Participants in the current research suggest an upper limit of five lists per week,

however future research should assess the impact of the number of endoscopy lists performed in a week on detection, to guide a recommendation.

5.6.3 Unit-leads

Unit-leads described their interaction with the NED website for extracting performance information about their endoscopists (Chapter 4), and the challenges of reviewing and monitoring many endoscopists' KPIs. Future work should address the design of the NED website for unit leads to improve review of centre-level and endoscopist-level performance with input from unit-leads in the design.

The importance of unit-leads in managing underperforming endoscopists with face-to-face discussions, assessing understanding both KPIs and detection behaviours, and setting targets and action plans is described in Chapter 4. However, with the limited number of unit-leads enrolled into this study, these themes may not have reached saturation. Managing underperformance has been addressed in commentaries and guidance produced through the BSG and JAG.[22,30] Kaminski et al demonstrated leadership training of endoscopy leaders improved centre wide performance in Poland.[236] Further studies should consider identifying the training needs of UK unit-leads in relation to published guidance, develop a theoretically informed unit-lead training BCI to address these needs and assess the impact on patient outcomes in endoscopy. The process evaluation of the NED-APRIQOT assessing the effectiveness of the A&F BCI gives the opportunity to explore this first step, through interviewing unit-lead participants to explore their utilisation of A&F tools and management training needs. Endoscopy centres that did not see or had limited improvement in the NED-APRIQOT should be identified to explore the underperformance management processes not evaluated through NED.

5.6 Conclusion

This thesis has demonstrated the acceptability of detection KPIs computed within the NED, designed a theoretically informed A&F BCI for colonoscopy detection and developed this through FIT-based qualitative interviews, and explored the current A&F practice and its implications for implementation of an A&F BCI.

The described FIT-based programme theory for colonoscopy A&F allowed mapping of endoscopist behaviours, coping mechanisms to improve polyp detection and paradoxical

effects. Future colonoscopy A&F work should consider such a FIT model and targeting of these behaviours in the development and evaluation of their interventions for endoscopists. This work identified detection and patient safety was dependent on team behaviours, and unit-lead management of underperformance. Future work should apply and broaden the FIT model through developing and evaluating interventions targeted on behaviours of the wider endoscopy team and unit-leads.

Further recommendations for future research are summarised in Box 5.1. The NED-APRIQOT process evaluation following the conclusion of the trial will begin in December 2021.

List of abbreviations

A&F	Audit and feedback
ADR	Adenoma detection rate
AMR	Adenoma miss rate
APP	Adenomas per positive participant
BCI	Behaviour change intervention
BCSP	Bowel cancer screening programme
BCTT	Behaviour Change Techniques Taxonomy
BoSS	Bowel Scope Screening – part of NHS England BCSP
BSG	British Society of Gastroenterology
Buscopan	Hyoscine butylbromide trade name
CI	Confidence interval
CIR	Caecal intubation rate
CPFIT	Clinical Performance Feedback Intervention Theory
CRC	Colorectal cancer
CT	Computer tomography
ENTS	Endoscopic non-technical skills
EQIP	Endoscopy Quality Improvement Programme – a subgroup of the BSG
ERS	Endoscopy Reporting System
ESGE	European Society for Gastroenterology
EUG	Endoscopy user group meeting – a faculty meeting of endoscopists
FIT	Feedback intervention theory (note definitely not faecal immunochemical testing)
GRS	Global Rating Scale – endoscopy centre accreditation assessment tool
JAG	Joint Advisory Groups for gastrointestinal endoscopy

KPI   Key performance indicator

MAP   Mean adenomas per procedure

MHRA   Medicines and Healthcare Regulatory Authority

MNP   Mean number of polyps

MPR   Mean polypectomy rate

NED   National Endoscopy Database

NED-APRIQOT National Endoscopy Database Automated Performance Reports to Improve
               Quality Outcomes Trial

NHS   National Health Service

OPAD   Optimal procedure adjusted detection – case-mix adjusted KPIs

P   Participant

PCCRC   Post-colonoscopy colorectal cancer

PDR   Polyp detection rate

Pg.   Page

PPP   Polyps per positive participant

PPR   Proximal polypectomy rate

Prep   Bowel preparation – bowel cleansing begore colonoscopyS
    Subtheme

SSP   Specialist Screening Practitioner - nurses employed in the BCSP and trained in
               colonoscopy quality

TCT   Train the colonoscopy trainer – a colonoscopy course

TDF   Theoretical domains framework

TPB   Theory of planned behaviour

UK   United Kingdom

V   Version of behaviour change intervention

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Appendix A UK Endoscopy Current Practice, Recommendations and Mapping to A&F Modifiable Design Elements and ISFU framework

The below Table A1 shows Joint advisory group for gastrointestinal endoscopy (JAG), British Society of Gastroenterology (BSG) and Association of Coloproctology of Great Britain and Ireland (ACPGBI) working group audit and feedback (A&F) intervention recommendations, mapped to Colquhoun et al's A&F modifiable design elements.[11,22,23]

A&F design elements	Endoscopy working group A&F recommendations
1. Was feedback given to individual, group or both?	Recommendation to be given to individuals. No guidance on use of group feedback.
2. Was it given to the person in whom the practice change was desired?	Yes. JAG recommend to provide feedback to endoscopists.
3. Was there feedback about the processes of care ?	Yes. BSG and JAG recommend 6 monthly key performance indicators (KPI) feedback to include: • Caecal intubation rate (Standard 90%, aspirational target 95%) • Adenoma detection rate (ADR) in general population (Standard 15%, Aspirational target 20%) • Bowel preparation sufficient not to warrant repeat test (Standard 90%, aspirational target 95%) • Rectal retroversion rate (Target 90%) • Colonoscopy withdrawal time (Target mean ≥6mins, aspirational target mean ≥10mins) • Sedation level for <70, median total doses: ≤ 50mg Pethidine, ≤100mcg Fentanyl, ≤ 5mg Midazolam. • Sedation level for ≥70, median total doses: ≤ 25mg Pethidine, ≤50mcg Fentanyl, ≤ 2mg Midazolam. • Number of colonoscopies undertaken by endoscopist per year (Target 100, aspirational target 150). • Polyp retrieval rate >90% • Tattooing all lesions ≥20mm/cancers outside rectum and caecum (100% target)
4. Was there feedback about patient outcomes?	Yes. BSG recommend annual patient outcomes: • All post colonoscopy colorectal cancers (PCCRC) • Patient comfort level • Overall perforation rate (Target <1/1000, aspirational <1/3000) • Diagnostic perforation rate (Target <1/2000, aim <1/4000) *continued*

Table A1 Endoscopy working group recommendations A&F design elements

A&F design elements	Endoscopy working group A&F recommendations
4. Was there feedback about patient outcomes? *continued*	• Perforation rate where polypectomy performed (<1/500 target, aspirational target <1/1500) • Post polypectomy bleeding rate of intermediate severity or higher (target <1/200, aim <1/1000)
5. Was there feedback about something other than processes of care or patient outcomes?	No national guidance.
6. Was the feedback about individual provider performance?	Yes. JAG recommend to provide feedback to individual endoscopists.
7. Was the feedback about the performance of the provider group?	BSG recommends units should collect a group PCCRC and aim for <5% per year. No other guidance for group performance.
8. Was the feedback about individual patient cases?	No national guidance. PCCRCs have root cause analysis undertaken, and feedback may be provided to endoscopist as part of this process.
9. Was the feedback about an aggregate of patient cases?	Yes, feedback on aggregate cases over 6 months.
10. Did the feedback identify a specific behaviour(s) to be changed?	No national guidance, practice may vary. If persistent underperformance, then department leads to assess and set out a plan with the endoscopist.
11. What was the comparison provided in the feedback specified?	Comparison to JAG and BSG KPI targets, described above.
12. Were graphical elements included in the feedback?	No national guidance.
13. What was the lag between the time of audit and the delivery of the feedback?	3 years for PCCRC. 1 year for other patient outcome KPI. 6 months for process of care KPI.
14. What rationale was given for using A&F (specified)?	BSG: To standardise and formalise quality assurance in colonoscopy. To establish clear minimum standards for KPI and quality assurance in colonoscopy. To reduce most serious consequence of underperformance of potential harm to patients and wider negative impact on the quality of endoscopy units. JAG: to ensure that the service implements and monitors systems to ensure the clinical and technical quality of all procedures. Not otherwise specified. *continued*

Table A1 continued Endoscopy working group recommendations A&F design elements

A&F design elements	Endoscopy working group A&F recommendations
15. Was the feedback given face to face?	No national guidance for routine KPI feedback. JAG recommends for underperformance, a confidential meeting with the endoscopist to discuss feedback data, accuracy and underlying circumstances and causes. A plan should be made with a revaluation and reassessment planned.
16. Were providers explicitly asked to consider the implications the A&F had for their practice?	No national guidance.
17. What was the total number of times the feedback was given (specified)?	Twice per year, on an ongoing basis.

Table A1 continued Endoscopy working group recommendations A&F design elements

The below Table A2 shows a summary of all data fields included in the National Endoscopy Database version 1, as described on the Joint advisory group for gastrointestinal endoscopy (JAG) website. [247]

NED Content	Description of NED fields
Session (list) Type	Provides a unique identifier for the list within the ERS, the date and time the list was undertaken. If the list was as service, dedicated training or ad hoc training list. The hospital site code where the list took place.
Procedure Type	Provides a unique identifier for the procedure and the type of endoscopy procedure undertaken. The patient comfort score (not specified/comfortable/minimal/mild/moderate/severe), bowel preparation score (excellent, good, fair inadequate, not specified) and extent of examination. If a digital rectal examination was performed. The withdrawal time, and if magnetic endoscopic imager was used.
Patient type	Patient sex, age, admission type (outpatient/inpatient) and procedure urgency (routine/surveillance/urgent/emergency).
Drug Type	List of all medications and their doses given during the procedure.
Staff members type	For each endoscopist in the procedure: their professional registration number, their endoscopy role (trainer/trainee/independent), their procedure role (independent, assisted, observed), the extent of their examination in the colon (used to calculate caecal intubation rate), if they carried out rectal retroversion and a list of therapeutics they carried out.
Therapeutic Type	Identifies any therapeutics undertaken in the colon, including polypectomy, the type of therapeutics, the site, their polyps size (<10mm, 10-19mm, 20mm and larger), if the site was tattooed.
Indication Type	Lists any ticked indications and provides free text responses for "other" indications.
Limitations Type	Lists any ticked limitations to the extent of the procedure such as stricture, poor bowel preparation, colitis, unresolved loop etc. or other and a free text response.
Biopsy Type	Lists the location and number of any biopsies taken.
Diagnosis Type	Lists the ticked diagnoses for the procedure. Lists any tattooing performed and location in the bowel.
Adverse Events Type	Lists any recorded adverse events ticked at the time of procedure (perforation, bleeding, desaturation, requirement for reversal agent, admission etc.) and free text comments if provided.

Table A2 National Endoscopy Database version 1 data field types

Importance to measure and report: Extent the specific measure focus is evidence based, important to making significant gains in health care quality, and improving health outcomes for a specific high priority aspect of healthcare, where there is less than optimal performance.

- Evidence base
    - The relationship between the health outcome (finding polyps) and the process has a rationale.
    - The systematic assessment and grading of the evidence of this rationale.
- Performance gap – demonstration that there is a quality problem, and opportunity for improvement
- The health outcome is a high priority aspect of healthcare

Scientific acceptability of measure properties: Extent to which the measure produces reliable and valid results about the quality of care implemented. Must meet the criteria for both reliability and validity.

- Reliability – well defined measure and specified so that it can be implemented consistently and allows comparability.
- Validity – specifications are consistent with the evidence. Target populations and exclusions are supported by the evidence. Validity testing assess measure. Statistically significant and clinically significant difference identified by measure.
- Disparities – measure allows identification of disparities through stratification of results.

Feasibility: Availability of the specifications requires for the measure, and extent of burden to capture the measure.

- Clinical measures need to be routinely generated and used
- Data elements available in electronic sources
- Data collection strategy can be implemented

Usability: Extent to which potential users can use performance results for both accountability and performance improvement to achieve the goal. A rationale describes how the performance results could be used to further the goal of high quality, efficient healthcare for individuals or populations.

Box A1 The ISFU framework applied to polyp detection KPI[32]

Appendix B Mapping of Behaviour Change Intervention Version 1

B.1 BCTT mapping

Figure B.1 shows mapping of the BCI version 1 to the BCTT. Table B1 shows the BCTT elements and descriptions applied to the BCI.

B.2 Problem statement and action plan decision matrix

Table B2 shows the decision matrix for providing a social reward and social comparison statement. Below is the algorithm used to generate an action plan in BCI version 1, based initially on the participant's mean polypectomy rate (MPR).

MPR >100

1) Proximal detection rate

    a. <25% then:

        You may still be missing subtle right sided polyps, as your proximal polypectomy rate is x%, which is below the target of 25%.

        PLAN: This month ask your assistant to time your withdrawal in the ascending colon and the caecum, aiming to spend at least 2 minutes looking for subtle right sided polyps.

    b. ≥25% then

        Your proximal detection rate is also excellent.
        PLAN: Make sure that you are asking the patient to turn on withdrawal to maximise visualisation of the colon: patient on their left side to look at the right colon, on their back in the transverse, and on their right side to look at the left colon. Using your success in these areas, can you think how you can improve the number of polyps you detect?

MPR 80-90

1) Withdrawal time

a. Mean WT <7 minutes then:

Your mean withdrawal time is x minutes.

PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 8 minutes withdrawing.

b. Mean WT ≥7 then go to proximal detection rate

2) Proximal polypectomy rate

a. Proximal polypectomy rate <25% then:

You may still be missing subtle right sided polyps, as your proximal polypectomy rate is x%, which is below the target of 25%.

PLAN: This month ask your assistant to time your withdrawal in the ascending colon and the caecum, aiming to spend at least 2 minutes looking for subtle right sided polyps.

b. Proximal polypectomy rate ≥25% then go to Buscopan

3) Buscopan

a. Buscopan prescription <50% then:

You only prescribed Buscopan in x% of cases.

PLAN: Buscopan 10-20mg has been shown to allow better detection of polyps on withdrawal. Consider given Buscopan when you reach the ceacum. This month ask your assistant to remind you to retrovert in the rectum.

b. Buscopan prescription >50% go to Rectal retroflexion

4) Rectal retroflexion

a. Rectal retroversion <90% then:

You may still be missing rectal lesions, as your rectal retroversion rate is x%.

PLAN: This month ask your assistant to remind you to retrovert in the rectum.

b. Rectal retroversion ≥90% then:

This month you have a good average withdrawal time, buscopan prescription and rates of rectal retroversion, well done.

PLAN: Make sure that you are asking the patient to turn on withdrawal to maximise visualisation of the colon: patient on their left side to look at the right colon, on their back in the transverse, and on their right side to look at the left colon. Using your success in these areas, can you think how you can

improve the number of polyps you detect?

MPR <80

1) Withdrawal time

    a. Mean WT <7 minutes then:

    Your mean withdrawal time is x minutes.

    PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 8 minutes withdrawing.

    b. Mean WT ≥7 then go to Buscopan

2) Buscopan

    a. Buscopan prescription <50% then:

    You only prescribed Buscopan in x% of cases.

    PLAN: Buscopan 10-20mg has been shown to allow better detection of polyps on withdrawal. Consider given Buscopan when you reach the ceacum. This month ask your assistant to remind you to retrovert in the rectum.

    b. Buscopan prescription >50% go to Rectal retroflexion

3) Rectal retroflexion

    a. Rectal retroversion <90% then:

    You may still be missing rectal lesions, as your rectal retroversion rate is x%.

    PLAN: This month ask your assistant to remind you to retrovert in the rectum.

    b. Rectal retroversion ≥90% then go to Proximal polypectomy rate

4) Proximal polypectomy rate

    a. Proximal polypectomy rate <25% then:

    You may still be missing subtle right sided polyps, as your proximal polypectomy rate is x%, which is below the target of 25%.

    PLAN: This month ask your assistant to time your withdrawal in the ascending colon and the caecum, aiming to spend at least 2 minutes looking for subtle right sided polyps.

    b. Proximal polypectomy rate ≥25% then

    This month you have a good average withdrawal time, buscopan prescription and rates of rectal retroversion, well done.

PLAN: Make sure that you are asking the patient to turn on withdrawal to maximise visualisation of the colon: patient on their left side to look at the right colon, on their back in the transverse, and on their right side to look at the left colon. Using your success in these areas, can you think how you can improve the number of polyps you detect?

Feedback intervention theory

Behaviour change technique taxonomy

NED | APRIQOT

Dear Jamie,

Here is your colonoscopy data for this month, as part of the NED APRIQOT study.

85

On average you removed 85 polyps per 100 procedures, this is based on 15 independent colonoscopies you have performed this month, adjusted for your case mix.

We recommend:
Minimum target 80 polyps per 100 procedure,
Ideal target 100 polyp per 100 procedures.
Based on a review of 100 000 procedures.

Proximal polypectomy rate	20%	Aim >25%
Mean withdrawal time	8 minutes	Aim >7 minutes
Buscopan Prescription	15%	Aim >50%
Rectal Retroversion	90%	Aim >90%

You have reached the minimum target, which is good, but 20% of colonoscopists found more polyps than you this month.

Results in orange and red suggest areas which could be improved. You may still be missing subtle right sided polyps, as your proximal polypectomy rate is 20%, which is below the target of 25%.

Talking to a colleague about your feedback can help you digest and act on it. How do you think you could improve your polyp detection?

This month ask your assistant to time your withdrawal in the ascending colon and the caecum, aiming to spend at least 2 minutes looking for subtle right sided polyps.

Your average number of polyps removed has stayed stable since last month.

Mean Polypectomy Rate per 100 colonoscopies
August 2019 - December 2019

Series1	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
	80	70	90	83	85

This data is adjusted for your patient's age, gender and indication for the test, and is based on the 24 NED recorded colonoscopies you performed this month without a trainee.
For more detailed performance information and ways to improve, click here.

Happy scoping,

The NED APRIQOT team.

Endorsed by the Joint Advisory Group for GI endoscopy and the National Endoscopy Database

Any complaint or concern about any aspect of the way you have been dealt with during the study will be addressed; please contact your local research nurses in the first instance. Alternatively you can contact ***, about any Project Management issues at *** @rcplondon.ac.uk or for clinical questions Dr Jamie Catlow, Endoscopy Research Fellow at ***@newcastle.ac.uk.

Feedback intervention theory labels (left):
- Standard Identification and comparison to standard
- Adopt strategy to eliminate gap
- Comparison to standard: Velocity

Behaviour change technique taxonomy labels (right):
- 1.6 Discrepancy between current behaviour and goal.
- 7.2 Green cue signalling reward. Red, amber, green colour coding throughout.
- 2.7 Feedback on outcomes of behaviour.
- 1.1 Goal setting behaviour.
- 1.2 Problem solving. 2.7 Feedback on outcomes of behavior 1.3 Goal setting outcome
- 10.4 Social reward statement 6.2 Social comparaison.
- 1.2 Problem solving.
- 1.5 Review behaviour goal encouraged. 3.1 Social support (unspecified)
- 7.1 Prompts 1.3 Goal setting outcome 1.4 Action plan
- 2.4 Self-monitoring of outcomes of behaviour
- 9.1 Credible source

Figure B1 Behaviour Change Intervention Version 1 (BCI V1) mapped to Feedback Intervention Theory and the Behaviour Change Technique Taxonomy.

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BCT element	Description	BCI element
1. Goals and Planning		
1.1 Goal setting behaviours	Set goal defined in terms of the behaviour.	Goal: removing a number of polyps per 100 procedures, average above a "minimum" or "ideal" target. Targets based on multi-variate analysis in NED APRIQOT (unpublished) and paper demonstration association of mean polypectomy rate to risk of post colonoscopy colorectal cancer.[115]
1.2 Problem solving	Prompts endoscopist to analyse factors influencing behaviour and generate a strategy with increasing facilitators.	Providing a breakdown of process outcomes for behaviours which influence polyp detection. These are: • Proximal detection rate – and the behaviour of spending time inspecting the proximal colon • Withdrawal time – and the behaviour of timing withdrawal • 'Buscopan' prescription – and the behaviour of prescribing hyoscine butylbromide. • Rectal retroflexion – and the behaviour or retroflexing the scope in the rectum. The report highlights one process outcome, with a plan prompting use of an assistant to aid the behaviour change.
1.3 Goal setting outcome	Set a goal defined as a positive outcome.	Process outcome targets are stated with one goal used in a plan, either: • Proximal detection rate – "Aim >20%" • Withdrawal time - "Aim >7 minutes" • Buscopan prescription – "Aim >50%" • Rectal retroflexion – "Aim >90%"
1.4 Action planning	Prompt detailed planning of performance behaviour including context, frequency, duration, or intensity.	Each plan focusses on: • A specific process outcome behaviour which is below target, or "turning the patient" an unmeasured behaviour associated with increased detection. • Using a staff prompt to remind this behaviour. • A duration of "this month", suggesting reviewing the outcome next month.
1.6 Discrepancy between current behaviour and goal	Draw attention to discrepancies between current and the persons set outcome goals.	Discrepancy between current behaviour and outcome goals is highlighted using a red, amber and green colour code for process outcomes.

Table B1: Mapping BCI-1 to Behaviour Change Technique Taxonomy (v1)[1]

2. Feedback and monitoring		
2.4 Self-monitoring of outcome(s) of behaviour	Establish a method for the person to monitor and record the outcome(s) of their behaviour(s) as part of the behaviour change strategy.	Endoscopists able to review the recorded outcome mean polypectomy rate over the last 5 months, plotted in a graph.
2.7 Feedback on outcomes of behaviour	Monitor and provide feedback on the outcome of performance of the behaviour.	Headline mean polypectomy rate and process outcomes provided monthly, and trend over five-months of mean polypectomy rate.
3. Social support		
3.1 Social support unspecified	Advise on, arrange, or provide social support for performance of the behaviour, including encouragement and counselling.	BCI prompts reflection and recommends: "Talking to a colleague about your feedback can help you digest and act on it."
6. Comparison of behaviour		
6.2 Social comparison	Draw attention to others' performance to allow comparison with the person's own performance.	Mean polypectomy rate (outcome) is compared to other endoscopists nationally in a statement. "X% of colonoscopists found more polyps than you this month".
7. Associations		
7.1 Prompts/Cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour.	In the action plan endoscopists are asked to ask an assistant to: - Time withdrawal - Prompt rectal retroversion - Prompt giving 'buscopan' at the caecum.
7.2 Cue signalling reward	Identify an environmental stimulus that reliably predicts that reward will follow behaviour.	The colour green is used as a reward stimulus for achieving targets.
9. Comparison of outcomes		
9.1 Credible source	Present communication from a credible source.	The BCI is endorsed by the Joint Advisory Group for GI endoscopy (JAG), a credible organisation.
10. Reward and threat		
10.4 Social reward	Non-verbal reward if there has been effort or progress in performing the behaviour, includes positive reinforcement.	Rewarding statement for achieving minimum target "which is good", and ideal target "keep up the excellent work".

Table B1 continued Mapping BCI-1 to Behaviour Change Technique Taxonomy (v1)[1]

Mean polypectomy rate	Trend	Social reward statement	Social comparison statement
>100	NA	"Keep up the excellent work, …"	"… x % of colonoscopists found more polyps than you this month."
80 – 100	NA	"You have reached the minimum target, which is good, but …"	
<80	Increasing	"Your polyp removal rate is improving, although this is below the minimum target, …"	"… x% of colonoscopists who perform a similar number of procedures found more polyps than you this month."
	Stable or falling	"Your polyp removal rate is below the national target, …"	

Table B2 BCI V1 social reward and social comparison decision matrix

Appendix C Mapping of Behaviour Change Intervention Version 5

C.1 Mapping changes to FIT and BCTT

Figure C1 shows the elements of the BCI developed through interviews mapped to FIT. Table C1 shows the BCTT elements and descriptions applied to the BCI.

Figure C1 Changes to Behaviour Change Intervention Version 5 (BCI V5) mapped to Feedback Intervention Theory.

Mean number of polyps (MNP) over the last 4 months

| Overall adjusted MNP per 100 procedures since Sep 2020 | **69** | This is within the expected range of 49-119 MNP. | Information |

Your mean number of polyps detected has stayed stable

| 0 | 49 | 69 | 119 | 425 |

Bottom 25%   Within expected range   Top 25%

MNP (adjusted) Sep 2020 to Dec 2020

	Sep 2020	Oct 2020	Nov 2020	Dec 2020
MNP (Adjusted)	88	26	59	90
No. Procedures	18	14	33	19
You detected this many polyps	31	5	28	29
We expected you to find this many polyps in 100 procedures	134	95	98	116

To see how you compare to others in your trust click here.

How do you feel about your data?

We have not included procedures performed with another endoscopist or trainee or when the test was not completed to the caecum. This data is adjusted for your patient age, sex and indication for the test, see how we adjusted for your case mix here.

If you don't think your data is accurate check out our NED data entry tips here.

Any complaint or concern about any aspect of the way you have been dealt with during the study will be addressed; please contact your local research nurses in the first instance. Alternatively you can contact Dr Jamie Catlow, Endoscopy Research Fellow at j.catlow1@newcastle.ac.uk.

Identifying a performance gap
- Attention given to trend over 4-months, used to focus on dips in performance and monitor outcomes.

Standard identification:
- Clear information and contacts provided if data not credible.

Figure C.1 continued: Changes to Behaviour Change Intervention Version 5 (BCI V5) mapped to Feedback Intervention Theory.

BCTT element	Description	Evidence in BCI V5
1. Goals and Planning		
1.1 Goal setting behaviours	Set goal defined in terms of the behaviour.	Goal: detection "within expected range" or "top 25%" of performance. The BCI uses a national comparison to Mean Number of Polyps (MNP) with target aim of being within the expected range of the middle 50%, and target aim of the top 25%.
1.2 Problem solving	Prompts endoscopist to analyse factors influencing behaviour and generate a strategy with increasing facilitators.	Providing a breakdown of process outcomes for behaviours which influence polyp detection. These are: • Proximal detection rate – and the behaviour of spending time inspecting the proximal colon • Withdrawal time – and the behaviour of timing withdrawal • 'Buscopan' prescription – and the behaviour of prescribing hyoscine butylbromide. • Rectal retroflexion – and the behaviour or retroflexing the scope in the rectum. The report highlights one process outcome, with a plan prompting use of an assistant to aid the behaviour change.

Table C1 Explanation of BCI V5 mapped to BCTT [64]

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BCTT element	Description	Evidence in BCI V5
1. Goals and Planning		
1.3 Goal setting outcome	Set a goal defined as a positive outcome.	Secondary process outcome goal stated with one plan, either: • Proximal detection rate – "Aim >20%" • Withdrawal time - "Aim >10 minutes" • Buscopan prescription – "Aim >50%" • Rectal retroflexion – "Aim >90%"
1.4 Action planning	Prompt detailed planning of performance behaviour including context, frequency, duration, or intensity.	Each plan focusses on: • A specific process outcome behaviour which is below target, or "turning the patient" an unmeasured behaviour associated with increased detection. • Using a staff prompt to remind this behaviour. • A duration of "this month", suggesting reviewing the outcome next month.
1.6 Discrepancy between current behaviour and goal	Draw attention to discrepancies between current behaviour (form, frequency, duration or intensity of behaviour) and the persons set outcome goals.	Discrepancy between current behaviour and process outcome goals is highlighted using red, blue green colour code for process outcomes.
2. Feedback and monitoring		
2.3 Self-monitoring of behaviour	Establish a method for the person to monitor and record their behaviour(s) as part of the behaviour change strategy.	Endoscopists highlighted to log into and access their personalised NED APRIQOT website where they can review the recorded above process outcome measures over the last four months.
2.4 Self-monitoring of outcome(s) of behaviour	Establish a method for the person to monitor and record the outcome(s) of their behaviour(s) as part of the behaviour change strategy.	Endoscopists able to review MNP and process outcomes over 4 months, plotted in a graph. Endoscopists can engage in click links to review trends for process outcomes on the NED APRIQOT site.
2.7 Feedback on outcomes of behaviour	Monitor and provide feedback on the outcome of performance of the behaviour.	Headline mean number of polyps (MNP) detected and process outcomes for each month, with trend for MNP over 4 -months plotted.
3. Social support		
3.1 Social support unspecified	Advise on, arrange or provide social support for performance of the behaviour, including encouragement and counselling.	BCI prompts reflection and recommends: "Talking to a colleague about your feedback can help you digest and act on it. Your endoscopy NED-APRIQOT unit lead is …" and provides the name and contact of the unit endoscopy lead.

Table C1 continued: Explanation of BCI V5 mapped to BCTT [64]
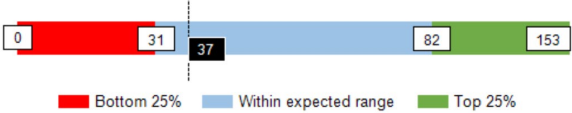
BCTT element	Description	Evidence in BCI V5
4. Shaping knowledge		
4.1. Instruction on how to perform a behaviour	Advise on how to perform the behaviour.	Information links are provided with each process outcome which describes how to undertake the behaviour. A monthly tip is procedures which explores how to perform process outcome behaviours, and the evidence base behind them.
5. Natural consequences		
5.4 Monitoring of emotional consequences	Prompt assessment of feelings after attempts at performing the behaviour.	Endoscopists asked "What do you think about your results? Do you think you can improve them? Talking to a colleague about your feedback can help you digest and act on it." "How do you feel about your data?" With prompt to discuss with the endoscopy unit lead.
6. Comparison of behaviour		
6.2 Social comparison	Draw attention to others' performance to allow comparison with the person's own performance.	MNP (outcome) is plotted compared to all other endoscopists nationally, and participants are show if they are in the bottom 25%, middle 50% or top 25% for each month and four-month detection. This is provided with a graphic:
7. Associations		
7.1 Prompts/ Cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the bahaviour.	In the action plan endoscopists are asked to ask an assistant to: - Time withdrawal - Prompt rectal retroversion - Prompt giving buscopan at the caecum.
7.2 Cue signalling reward	Identify an environmental stimulus that reliably predicts that reward will follow behaviour.	The colour green is used as a reward stimulus for achieving targets.
9. Comparison of outcomes		
9.1 Credible source	Present communication from a credible source.	The BCI is endorsed by the Joint Advisory Group for GI endoscopy (JAG), a credible organisation.
10. Reward and threat		
10.4 Social reward	Non-verbal reward if there has been effort or progress in performing the behaviour, includes positive reinforcement.	Rewarding statement for achieving minimum target "which is good", and ideal target "keep up the excellent work".

Table C1 continued: Explanation of BCI V5 mapped to BCTT [64]

C.2 Problem statement and action plan decision matrix for BCI version 5

Table C.2 shows the social reward statement, these are colour coded by social comparison of case-mix adjusted MNP, classified as:

- Green: MNP performance above the 75th percentile, above average performance.
- Blue: MNP performance between the 25th to 75th percentile, expected performance.
- Red: MNP performance below the 25th percentile, below average performance.
- Grey: Performed <5 colonoscopies that month

MNP	Trend	Social reward statement
Green	NA	You found more polyps than our model expected for your case mix, excellent news. You are in the top 25% of colonoscopists for polyp detection this month.
Blue	NA	You detected about as many polyps as our model expected for your case mix, which is not bad.
Red	Increasing >5%	This month your MNP is improving but you detected fewer polyps than our model expected for your case mix.
	Stable or falling	This month you detected fewer polyps than our model expected for your case mix.
Grey	NA	How can you increase the number of colonoscopies you perform next month?

Table C2 BCI V5 social reward and social comparison decision matrix

Below are the colour coded problem statements and action plan algorithm, used in BCI version 5.

MNP Green

2) Proximal polypectomy rate

    a. <20% then:

    You may still be missing subtle right sided polyps, as your proximal polypectomy rate is <20%. A polypectomy rate <25% is associated with higher risk of proximal post colonoscopy colorectal cancer (information).

    PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 5 minutes looking for subtle right sided polyps.

    b. ≥20% go to WT

3) Withdrawal Time

    a. Mean WT <7 minutes then:

    Your mean withdrawal time is X minutes. A withdrawal time of under 10 minutes is associated with a lower detection of adenomas (information).

> **PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 10 minutes withdrawing.**

    b. WT ≥7min, go to buscopan

4) Buscopan

    a. Buscopan prescription <50% then:

    You prescribed hyoscine butylbromide (Buscopan) in x% of cases. There is some evidence Buscopan 10-20mg is associated with better detection of polyps on withdrawal (information).

> **PLAN: This month consider giving buscopan when you reach the caecum, if not contraindicated.**

    b. Buscopan prescription ≥50%, go to retroflexion

5) Rectal retroflexion

    a. Rectal retroversion <90% then:

    You may still be missing rectal lesions, as your rectal retroversion rate is under 90%. However, close forward view inspection is still essential (information).

> **PLAN: This month ask an assistant to remind you to retrovert in the rectum, if not contraindicated.**

    b. Retroversion >90%, go to turning the patient.

6) Withdrawal Time

    a. Mean WT <10 minutes then:

    Your mean withdrawal time is x minutes. A withdrawal time of under 10 minutes is associated with a lower detection of adenomas (information).

> **PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 10 minutes withdrawing.**

    b. WT ≥10min, go to turning the patient

7) Turning the patient: This month you have excellent withdrawal times and Buscopan prescription, well done. Turning your patients on withdrawal can improve polyp detection (information).

> **PLAN: This month ask the patient to turn on withdrawal to maximise visualisation of the colon: patient on their left side in the right colon, on their back in the transverse, and on their right side in the left colon.**

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MNP Blue, Red or Gray

1) Withdrawal Time

   a. Mean WT <7 minutes then:

   Your mean withdrawal time is X minutes. A withdrawal time of under 10 minutes is associated with a lower detection of adenomas (information).

   PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 10 minutes withdrawing.

   b. WT ≥7min, go to Proximal detection rate

2) Proximal polypectomy rate

   a. <20% then:

   You may still be missing subtle right sided polyps, as your proximal polypectomy rate is <20%. A polypectomy rate <25% is associated with higher risk of proximal post colonoscopy colorectal cancer (information).

   PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 5 minutes looking for subtle right sided polyps.

   b. Proximal polypectomy rate ≥20% go to Buscopan

3) Buscopan

   a. Buscopan prescription <50% then:

   You prescribed hyoscine butylbromide (Buscopan) in x% of cases. There is some evidence Buscopan 10-20mg is associated with better detection of polyps on withdrawal (information).

   PLAN: This month consider giving buscopan when you reach the caecum, if not contraindicated.

   b. Buscopan prescription ≥50%, go to Rectal retroflexion

4) Rectal retroflexion

   a. Rectal retroversion <90% then:

   You may still be missing rectal lesions, as your rectal retroversion rate is under 90%. However, close forward view inspection is still essential (information).

   PLAN: This month ask an assistant to remind you to retrovert in the rectum, if not contraindicated.

   b. Rectal retroflexion >90%, go to turning the patient.

5) Withdrawal Time

    a. Mean WT <10 minutes then:

    Your mean withdrawal time is x minutes. A withdrawal time of under 10 minutes is associated with a lower detection of adenomas ([information](#)).

    PLAN: This month ask an assistant to time your withdrawal, aiming to spend at least 10 minutes withdrawing.

    b. WT ≥10min, go to turning the patient

6) Turning the patient: This month you have excellent withdrawal times and Buscopan prescription, well done. Turning your patients on withdrawal can improve polyp detection ([information](#)).

    PLAN: This month ask the patient to turn on withdrawal to maximise visualisation of the colon: patient on their left side in the right colon, on their back in the transverse, and on their right side in the left colon.

Appendix D: Ethnographic Observation Summaries and Site Maps

The below figures show annotated site maps with field notes for sites 1-5.

Figure D1 Ethnographic maps and notes for endoscopy sites

Site 3a Map and notes

Key
- Door
- S Endoscopy stack
- M Monitor
- N Nurse/assistant
- E Endoscopist
- 1 Endoscopy room number

Corridor to decontamination

DRUGS

Endoscopy Room
3 rooms
Felt cramped – low ceilings
Paucity of storage

Meds
Drugs pre-drawn up at request

Endoscopy Room
Equipment
3 Olympus 260 scopes
3 Scope guides
3 irrigators available
Clock on monitor, endoscopist timed, nurse timing on request

STORE
DESK

List timing
12 points AM
10 points PM
No emergency patients

To corridor to reception and waiting room

Stores and dirty utility

Offices

Nurses station/kitchen

Changing and consent rooms

Male recovery

Female recovery

Staff notes
2 nurses (band-5) in the room
1 nurse: flushes/biopsy/snare + watches screen
1 nurse: patient head end

Nurse staffing
Nurse staffing levels good. Staff changeover medium, lost management nurses recently , challenge
No break room – hang at nurses station

Communication
Nurse huddle 08.30am (staffing) – perceived rushed
Room huddle (introductions & assess lists)
Endoscopist/Nurses consents
WHO checklist before each patient

Site 4 Map and notes

Key
- Door
- S Endoscopy stack
- M Monitor
- N Nurse/assistant
- E Endoscopist
- 1 Endoscopy room number

Nurse office

Office clerical staff

Recovery area

To corridor to reception and waiting room

Consent areas

Endoscopy room
2 large rooms
Equipment
2 Olympus 290 scopes
2 Scope guides
1 irrigator available
Clock on monitor, endoscopist timed
Meds
Drugs pre-drawn up at request

DESK
BED
DRUGS
STORE

List timing
12 points AM
12 points PM
Regular emergency patients additional
Endoscopist consents

Staff notes
2 nurses (band-5) in the room, occasionally Band-5 + Band-3.
1 nurse: flushes/biopsy/snare + watches screen
1 nurse: patient head end

Communication
Nursing huddle 8am (assess lists, staffing)
WHO checklist before each patient

Nurse staffing
Nurse staffing levels good
Staff changeover low, ageing staff – more part time becoming challenge
No break room

To decontamination

Site 5 Map and notes

Key
- Door
- S Endoscopy stack
- M Monitor
- N Nurse/assistant
- E Endoscopist
- 1 Endoscopy room number

To open plan nurses station

Recovery areas opposite

Break room/kitchen

Staff toilet areas

Staff notes
2 nurses (band-5) in the room.
1 nurse: flushes/biopsy/snare + watches screen
1 nurse: patient head end + watches screen

Communication
Nursing huddle 8am (staffing)
Room huddle start of list (assess list needs)
WHO checklist before each patient
Room debrief if significant event

Nurse staffing
Nurse staffing levels variable – occasional cancelled list due to staffing
Staff changeover medium – training requirements of junior nurses
Break room.

Corridor, consent rooms opposite

Endoscopy room
2 large endoscopy rooms

Equipment
2 Olympus 260 stacks
2 Scope guides
2 irrigators
Clock on monitor, nurse timing on request
Meds
Drugs pre-drawn up at request

DESK
DRUGS
BED
STORE

List timing
12 points AM
10 points PM
Rare emergency patients
Nurses consent

To reception and waiting area

Figure D1 continued Ethnographic maps and notes for endoscopy sites

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Appendix E Illustrative Quotations During the Development of the BCI

E.1 Standard identification Illustrative quotations.

Subtheme	FIT & TPB	Illustrative quote
MNP Standard identification subthemes		
Detection important	MNP standard identification, behaviour belief	*"That is what's important because if you find more polyps, it normally means that you're doing good quality colonoscopy… I mean you've focused on [detection]. I think it's a good focus because I think it's what colonoscopy is about."* (P1, V1)
		"I'm intrigued to know about polyps because I think ultimately, to me, that's the most important one." (P17, V5)
		"I guess we probably should select number of polyps, I think that's probably the strongest indicator, isn't it, of adenoma detection rates. Obviously, we all know that individuals that are not seeing the polyps are those with the highest colorectal cancer interval rates and I guess that's what we want to reduce." (P6, V2)
MNP acceptable – broad inclusion	MNP standard identification, behaviour belief	*"There is a bigger outlook on what polyps are, the dangerous polyps. So yes, it's probably the way that we should be going [to mean number of polyps], rather than the way that we are with adenoma detection."* (P16, V4)
		"I think what's important to consider is it's polyp detection rates, it's not polypectomy rates, so it's your actual detection rate." (P8, V2)
MNP acceptable – nonbinary	MNP standard identification, behaviour belief	*"So I think that [MNP] is more useful because that [PDR] doesn't give you any idea of how many polyps you found each time and how many polyps you're finding, it's just binary, isn't it, yes or no, did you find a polyp. Whereas this [MNP] gives you an idea a bit better on how many you're finding all the time so you say, "Well yes, I might have had two or three procedures with none but on the person that had one I found all ten that they had." That's more useful."* (P3, V1)
		"And in terms of the KPI, so mean numbers personally, I think the key feature is that it's a measure of total number of polyps detected instead of one or more. It's a massive thing and I hope that that isn't lost on the majority of people that get this. And I'll be certainly reinforcing that within the unit and love all the adjustment." (P9, V3)
		"You can't have the 'one and done' rule here [with MNP]. You have got to find the polyps that are there but it's trying to make sure you are doing that high-quality inspection in every procedure." (P15, V4)

Table E1 Standard identification subthemes

Subtheme	FIT & TPB	Illustrative quote
MNP Standard identification subthemes *continued*		
MNP skew	MNP standard identification, control belief	*"I guess it's about whether you take off... so I don't think I would take off, if there was 80 polyps and 25 of them were adenomas, I'm not taking off 55 ... that are hyperplastic. I guess there is a bit about whether you're any good at actually detecting adenomas and assessing them."* (P3, V1)
		"I've had a few cases recently, where I've done eight or nine polypectomies in the one case that have been planned, so that might be artificially high because of that." (P4, V1)
		"So, I think it's skewed by the people, so people that do polyps, a lot of polyps, because there are people that basically have polyps on every single list that they do, and that's what they do. They do polyps so I think it will be skewed to a certain extent. Even if you're limiting it by the number of five which you said, I still think it gets skewed. … [after reading explanation of adjustment by case-mix] I think the rationale you've just described sounds okay. So I would accept that…" (P17, V5)
MNP and case-mix	MNP standard identification, control belief	*"So, a lot of experienced colonoscopists will have a lot more planned therapeutic procedures, thereby will have better polypectomy rates. So I don't know if that needs to be more, just for diagnostic procedures."* (P4, V1)
		"Well for me, it may be slightly skewed data because I do a lot of bowel cancer screening procedures anyway and I do a lot of therapy." (P6, V2)
		"Oh, my polyps are good then. That's because of the case-mix that I'm doing" (P7, V2)
MNP adjusted	MNP standard identification, behaviour belief	*"[Adjustment explained] I think, yes, because I think there does need to be a sense of adjusting for case-mix. I think otherwise you'd have the same people having the highest ADRs because there'd be people doing bowel cancer screening"* (P6, V2)
		"You said the procedures have adjusted for the population that we're scoping anyway. So automatically, I always think, "Well, it's different in bowel cancer screening to symptomatic." But if it's adjusted then it should be a level playing field, shouldn't it?" (P14, V4)

Table E1 continued Standard identification subthemes

Subtheme	FIT & TPB	Illustrative quote
MNP Standard identification subthemes *continued*		
MNP adjusted *continued*	MNP standard identification, behaviour belief	*"[Quietly reading aloud case-mix adjustments] So, this is how you do it, you mean, how you calculate it?... I never thought about that you can calculate or you should calculate your polyps according to your risk, but I guess it's important. So, if someone does only … 20-year-olds and IBD population, then they're probably, the polyps detection will be different [to] a bowel screener, and I think that's always been an argument of people, saying you do bowel screening or you do dedicated lists and that's why your detection is higher. So, I think it's actually very important. I didn't know that you could do- didn't know you can apply that. So, it sounds fair to do it that way. I'm sure there is research behind it, people clearly know the high-risk people. So, I think it's fair when you divide it that way."* (P18, V5)
MNP comprehension subthemes		
V1 and V2 comprehension	MNP standard identification, control belief	*"I guess it would be one of those things that you'd have to know where it was coming from and how it was coming and what the context is. … I think maybe just a little caveat that says this is calculated on the total number of polyps per procedures rather than as opposed to your adenoma detection rate. (Interviewer (I): So some clarification in the definitions of the MNP?) P3: Yes"* (P3, V1)
		"Number of polyps, 175 per 100, okay, so this is … I don't do 100 procedures, this is over a period of time, is it? Okay, I'm not sure about that [pause]... (I: What do you understand by that figure and how we got to it?) On average you detected 175, so you're extrapolating how many procedures I've done and how many polyps I would have detected had I done 100 procedures, is that what you're doing? (I: Yes.)" (P8, V2)
		"Well, your target of 80 polyps per 100 procedure it does seem to be rather high. Also, polyps per procedure, this is a standard of which I'm not aware actually because the standard that I'm aware of is the Adenoma Detection Rate, which is the number of polyps, the number of patients with polyps as opposed to the number of total polyps per procedure. So, there isn't a … It's not a distinction here about whether you're talking about a total number of polyps or whether you are talking about the number of polyps per case if you see what I mean." (P5, V2)

Table E1 continued Standard identification subthemes

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Subtheme	FIT & TPB	Illustrative quote
MNP comprehension subthemes *continued*		
V3 and V4 comprehension	MNP standard identification, control belief	*"(I: Okay. The MNP itself, that 106 figure over the four months – does that, kind of, make sense?) Without looking at the maths at this point in time and truly understanding it, no. But I can infer, as I said, that I think okay fine"* (P11, V3)
		"And the last four months… MNP? Oh, mean number of polyps. Okay. So that's, then, looking at, you're not just taking one off and, yeah, yeah." (P14, V4)
		"What else? Data; I am not used to looking at the mean number of polyps and it's only one…it's not giving an awful lot of extra data either so I guess it would take me time over probably a good few months just to get used to the MNP more than anything". (P15, V4)
		"Okay. What's MNP? [PDF explanation failed to load due to picture error … Sighs]. I don't know if I like the mean number of polyps as a data set because I am not really used to using it in terms of we don't get out data sent like that. It's more polyp detection. … When I opened it up and that was the first thing it started with I didn't really know what it meant in terms of I didn't know, 'What's a good MNP?' I don't know. Maybe having… (I: An introductory document?) Yes. It might be just a sentence to explain how it compares maybe and that might be helpful." (P13, V4)
Case-mix breakdown	MNP standard identification, control belief	*"Yes, that's okay. I know where it has come from although how do they work that out? That's clever. ….The adjusted stuff and predicted. I would quite like to be able to find out how that was calculated or predicted, yes, just out of curiosity really. … providing that I could work out that it seemed sensible from the way it had been calculated and what it meant then I would then just be happy to accept that as a data variable or whatever you call it."* (P13, V4)
		"I think maybe a general table of, you know, if you have got…I don't think people need to be able to work it out themselves. It would be more, 'You scoped 100% women so we would expect it to be lower or higher' so maybe just that sort of statement would be quite helpful because thinking back to how I would look at if my performance changed the things I would look at would be were there difficult colonoscopies? Were there obstructing …? What were the features of the patients that might have impacted onto it? Were they an IBD patient? I think that would be quite helpful because it would do it for you." (P15, V3)

Table E1 continued Standard identification subthemes

Subtheme	FIT & TPB	Illustrative quote
MNP comprehension subthemes *continued*		
V5 comprehension	MNP standard identification, control belief	*"That's not bad, so why is it green then? So, out of 100 procedures, some people detect 104 polyps? … So, this is polyps per procedure, this is total polyps. … So, you could find more. If you had a colonoscopy with 20 polyps, then that would obviously push it up. … It obviously makes you think you need to detect more… I think the rationale you've just described sounds okay. So I would accept that".* (P17, V4)
		"So, I think it's very easy to read, this part and it's quite easy to understand where you belong. So, that's what you get first. Yeah, it's very easy to understand and read. That's what I like about it. Obviously, I can see that I was doing alright for January, I've done well. I got a lot of polyps, with 179, then back down to the plan and I can see this is okay." (P18, V4)
		"(I: [About MNP and the report] How much effort do you think it took to look at the report and comprehend it?) For me? (I: Yes.) I'm able to do it and I have a very short attention span." (P19, V5)
Headline credibility and low numbers		
Credible	MNP standard identification, behavioural belief	*"I mean the withdrawal time looks about right for me, I pretty much always do retroversion in the rectum. The Buscopan, yes …. So if they're extrapolating from ten procedures, it could be correct, yes. I don't look at it and think that's completely alien for me."* (P4, V1)
		"[Asked about credibility] I've just taken your word for all this data here, I mean, this does feel about right. So, yes." (P6, V2)
		"Right, okay. That [the data] makes sense to me. That's exactly what I would expect." (P10, V3)
		"I think it's [local endoscopy reporting systems have] been as good a tool as we can get up to now, but I'm looking forward to NED [the BCI] taking over that and being more accurate and giving better feedback". (P14, V4)
		"[Asked about credibility] I wouldn't argue with it. I think, the important is you put, you make sure the data … if this is coming from the, what do we call it here? Unisoft [endoscopy reporting system]. If you put the data in accurately then this data should be the same data as that." (P19, V5)
Low number high error	MNP standard identification, control belief	*"I don't do that many colonoscopies now … It's always difficult to … the errors bar is going to be quite wide."* (P19, V5)

Table E1 continued Standard identification subthemes

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Subtheme	FIT & TPB	Illustrative quote
Headline credibility and low numbers *continued*		
Low number high error *continued*	MNP standard identification, control belief	*"So that's extrapolating a fair bit and it may just be that one of those cases has a lot of polyps [laugh]. So you probably would get a more realistic number, based on more procedures, I would have thought. So probably averaging it out, over a lot, a bigger sample size, basically, it might give a more accurate reflection."* (P4, V1)
		"I suppose the problem with real numbers when they're small is that there is error in it." (P3, V1)
Rejects monthly data sought longer period	MNP standard identification credibility, control belief	*"In my case because the numbers are so low you can't extrapolate any useful and meaningful data from that … across the four months and even that on its own, [the 4-month figure] that's okay."* (P8, V2)
		"What do you think about your results? What do I think? I don't think anything about that because it was only three procedures and no polyps. But I'm really excited about seeing it when there's more numbers in." (P9, V3)
		"A month seems like a very short time to be analysing your data every month. It doesn't seem like enough time to me. … I suppose and I guess it could be sort of an early warning or something whereas that's [indicates a dip in performance] like a one off out of the four months." (P13, V4)
Numbers	MNP standard identification, control belief	*"You probably do need to know the numbers [of procedures], I think, to make that meaningful and over what time period you're measuring it as well."* (P1, V1)
		"I think the month by month is quite useful and I think putting the number of procedures on it useful as well because then you know that you did five so the fact there weren't any polyps is not the end of the world." (P3, V1)
		"Given the length of time, is a fairly low number of colonoscopies. So, I would take it as well that's nice and reassuring that perhaps with a degree of salt would be my interpretation." (P11, V3)
Highlighting 4-month period acceptable	MNP standard identification, control belief	*"(I: [Synopsis of conversation] If there is low numbers and the loss of engagement because of low numbers, it sooner identifies where they can get more rich data that has more credibility. Is that [right]?) Yes. I think that would be good because then I would click on that to compare and then I would scroll through the rest of it probably."* (P13, V4)

Table E1 continued Standard identification subthemes

Subtheme	FIT & TPB	Illustrative quote
Headline credibility and low numbers *continued*		
Highlighting 4-month period acceptable *continued*	MNP standard identification, control belief	"Over the last four months it's probably a better figure to look at. Because it gives me a broader idea of my overall practice, rather than just what's happened in the last four weeks." (P14, V4)
		"(I: Now you are scrolling down to the four-month data.) Actually, this is probably the most helpful stuff, isn't it? … It's quite helpful to know how many procedures you have done in that month. So, actually you haven't done that many huge numbers and actually in other months you have done far more so I guess it's quite good to compare…what am I trying to say? [Pause]. It's good to get a bit of context on what these results are reflecting in." (P15, V4)
		"I think the four monthly one is probably more helpful, but I think monthly one has got its value as well, just in case you've dropped." (P17, V5)
Process outcome standard identification		
PPR	PPR standard identification, behavioural belief	"The proximal polypectomy, I think that's important in terms of cancer risks and stuff like that. So I guess to me, I would be like, 'Yes, there's all this other stuff that you can find in the sigmoid …' or whatever, whereas actually to me, I think that's quite an important thing. If I see a proximal polyp I think, 'Okay. Do I need to now look harder everywhere else in this person that's had a proximal polyp?'" (P3, V1)
		"I think one thing that I've been interested in … this proximal polypectomy rates is the identification of the sessile serrated [polyps] in the right colon but has also been a surrogate marker of the acceleration [of bowel cancer screening programme], because arguably we've reduced the mortality from colon cancer in the left colon, but the right colon is still pretty static. I think because historically, we've not acknowledged the significance of the [sessile serrated polyps] in the proximal colon." (P6, V2)
		"I know it's [proximal polypectomy rate is] important, especially coming through a background of bowel screening, I know we would remove anything on the right side … I know that right-sided polyps, we don't know enough about them yet to know how significant they are, but obviously this data is starting to show that they are significant." (P16, V4)

Table E1 continued Standard identification subthemes

Subtheme	FIT & TPB	Illustrative quote
Process outcome standard identification *continued*		
Withdrawal time	Withdrawal time standard identification, behavioural belief	*"I think the only way you would do it [improve detection] is by slower withdrawal and you know make sure you have excellent views on the way out and just take your time."* (P10, V3)
		"I have slowed right down and have certain times, … some of my withdrawals, 10, 12 minutes but I am finding things a lot more." (P12, V3)
		"I take a long time coming out and the longer you take, the more likely you are to find something." (P16, V4)
		"You must be finding every adenoma so basically slowing down and making sure that I was finding things that needed to be found." (P15, V4)
		"[To increase detection] Increase my withdrawal rate or increase my withdrawal time. So, that's about all you can do really." (P19, V5)
Buscopan	Buscopan standard identification, behavioural belief	*"I know from previous studies, that you can detect more adenomas if you give Buscopan, so absolutely, so I can take that on board, so that's useful."* (P4, V1)
		"I've always known that [Buscopan] has helped and I've known that from studies that have been published but I've also just known it from my own practice". (P7, V2)
		"Personally, I feel that [Buscopan] does help improve the views that I am getting so I am often a lot happier with the view when I have used Buscopan as to when I haven't." (P13, V4)
		"I have got a little bit of a vested interest though because I did the QIC study so the evidence for the Buscopan is a bit mixed. We don't actually know if it makes much difference but it was used within the QIC study which was introducing a bundle of measures to improve colonoscopy and adenoma detection rate and one of those four things was Buscopan prescription and it was one of the few things we could measure." (P15, V4)
Rectal retroflexion	Retroflexion standard identification, behavioural belief	*"The rectal retroversion, yes, I do always try and retrovert."* (P2, V1)
		"Certainly for me, … rectal retroversion will be steady. They won't change. That's how I was trained, you do those things when you do these procedures. That's that, isn't it?" (P3, V1)
		"I pretty much always do retroversion in the rectum." (P4, V1)

Table E1 continued Standard identification subthemes

E.2 Identifying a feedback-standard gap illustrative quotations.

Subtheme	FIT & TPB	Illustrative quote
MNP targets		
MNP target too high	Identify MNP feedback-standard gap, control belief	*"I think the 80 per 100 for diagnostic population, I could be wrong but that feels too high to me. That may be reflective of my practice and my detection rate but that feels too high, I think it's nearer 50% but that's just anecdotal."* (P4, V1)
		"A minimum target of 80 polyps per 100 procedures. That seems unrealistic unless you want us to record the tiny. I mean, we can all diminutive hyperplastic polyps in anybody but … ideal target 100 polyps per 100 procedures, based on a review of 100 thousand procedures. [Pause]" (P6, V2)
		"(I: Do you think [the MNP targets] are feasible targets?) Yes. I think the type of work I'm doing and the experience I've got, it should definitely be [as a BCSP endoscopist]." (P7, V2)
Social comparison	Attention to feedback-standard gap, normative belief	*"(I: 20% of colonoscopists found more polyps that you…. How does that make you feel?) [gestures] (I: Don't care? Good?) Yes, [laughter], not bothered. I think really, looking at the people we have who scope within our team right … are very good endoscopists and the fact that only 20% found more I'm quite happy with that. … Yes, I'm okay with that so it means, you know, going off on military parlance, what we used to do was you would aim for trying to be, are you in the top third the middle third or the bottom third? So, if you're looking to promote somebody … it was, are you in the top third, the middle third or the bottom third? I always aim to go in the top third and I'm in the top third, it keeps me happy."* (P2, V1)
		"I think people want to know they are not at the bottom, or if they are at the bottom they would want to know, you know. So, I think it's good to emphasise to people that they could be up there." (P5, V2)
		"I'm quite pleased but I want to move up the scale. (I: Being in the top 92nd percentile's not enough clearly.) [Laughter] No. Working in little [county], that's quite good. So, yes. It does, you want to be up there. Over the years, I have done quite a lot of national stuff over time, not since I've moved back here, but you want to be there." (P7, V2)
Graphical form preferred	Attention to feedback-standard gap, normative belief	*"That's okay. So it's just getting your head around it, isn't it, like the 75th. Which way round is it? So 30% are getting more so it means that you're getting more than the 70% under you … I guess it would be useful in that to say what the range of numbers people are doing a month is… I suppose I know a little bit about it, but funnel plot things are quite useful."* (P3, V1)

Table E2 Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
MNP targets *continued*		
Graphical form preferred *continued*	Attention to feedback-standard gap, normative belief	*"The comparison 10% of colonoscopists found more polyps than you, I think it's just a bit … I don't know, I don't like that direct comparison, I think it's just a bit unnecessary. … Can you put that in a graph, so you know if you're an outlier, because we're so used to doing graphs for looking at outliers, scattered about…Yes, a funnel plot… [Interviewer explains get it right first time campaign bar chart] Yes, I mean those are the two ways that we're used to seeing that data presented and in fact, I think the [national bowel cancer audit] data is certainly presented like that and most of our Trust data is also presented in this format. So I think these are two formats that we're used to looking at, so yes that would be more helpful than a statement."* (P8, V2)
Social comparison motivating	Attention to feedback-standard gap, normative belief	*"(I: You're in the top 15%, which is pretty good.) Wow. I mean I look at that and I think oh it would be nice to be 95."* (P12, V3)
		"Okay. I like being normal, that's fine… Because that's motivated me to go out and find more polyps. … And I like being middle of the road and normal, but actually I want to be better than that. And it's already motivating me to go out and find more polyps … I really like the top 25% concept, because the bit of me that wants to be the best draws me towards being in that green box up there." (P9, V3)
		"I am rubbish, consistently rubbish by the look of the report… Well I mean the red for starters and it clearly says that more people did better than me. (I: So you're referring to …'75% of endoscopists found more polyps than you'. What are your thoughts… how does that make you feel?) Competitive, I'm going to drive to obviously improve it." (P16, V4)
Social statement design beliefs	Attention to feedback-standard gap, control belief	*"[Indicating social comparison] I think, from my interpretation of this, was what needs to be highlighted is that the blue or amber or whatever you choose, is that is the safe range. That what you're doing is of an acceptable standard, not that just because you're not in the green, the top 25%, does not mean that what you're doing is unsafe."* (P11, V3)
		"This wasn't helpful. (I: '58 % of endoscopists found more polyps than you'.) Yes. (I: Why not? [Laughter].) It's too confrontational. (I: Okay, did you find that a bit of an attack?) Yes. I think this is quite nice [indicates graphic bar], the way it is presented there as, 'You are within the expected range' rather than saying…yes…rather than saying, 'This many more people did better than you this month' which is how I read that sentence... where you lie in the scale would be I think a nicer way to receive that data." (P13, V4)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
MNP targets *continued*		
Social statement design beliefs	Attention to feedback-standard gap, control belief	*"(I: What do you think about the number [indicating 15% of colonoscopists found more than you]?) Yes and on average, what would average be? Oh here, so I'm above average, I'm happy with being above average. (I: Yes, so you're in the top 15%, which is pretty good.)"* (P12, V3)
Low numbers comparisons		
False reassurance	Reject MNP feedback-standard gap, normative belief	*"30% of colonoscopists performed a similar number of procedures found more polyps … which does suggest that lots of people aren't meeting the minimum target because that bit, initially you look at it and go underperforming but actually, when you compare yourself to other people doing the same numbers, you're actually doing reasonably well within that cohort of people for that number of procedures but knowing that it's not that many procedures."* (P3, V1)
		"I don't think that's helpful because I think – (I: The 10% rate [social comparison]) Well I think you're sending this data out to people … it's a slightly subjective thing at the bottom, this most "excellent work" and if I was in a hurry and just looking at this, I would just look at that and go, oh that's fine but you just take that out encourage people to look at the actual data itself, then that tells a very different story. … So I think, I'm not sure that's very helpful… if I had that in a hurry and not properly read it or looked into it, then I might have thought that was okay and I wouldn't actually have drilled down into the data. So no that one is not helpful." (P8, V2)
Attention to low numbers	Identify low numbers feedback-standard gap, behavioural belief	*"Yes, I'm not too fussed about that [one month figure] because the denominator is so small that you can only look at the whole bit of data. [Pause] Yes, so that [four-month figure] makes some sense to me."* (P19, V5)
		"(I: Please open the next PDF, which is your actual report.) This one. (I: Yeah.) I've not done enough, "You did not complete enough procedures to generate an adjusted mean number of polyps." No polyps and three procedures… [reviews 4-month data] oh, 26 colonoscopies since May, so 26 colonoscopies over four months. Just not enough, is it? That means I'm not doing enough endoscopy at the moment … it's already nudging me towards picking up that list that I might otherwise have left." (P9, V3)
		"Someone has to scope on a Monday [with bank holiday's cancelling lists]. I'm far more interested in [pause]…is what I'm doing when I am scoping safe and acceptable? The numbers [of procedures] per se, I am not terribly interested in. I'm far more interested, as I said, to know that when I do do it, it's to an acceptable standard." (P11, V3)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Attention to feedback-standard gap - colour		
Red and green positive attention	Attention to feedback-standard gap, behaviour belief	*"I think they key figures come out the page quite quickly, your biggest figure in the page is the number of polyps per 100 procedures, so that just jumps straight out at you. I mean you've got your traffic light systems and you've got your polypectomy rate and your withdrawal time and it just draws you straight into that. … (I: Okay and if it looked like there were (pause) if more of the values were red …?) I'd pay attention… Absolutely, I would pay attention to that. I think that's a good way of highlighting it, use a traffic light system and psychologically that's telling you, hang on you really need to look at this, you need to think about making a change there and that's important."* (P4, V1)
		"The red flags [and] colour-coding is very useful." (P8, V2)
		"Mean number of polyps'; is that good? It's in the green so it's in the top 25% and that's good. (I: It is interesting how you bypassed the good completely.) Yes. I didn't even look at it. I just looked at the red. [Laughter]. (I: [Laughter]. What made you bypass the green?) I am only interested in the red. I am only interested in what I am not good at. I didn't even look at that. I just looked at this… (Is the red colour okay or is it too aggressive?) No. It draws you straight to it. When I open up I want to just look at the red. I would look to see what was red straight away." (P10, V3)
		"It is obvious red means it needs to be improved and they are the ones your eye is drawn to first and it then tells you what your marker is that you are aiming for." (P13, V4)
		"I like the colours. I like that it's colourful, so actually, it's not plain black because I wouldn't be able to read it easily. Obviously, it's good that you can see that, and it's green, so it looks encouraging. I guess if it was red, it might have been a bit [pulls a face]- (I: scary?) Yeah, it's good that you can see that and it's just a positive thing that comes." (P18, V5)
Red negative attention	Attention to feedback-standard gap, behaviour belief	*"And then just as a kind of thought experiment, how would I feel if I was in that red zone? Personally, I'd want to get out of it, and the red kind of screams warning to me and tells me that there's something up, so I like that. Also, I'm not looking forward to when the endoscopists in the team are in the bottom 25%. That's going to trigger, [Laughs], it's going to make people act to get in the front, "What's going on?" you know. I can see the emails blasting out – as a result of that bottom 25%. I think it might induce some use of the caps lock button. But maybe that's a good thing."* (P9, V3)
		"I want to be in green. [Laughs]. (I: How would you feel if you were in the red?) Oh, really, really bad. Really bad. [Laughs]…." (P14, V4)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Attention to feedback-standard gap – colour *continued*		
Red negative attention *continued*	Attention to feedback-standard gap, behaviour belief	"No, I think red would freak me out… Yes, red you'd reduce me to tears and I'd go off and have a gin [laugh]. I'd walk out the hospital if I was red [laugh]. But no, I think the colour choice is fine because it's an average colour, blue. So no, green I love." (P12, V3)
		"It's red, it looks bad. … (I: Is it a bad thing?) I don't know, I haven't read it yet. (I: You'll have to read it.) Red is a negative colour, so it's obviously a bad report." (P16, V4)
Orange negative	Attention to feedback-standard gap, behavioural belief	"[there is a] slightly negative looking colour of brown. It's might meant to be orange and it's probably meant to be a traffic light. So I guess what that's probably saying is that you're doing alright but you could be better". (P1, V1)
		"So I'm not reassured by that [orange colour], I'm more worried by that… (I: So you've got a yellow flag and you've said its, kind of, reassuring but not that reassuring.) I think that's something I need to look at, yes." (P8, V2)
Blue normal	Attention to feedback-standard gap, behavioural belief	"Then, okay, so we have got red, blue and green. So, I am thinking red is bad, blue is expected, and green is exceptional." (P15, V4)
		"[Colours are] standard practice. I see so many of these. It's standard… Red is always – it highlights the issue… [blue] I mean, that's fine. I don't have a problem with that. I wouldn't change them. I don't feel strongly about it." (P19, V5)
		"Green, blue and red… Nicely colour-coded … I love how that blue is the same colour as the background, and it does kind of, it feels normal. And I really like the top 25% concept, because the bit of me that wants to be the best draws me towards being in that green box up there." (P9, V3)
		"Yeah, I mean, okay. I think I would prefer to get out of the blue and into the green, so I think slowing down a little bit is a learning point for me." (P14, V4)
Velocity – trend over time		
Trend review	Velocity, behaviour belief	"I quite like these ones [trend graph] that tell you what the sort of progression is so you get one month, don't you, but then you get it in context of the other months…So that's quite nice. It's useful to have I think." (P3, V1)
		"I think it would, particularly if, figures remained static. I think if people were generally concerned about and motivated to improve their figures ... It may not sink in perhaps one or two times but [a trend] can drive the message home." (P6, V2)
		"If I had a consistent series of [detection] rates, whatever, that were out with the expected range, then I might think there perhaps might be an issue here and let's talk with someone about it. … it would need to be at least two, clearly, you know, to make sure." (P11, V3)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Velocity – trend over time *continued*		
Trend review *continued*	Velocity, behaviour belief	"*I think trend is more helpful than a snapshot basically so a one off drop I would feel less worried about knowing that the month before I had a great month so I think the trend is one of the most helpful parts of it… [it] makes sure you are doing that high quality inspection in every procedure rather than just chasing it when you are having a bad month and I think [reviewing the trend is] the kind of mind-set that this will bring us all into doing. So, rather than thinking, 'I had a bad month and I will have to work harder' actually you should be working harder everyday.*" (P15, V4)
Dip review	Velocity, behaviour belief	"*I think a graphical presentation is always helpful to give you a sense of how you're doing compared to the last, there may be reasons why I get back off, particularly if I start scoping, and I may find there might be a slight dip in my performance which would be helpful to see in sort of graphical form in order to just alert me to that and just make me more kind of mindful.*" (P6, V2)
		"*I've got a little blip there…what's happened there, and just want to unpick that and unravel that really. You want to look at why your performance wasn't good there, it's nice to get this bit, but you question what was different, what didn't I do. But I had a series of difficult ones that I just had a months holiday*". (P7, V2)
		"*I guess, I can't really explain why July was so different to May and June, or why the mean number of polyps was three times what it was in May and June, in July. And despite being adjusted. So I'm a bit, I'm trying to get my head round that but I'm not sure I can or will do, sat here.*" (P9, V3)
		"*It starts well in May and then goes down in June. Then it picks back up. It will be interesting to look at what happened in June. 'Number of polyps: 51' so that's far less than the rest of them and there was still a reasonable number of procedures done. In fact there were more procedures done so that reflects the trend I was talking to you about where the more I do I worry about the detection rates because of the time constraints.*" (P10, V3)
		"*I'm looking to go down to the bit that I didn't get into the green bar. So the mean number of polyps detected stayed the same, so I want to know a little bit more about that.*" (P14, V4)
Process outcome trends	Velocity, behaviour belief	"*It would be interesting to know what the Buscopan prescription was in the past few months. Is that linked together? I don't know.*" (P1, V1)
		"*I'm under average there with my Buscopan, so I don't know. I mean if I make a point of giving it unless it's contraindicated, if I give the Buscopan, as from now, routinely, it would be interesting to see. See if the proof is in the pudding.*" (P12, V3)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Velocity – trend over time *continued*		
Process outcome trends *continued*	Velocity, behaviour belief	*"[Suggests a withdrawal time trend] So the mean withdrawal time will be are you having a bit where you've taken your eye off the ball and you start withdrawing a bit quicker or it's got better and you've slowed down and then you get that positive feedback that you've slowed your time and your detection rate has got better."* (P3, V1)
		"Well, it looks like it is here. Definitely, in two months, it looks like I've doubled something there, and the graph is quite interesting to see what you do. It will be interesting to see if I change now with interventions, with the Buscopan and stuff, so that will be interesting to see." (P18, V5)
Feedback effort		
Low effort	Feedback effort, control belief	*"So once you've read this once, you will quite easily be able to look at it and go, alright that's fine. The information is there, it's quite easy to see."* (P4, V1)
		"Well because it's got the key figures as the highlighted ones, I don't think it would take that long and then if you needed to drill down into them, the information is all there for you to do that with." (P16, V5)
		"Now that you've explained what I'm looking at, I think I could go through it quicker but I think it did take a while to get my head around what I'm looking out because these are all new things, aren't they? Because it's not something we're used to. So, I think you need to expose the endoscopists to it a bit more." (P17, V5)
		"I'm able to do it and I have a very short attention span. I get hundreds of these things and if I get beyond page 1, you're lucky. So, this is only a few flicks of the wheel. I wouldn't want much more data than that because I get all sort of things like this about this and that. All sorts of stuff. So, you don't want a huge amount of data and that's quite nice." (P19, V5)
Log-in barrier	Feedback effort, control belief	*"[Asked about using click links to further information] If that's easily available there [through the click link information] and to look at that, yes".* (P7, V2)
		"(I: And if you click Log In to see your KPI data… Do you have a NED login?) Yeah, I do, yeah. I don't remember it. (I: I'll pause the tape just whilst you try and remember. So [Participant 14] the first time, first time found the password, logged in without any bother.) [Laughs]. Got to be worth points." (P14, V4)
		"Do you know your JETS login by any chance? [Unable to log in] Okay unable to log into JETS. That's fine." (P19, V5)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Feedback effort *continued*		
Opposition	Feedback effort, normative belief	"*People just don't read emails very much and also they also disengage with it if they don't value the data.*" (P5, V2)
		"*I think this is something which you would have to probably pilot amongst a few endoscopists first and invite others along and maybe, so maybe bowel cancer screener practitioners could get some data and maybe perhaps in an open forum discuss it with other colleagues there, seeing back, and trying to engender that kind of culture of peer to peer feedback. I think whether we can, I don't think we can roll it out across the whole department initially because I think there'd be a lot of opposition. You could, is that a reason not to do it? I don't know.*" (P6, V2)
More time and plan if red	Feedback effort, control belief	"*15 minutes to say, depending on what the data was presenting. I mean if it was sort of sort of saying … red light, red light, you would be thinking, oh hell! If I think I would need to be doing something about that and then I would have to go and talk to somebody about it.*" (P2, V1)
		"*I would think that as long as my performance is showing stability or improvement then I think it would be very much 'we'll have a look, yes, I'm okay with that'. I think when there's something that is below the standard, that would make me look to research into why and spend a bit more time.*" (P7, V2)
		"*I kind of feel like I personally would spend five minutes reading all of that, trying to digest it … obviously, if you are okay and you're green then it's going to be quicker, and if you're not it's going to take a bit longer.*" (P9, V3)
		"*I would have a quick scroll through it I think and if I saw something that was red I would look into it in more detail. I think if it was all blue and green I would probably…you want honesty here, don't you? I would have a quick look and say, 'Right. I am doing fine. … Oh, that's red. What do I need to do?' I would clock it and move on from it probably. If it was red on a regular basis then that's when I would be prompted into escalating things further for myself.*" (P15, V4)
Non intimidating	Feedback effort cognitive interference, behavioural belief	"*It's non-intimidating. I think the thing I like about it is actually…my first reaction when I read 'You detected as many polyps as our model expects of your case-mix which is not bad' I thought, 'That's a bit cheeky and informal' but actually I think that's quite nice the more I think about it. None of this…there is a bit of red but at no point does it put my heart rate up and I think, 'I am doing really badly.' It's friendly I think if that makes sense.*" (P15, V4)
		"*So, I don't feel disappointed. I just feel like I'll try and get better. It doesn't upset me.*" (P17, V5)

Table E2 continued Identifying a feedback standard gap

Subtheme	FIT & TPB	Illustrative quote
Feedback effort *continued*		
Emotional response	Feedback effort cognitive interference, behavioural belief	"*I am rubbish, consistently rubbish by the look of the report (I: Why do you say you're rubbish?) Well I mean the red for starters and it clearly says that more people did better than me. (I: So you're referring to this bit, 75% of endoscopists found more polyps than you. How does that make you feel?) Competitive, I'm going to drive to obviously improve it.*" (P16, V4)
		"*The report came out. I had seen P16's report before the interview, and the low MNP in big red letters. I had suspected it was related to data entry of polypectomy, and thought P16 may dismiss the report out of hand. However, as soon as she saw the red her face dropped, her voice became quiet, and she repeatedly described herself as rubbish. She read through the report very quietly, clearly taking this as burdensome bad news. I felt uncomfortable and tried to resist the urge to relieve the tension by reassuring P16 or making light of it, I think I stayed quiet. To break the pause, I asked P16 what she meant by "rubbish", and this helped restart the dialogue a little. We managed to continue the interview.*" (Reflective log, P16 interview)
		"*I just feel, right now, it's [the BCI is] very, 'you're not doing well' but without going into it in great detail, I don't know what I need to be at. (I: So what would you do now, at this point, with that?) Well, look in the information box to see if it drills it down for me… [P16 reviews information on the website, and plans to change documentation to improve accuracy of NED data] … (I: Okay, how do you feel?) Okay, I'm not jumping for joy but I'm okay. (I: In terms of getting this kind of a report and it being quite red and a bit negative, how does that motivate you?) I am motivated but I'm still in that headset that is it the data or is it my … is it the polyps or is it the data … So I think I will be doing my data a lot more religiously, I still think I probably will speak to people now about Buscopan because I obviously haven't used it at all in the timeframe… So I do need to address that as a separate issue but no it would drive me to want to improve it, definitely.*" (P16, V4)

Table E2 continued Identifying a feedback standard gap

E.3 Adopting a plan and process outcomes illustrative quotations.

Subtheme	FIT & TPB	Illustrative quote
Process outcomes		
Actionable behaviours	Adopting process outcome strategy, behaviour belief	*"I like these [process outcomes] with the this is ideally what we'd like you to get and then you've got quite a clear idea of where you are related to it… Yes, is good. Then it's useful. It breaks it down a bit more so the proximal polypectomy stuff and then it puts it into context with your time and your Buscopan, all your other stuff."* (P3, V1)
		"Oh, the plan, yeah, yeah, the plan. But as in, I think there's stuff you've got in there about, 'What can I do differently?' I found. That would be really helpful. … Especially, I think, because it's specific, and each element of, you know, the mean number of polyps you might think about doing this, and this other plan was very specific to the element that you would describe. And I think that's really helpful for people, and people might use that for, you know, specifically to improve that area." (P14, V4)
		"There are areas actually that definitely needed intervention, if that makes sense. So, seeing that it's [process outcomes are] actually picked up by someone else, that this is what I need to change, I think it's quite a valid point. … I agree with everything suggested, if that makes sense… I think they match with what I think." (P18, V5)
Further information	Adopting process outcome strategy, Control beliefs	*"It would be interesting to know what the Buscopan prescription was in the past few months. Is that linked together? I don't know."* (P1, V1)
		"[Post interview note] I: We talked a bit about the Buscopan plan and P8 was keen to have more data on Buscopan including possible evidence to the justification for use of Buscopan and a link to paper evidence or guidelines. Participant 8 was quite keen to have a better description of the justification for all the targets that are set and why these are targets and how they've come to be and I think this would be very useful to have in the extra information on the website with clickable links within the report." (P8, V2)
		"So, without understanding what the data and evidence is behind that, I can't really make an opinion on that really because whatever your recommendation is well that may be your recommendation, but I haven't seen the data." (P5, V2)

Table E3 Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Process outcomes *continued*		
Despite low numbers	Adopting process outcome strategy, behaviour belief	*"So I know that red dot is meaningless, because I hadn't done any procedures that month, or I've done three procedures that month … the numbers are meaningless, because the confidence intervals are so wide. Being a conscientious person, if there was a downward trend over that time, despite the numbers being low and the confidence intervals being wide, I'd still interpret that badly. I'd still go, 'Sugar, I need to up my game here,' even though there might not be any reflection in my performance. And if it's going up … I'd still take it as a pat on the back, just because, quite frankly, when you get to our stage, [interviewer], you have to take every pat on the back you can get."* (P9, V3)
		"[circles Buscopan prescription in red] … I mean I was aware of [Buscopan] but I certainly didn't know it was a target, maybe I should have a look at that and particularly in light of the fact that my polyp detection rate seems to be a little bit low, maybe I should be using it. … in my case because the numbers are so low you can't extrapolate any useful and meaningful data from that. … [further discussion about plans] I might start using Buscopan actually, yes, I mean I think I'll have to really consider that actually, yes." (P8, V2)
		"'We hold our hands up. We know this is statistical bollocks … Please do not read into this that we think that if your data dips below that [indicates standard] it has any statistical value, it is simply this form … results in most change'." (P5, V2)
Pre-test risk	Adopting process outcome strategy, Control beliefs	*"There is all the what is your pre-test risk of there being polyps and that kind of thing and what you're doing it for. I think maybe the people on polyp surveillance will be more likely to be moving them around."* (P3, V1)
		"I don't tend to use [Buscopan] in my young people who are IBD because I think, 'I am not really doing this for polyps' but if it's an older person or someone who I think they might have polyps then I would be more likely to use it. That's just my personal practice." (P13, V4)
		"I mean, if I'm doing a [bowel cancer] screening patient, I will probably do more position changes and I'm more likely to use Buscopan with those patients." (P7, V2)
		"Some people obviously have higher suspicion of something let's say or so if it's a 20-year-old patient, sometimes you're not expecting to find a cancer or polyp so … you might not be as, as careful potentially as someone else." (P18, V5)
		"[Behaviours when performing colonoscopy] It depends why you're doing the scope, doesn't it really, and what you're looking for." (P19, V5)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Proximal polypectomy rate		
Case and skill dependent	PPR standard identification, control belief	*"[PPR] data would be more meaningful if we could be do it by case selection and because I think otherwise, those people that just do people with the long lists with constipation, IBS [irritable bowel syndrome], inevitably they're going to be lower down".* (P6, V2)
		"[Reflective log] I: We also talked [off microphone] about the polypectomy rate and if this was low, this may be due to other issues regarding anticoagulation, platelet prescription and also case-mix that isn't picked up." (P8, V2)
		"The proximal polypectomy rate at this point – I'm not sure the relevance of that at this point, mainly because my decision to take a polyp off is not related to where it is within the bowel. It's related to, do I feel I have the necessary skill to take that off? And is it appropriate for me to take it off? Is it right for me to take it off, i.e., if it's a 1cm polyp sitting in the cecum that's fine, I'll take that off. If it's a 3cm polyp sitting in the cecum, I won't." (P11, V3)
Attention to PPR plan	Attention to feedback-standard gap, behaviour belief	*"I've never thought about proximal/distal polypectomy rates, I've just thought of polypectomy rates and detection rates over the whole colon, to be honest. So breaking [withdrawal] down into regions, is an interesting way to think about endoscopy … maybe I should start to think a bit more about segmentally … have a segmental detection rate."* (P4, V1)
		"That would be one of the things I would think about and then the proximal polypectomy rate maybe would come back to withdrawal time. Am I coming out of the right colon a bit too fast and then I might think about maybe I need to ask someone to make sure I spend four minutes in the right colon." (P13, V4)
		"And what I will be interested to see is the kind of more detailed breakdown over time there. Proximal polypectomy right in there. (I: So if you click on information ...) [Clicks on link to further PPR information] Oh, sweet. Oh, this is it broken down, over time. So proximal polypectomy, right." (P9, V3)
Low dominance	Adopts PPR strategy, control belief	*"What I would do is, I've got a BCSP list this afternoon, so I will be saying to the [nurse], 'Just monitor my time and make sure I'm not coming out too quickly.' And I'll do that from caecum rather than just waiting until I got kind of to the left side before making that adjustment. I would want to spend a bit more time in the right colon just to make sure that, because I think that's where you're picking up the more subtle lesions, really, in the right colon."* (P14, V4)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Proximal polypectomy rate *continued*		
Low dominance *continued*	Adopts PPR strategy, control belief	*"I guess there is a bit about time withdrawing in the ascending colon but that might be recognition. So these might be sessile serrated lesions not being picked up. So it might be a little bit of education for that person as well but what you've written down there is quite straight forward to look at and do".* (P1, V1)
		"So, at least four minutes looking at the right side? I am sure I could do that. (I: Would that be easy to do?) Yes. We have got a clock in the room. [Laughter] …Four minutes looking at the right side? Yes, that's fine and I can do that." (P10, V3)
High dominance	Adopts PPR strategy, control belief	*"You have to ask someone to do it for you and you have to rely on yourself then…so, it's a lot of conscious going back and forth I think… I agree it is important because the right colon is a real worry and you think you have seen it better than you probably have generally but I worry about overloading people and the burden of, 'I am measuring this side. I have got to…what time is it?' and I think you can get lost in it a little bit so it's maybe worth a trial."* (P15, V4)
		"Let's use kind of segmental withdrawal rates as an example. It's quite a nuance thing, that, and I think that it would be achievable. But it would need a bit of, it would probably need somebody to kind of support the endoscopist and the nurses and give them a bit of framework to do it." (P9, V3)
		"Certain minutes in segments, well, that sounds interesting but actually, the colon, every colon's a bit different. Do you spend two minutes in the ascending and then two minutes in the transverse, two minutes in descending, … If everyone has then got access to Scope Guide and we now have more access than we did, that might be an option". (P5, V2)
Withdrawal time		
Personal target	Withdrawal time standard identification, behavioural belief	*"I always thought round about seven to eight minutes withdrawal was adequate."* (P10, V3)
		"Yes, 8 minutes [withdrawal time in plan], I know six is the standard, ten is the aim, isn't it? And I think beyond ten minutes, you're probably, there's not much significant gain to be achieved [pause]." (P6, V2)
		"I aim to try and achieve, well, I say circa ten minutes. I am aware it should be in the ideal world, should be achieving ten." (P11, V3)
Ten minute target accepted	Identify withdrawal time gap, behavioural belief	*"Oh wow, withdrawal time [7 minutes in amber], that's interesting isn't it …So it's what I can do to make that better, what can I do to make sure that that button gets hit."* (P12, V3)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Withdrawal time *continued*		
Ten minute target accepted *continued*	Identify withdrawal time gap, behavioural belief	*"Because I am just under. (I: Nine minutes and 43 seconds, average.) Yeah. So yeah, perhaps spending a little bit longer on withdrawal might just then tip that into the green, because… I always want to be in the green bit."* (P14, V4)
		"I think if you want to go for ten then that's fine but to my knowledge there isn't a massive amount of data which says ten is better than seven or eight but if ten is what is recommended and it's what everybody is going for then that's fine". (P13, V4)
Slowing down plan	Adopts withdrawal time strategy, behavioural belief	*"So the mean withdrawal time will be are you having a bit where you've taken your eye off the ball and you start withdrawing a bit quicker or it's got better and you've slowed down and then you get that positive feedback that you've slowed your time and your detection rate has got better."* (P4, V1)
		"Well if I'm coming back a bit quickly, is that because I'm not looking enough?" So then actually not only am I coming back more slowly but I'm doing it more deliberately because there's no point just coming back slowly if you're not actually looking at anything. So I think I do like a bit of data. I like numbers and so I like saying, "Well I need to change something on that." (P3, V1)
		"[Other endoscopists receiving withdrawal time data] Well, I think it's easy for me to know that when I'm withdrawing I should focus on looking for polyps and nothing else. But I think that, unless you've grown up in that world, a lot of people just see it as getting the scope out. And maybe aren't as aware that it's a really key part of the examination, especially if they trained quite a long time ago." (P9, V3)
Self-reported effective	Adopts withdrawal time strategy, behavioural belief	*"[Seeing withdrawal time] I do make a conscious effort to look [at the clock for withdrawal time]. It does make me think about how long it's taken me to come back. I think I've definitely slowed down."* (P3, V1)
		"I think the problem is that [withdrawal time is] probably not that accurate…So it's difficult to know what the accuracy of that is but they seem to think that if someone's got a low PDR and they're withdrawing less than six minutes, they need to spend more time finding more polyps because they'll be missing cancers. So that's [reporting withdrawal time is] really helpful, I like that." (P1, V1)
		"I record [withdrawal time] anyway in my head … But, if you notice the time yourself then when you are getting to the transverse you can have a look and say, 'Am I going too quick? Am I going too slow?' So, I guess that's why I just check it myself." (P15, V4)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Withdrawal time *continued*		
Plan low dominance	Adopts withdrawal time strategy, control belief	*"So I just now monitor the time and just try and do a slow withdrawal and keeping an eye on the timings."* (P16, V4)
		"I record it anyway in my head but I think probably I will start using them [nursing staff] as well rather than having to worry about it. But, if you notice the time yourself then when you are getting to the transverse you can have a look and say, 'Am I going too quick? Am I going too slow?' So, I guess that's why I just check it myself." (P15, V4)
		"Sometimes, you're reaching [the caecum] … I'm not necessarily looking at the clock. The nurse will obviously say I will put the timer on but I still forget to look at it. … I think you just have to be more disciplined, at that point, sometimes, you're just tired and you just look around, or whatever you find, or the nurses talk to you and then you just chat away. It's just the normal things or there's music in the background. I still pay attention … but it's just I forget to look at the clock." (P18, V5)
Hyoscine butylbromide (Buscopan)		
Buscopan target	Identify Buscopan feedback-standard gap, behavioural belief	*"I would use it probably 95% of patients once they got the cecum, that's when I will give it. But I am starting to use it more again. So, I was put off from really to be more cautious with it and I just thought, well actually, I've never had a problem [knocks on wood] with it and most people, I tend to use it, [Buscopan], I will give 20 milligrams in the cecum."* (P7, V2)
		"(I: Buscopan prescriptions has come up as 7% and the aim over 50%, and it's come up bright red.) Yeah. Because I do tend to use Buscopan quite a lot… Yeah. I don't use it on everybody because I'm quite cautious, if someone's got a high heart rate I'll not use it. Whereas, I think some of my colleagues will just give it … blanket to everybody … But the majority of patients I would give it to would be, I would say, probably about 80% I would give it to." (P14, V4)
		"(I: [P17] is now looking at the secondary KPI data table) … Buscopan aim for 50 [mumbles in acceptance] … (I: The plan in the report is focused there on your withdrawal time. … Do you think Buscopan was more important to flag up?) Buscopan is probably more important." (P17, V5)
Buscopan plan	Adopts Buscopan strategy, behavioural belief	*"Do I think Buscopan works? Well the research is very much for it, isn't it? Do I know if it makes a big difference? Truthfully, I don't think so but saying that, I'm under average there with my Buscopan, so I don't know. I mean if I make a point of giving it … it would be interesting to see. See if the proof is in the pudding".* (P12, V3)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Hyoscine butylbromide (Buscopan) *continued*		
Buscopan plan *continued*	Adopts Buscopan strategy, behavioural belief	"So on that, probably it might motivate me to bring up at EUG, that we're not using as much Buscopan as we should." (P1, V1)
		"I don't routinely use Buscopan, it's just not something I've done really, as you can see, perhaps I should. (I: Is that through … do you not –) Just not, I don't know, I mean you'll probably be able to tell me if you're doing the study but I don't know many surgeons that do, it's not something that surgeons tend to do, I don't know why. (I: Did you know about the use of Buscopan as an agent to improve polyp detection?) Yes, I mean I was aware of it but I certainly didn't know it was a target, maybe I should have a look at that and particularly in light of the fact that my polyp detection rate seems to be a little bit low, maybe I should be using it." (P8, V2)
Low dominance	Adopts Buscopan strategy, control belief	"[The nursing staff] don't draw [Buscopan] up for me because they know I don't use it; they'll just draw it up when I ask them to but I think they do draw it up for others." (P16, V4)
		"(I: And Buscopan, has it been readily available when you've needed it?) Yes, yes, although when you start as a consultant people tend to ask 'Well, what do you like?' You can say, 'Well, I do this, I do this,' and then it gets put into your file, so to speak, and then that's … it's just there." (P11, V3)
Remembering Buscopan	Adopts Buscopan strategy, control belief	"No, in fact, now it's [Buscopan is] accepted practice. And as I said before, if you have a memory slip and you've had a difficult procedure, they often say, "Did you want to give this Buscopan?" They kind of prompt you to give it." (P14, V4)
		"Interesting, Buscopan I spotted before… I need to remember, I often forget, you know, when you know if your patient is comfortable and then I come out and I finish and I'm like, did I give Buscopan? No, damn." (P12, V3)
		"Buscopan's a good example. I guess the different level I'm working at is, I think it's an individual. If I read there that my Buscopan issue was low, I could go into a list and say, "Could you remind me to give it?" And I think the nurse would be very responsive to nudging me. I think that would work well." (P9, V3)
Buscopan safety	Adopts Buscopan strategy, control belief	"I know there is research saying that it improves ADR for people. I just think you have to be a bit more careful now with the new implications with cardiac history and all that." (P18, V5)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Hyoscine butylbromide (Buscopan) *continued*		
Buscopan safety *continued*	Adopts Buscopan strategy, control belief	*"Some nursing staff will quite rightly point out, oh hang on, this patient is almost a little bit tachycardic, should we be giving them Buscopan?"* (P4, V1)
		"I think people's practice with Buscopan has changed now since the MHRA alert and there are some units that I think just don't use it at all now. There are some units I know that if you are going to use Buscopan they want you to put 3 point cardiac monitoring on all patients. You can maybe tell from my tone that maybe I think that is a bit overkill. It's all about patient selection. ... I think Buscopan is just too controversial now. [Pause]." (P15, V4)
Not used	Adopts Buscopan strategy, control belief	*"I never use Buscopan so I can understand why they are red…. I would click on them and have a look. I am not clicking on these [indicates Buscopan information link] because I know why they are red… I used to give Buscopan when we did a trial in the department about withdrawal and polyp detection rates and I didn't see the data to say that it made a difference. I thought, 'Why should I give it? Just don't give it'. I think when I did give it anyway I didn't see much difference so I just don't give it. If someone told me that if my detection rates had gone up after I had used Buscopan I would use it… If it was going to benefit my practice and the outcome I would use it."* (P10, V3)
		"Buscopan I'm not interested in. I never use Buscopan… I say never, never. If you've got somebody who's really spasming … I don't have to bother finding out if the patient's got closed-angle glaucoma or a cardiac thing." (P19, V5)
		"If there was consistent spasm, yes, I would give it for spasm at caecum, I don't use it as just a drug to give during colonoscopy. I had two patients respond badly when having Buscopan before, so that put me off the use of it… I probably will speak to people now about Buscopan". (P16, V4)
Rectal retroflexion		
Target accepted	Identify retroflexion feedback-standard gap, behavioural belief	*"[Pause, reads retroflexion target which was achieved] Yeah, rectal retroflexion, yeah. [Pause]."* (P14, V4)
		"Buscopan aim for 50, retro rate 100%. Turning the patient on withdrawal can improve …[mumbling]." (P17, V5)
		"So, 90% [rectal retroflexion] usually, okay." (P18, V5)
Retroflexion controls	Identify retroflexion gap, control belief	*"So I'll know that my rectal retroversion rate is way off what it should be. But that's for various reasons, and that, I think, reflects my case-mix and the tests I do. So I don't get too worried about that."* (P9, V3)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Rectal retroflexion *continued*		
Retroflexion controls *continued*	Identify retroflexion gap, control belief	*"There are certain groups of patients that we wouldn't normally retroflex someone, we don't retroflex anymore in people who've had an anastomosis in the rectum because we had a leak in a patient several years down the line, who had a retroflexion where the anastomosis... and we don't retroflex in colitics."* (P8, V2)
		"The retroflexion, recently, I don't know. I'm just very cautious. I had one episode where I've retroflect someone and then it caused quite a lot of trauma and it was a bit of a torn area so I had to clip it. It wasn't a perforation, it was just a trauma from it. So, I think since then, I'm just very cautious on how to do it." (P18, V5)
Retroflexion plan	Adopts retroflexion strategy, behavioural belief	*"My retroflexion rates were low and that worried me slightly and I didn't quite know why that was. .... So I think that was useful, to know that my retroflexion rates were low."* (P8, V2)
		"Yes, so if my rectal retroversion rate, it's low, but if I wanted to do something about that, and I went into a list and said, "Right, I've got to do something about my rectal retroversion rate, can you make sure I do, or remind me?" Then I think that, put like that, me personally, they would be willing to remind me. So yes, I do. Whether other endoscopists would be willing to do that, I don't know. But I don't see why not." (P9, V3)
		"Yeah, that's good. I didn't realize that was information. 'To improve your-' [read's tips] that's good to know. … [reads information] 'What are the risks? There are small risks of perforation…' So, this is the cases that you might not be able to do, this 5%. 'How did I perform?' [Reads tip, pause] (I: What do you think about those tips?) It's very important to know why to do it because it gives you some research. … So, I think if you read it just before you go through your list, and you try to visualize it, it's easy to follow what it says. It gives you step by step. So, I would feel comfortable trying it and see if it works." (P18, V5)
Turning		
Increases detection	Turning standard identification, behavioural belief	*"(I: Do you think turning patients on withdrawal improves detection?) Yes. (I: You have a strong belief in that correlation?) Yes."* (P15, V4)
		"Turning the patient on withdrawal can increase polyp detection rate by distending the colon. Yeah, I agree with that." (P17, V5)
		"So, on withdrawal obviously I do move the patients' position for optimal visualisation…I would move them around definitely to get the best views." (P10, V3)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Turning *continued*		
Increases detection *continued*	Turning standard identification, behavioural belief	*"Turning patients is something that routinely I think the Bowel Cancer Screening Team do and we have, again, in writing back to endoscopists as a whole talking about improving adenoma detection rates, I've written that in the past saying, you know, look at turning patients. [We] put up on the wall actually the diagram of the optimal position that's for inspecting parts of the colon and withdrawal."* (P5, V2)
Turning plan	Adopt turning strategy, behavioural belief	*"The advice about moving patients, particularly on withdrawal, is, I think, helpful, because I don't think, we only ever seem to do that if we're honest in the basic skills course… When we're being observed by a lot of people."* (P6, V2)
		"I suppose I should give it a go. I think I do spend quite a lot of time making sure that the left side is all full up with air. I think that's one thing that I do do but I'm always open to trying something different and see if it changes it. I don't know. I would change it and then I guess it depends what the feedback has been like, doesn't it? If you get feedback and it says, 'That's made a difference,' you think, 'Well fine, keep doing it,' quite positive feedback on things." (P3, V1)
		"To be honest, I've been concentrating on making sure the patient's supine position, for the transverse colon and I tend to withdraw with the patient's supine the whole way. So I don't turn them on the left, to look at the right colon, I don't turn them on the right to look at the left colon. So that's something I can take from this." (P4, V1)
Turning task dominance	Adopt turning strategy, behavioural belief	*"I've never tried it actually [turning on withdrawal], so yes, I'm assuming that will make it a little bit trickier, you might lose position a little bit … I could try, I suppose and put the patient on the left and then sequentially roll them onto the back and onto the side but I'm guessing that, in itself, takes a bit of getting used to. So there might be a bit of a learning curve in withdrawing with that technique."* (P4, V1)
		"I just think sometimes it's just the whole difficult thing of just 'let's move you again on the left, again on the right'. So, it's just how difficult … and I may lose position. So, when you're comfortable at something and … you're seeing it and it's, like, okay". (P18, V5)
		"I mean when I saw it [turning the patient] being done it worked very well and I tried it straight away and it worked. So, then you think, I'll do that now. I try it once twice tip them over." (P10, V3)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Turning *continued*		
View dependent	Adopt turning strategy, control beliefs	*"Depending on the views. Depending on the liquid or any stool in the bowel or things like that or if it was collapsed … I would move the patients on withdrawal but not 100% of the time."* (P10, V3)
		"I tend to turn the patients when my views are obscured a lot, rather than mechanically going through those step changes all the way round. So if I am getting good enough views and the bowel's open and it's not flopping everywhere then I'll keep them where they are. But I quite frequently change them on withdrawal, if you get what I mean, to maintain the views." (P14, V4)
		"Normally, I withdraw on the back until some point in the sigmoid … I must say unless I can't see or there's too much fluid, I won't turn them." (P18, V5)
Patient factors	Adopt turning strategy, control beliefs	*"The patient sometimes tells you beforehand, "I find it really difficult to lie on my left side." So I always say … 'if you are uncomfortable, let me know and we'll change you.' So you kind of do it for a short, if a patient's uncomfortable I won't keep him on that side. So yeah, I suppose it is a barrier".* (P14, V4)
		"A couple of times [I've not turned the patient] but they have tended to be older and frailer people who I have thought, 'Maybe this wasn't the best test for them anyway' so I have commented then perhaps in my report if my views haven't been quite as good as I had wanted. I think you have to try to do the best for the patient at the time." (P13, V4)
		"[Turning is dependent on] the level of patient that's in front of me, their mobility status, the physical size because I've not long recovered from a back strain." (P16, V4)
Huff and puff	Adopt turning strategy, control beliefs	*"I am quite a believer in position changes actually. Sometimes I think you don't do it because you think, 'The nurse is going to kill me. Can I ask them to move the patient again?' … In reality they are absolutely fine especially when you say, 'I know you are going to kill me but we need to move them again and they go, 'Oh! Okay.'"* (P13, V4)
		"I felt in the past that maybe there was a bit of huffing and puffing of, 'Oh, she is moving him again!' but I think when you have worked in a place for a certain amount of time and they realise … they see that pay off. It's not an issue now." (P15, V4)
Monthly tips		
Colleague support	Adopt discussion strategy	*"I think probably initially I would probably speak either [gastroenterology consultant] or [site1 clinical lead]."* (P2, V1)

Table E.3 continued Adopting a plan and process outcomes

Subtheme	FIT & TPB	Illustrative quote
Monthly tips *continued*		
Colleague support *continued*	Adopt discussion strategy, behavioural beliefs	"If we were identifying areas consistently that were red, that's a sign that maybe I should have someone watch my technique. Going back to what I said earlier, get an experienced colleague to come in and say, right let me just watch you for a few cases." (P4, V1)
		"I would probably talk to the likes of [a local gastroenterologist] or [regional bowel cancer screening gastroenterologist]. I would talk to … yes, my colleagues, my nursing colleagues, my nursing endoscopy colleagues,... I would go to them first, without a shadow of a doubt, so my fellow nurse endoscopists … then I would go to the likes of [consultant gastroenterology colleagues]... [because] That's who I really look up to." (P12, V3)
		"I might speak to my colleagues a bit more and ask them about their use of Buscopan again and go through how they feel their Buscopan … because I just think I had a bad experience of it, it's not necessarily good practice. I'd probably do a bit of clinical supervision with colleagues and then go from there, really." (P16, V4)
Social spaces	Adopt discussion strategy, control beliefs	"It's just creating time to do it, so when would you do it? We don't all sit in the coffee room after our lists. The lists are absolutely bunged and massive and work to do and therefore you do your list, you leave. You might have a vague chat in the corridor." (P1, V1)
		"So, there's not necessarily a space for everyone to interact or discuss" (P18, V5)
Endocuff	Adopt Endocuff strategy, behavioural belief	"That's why you've linked [process outcomes increasing detection] together I'm guessing but there may be other things like use of the thing you put on the end of the scope, which name escapes me. (I: Endocuff?) Endocuff. So we could put Endocuff on." (P1, V1)
		"I don't tend to use Endocuff a lot. I do occasionally if I know that somebody's had a lot of small polyps previously and they've come back for surveillance. But I keep thinking maybe I should use it a bit more than I do, so perhaps that might be one thing that I can do as well, just to make a change." (P14, V4)
Unclear Endocuff benefit	Adopt Endocuff strategy, behavioural belief	"I know some people using this Endocuff, which I've never used actually and was quite curious to use but I've never had like one or never happened to be around one. So, I used a cap a few times, mainly for polypectomy just to see how again the more of a trial to see how it worked. I'm not sure if it improves anything but yeah, sometimes in a flat polyp it can help you a bit." (P18, V3)

Table E.3 continued Adopting a plan and process outcomes

Appendix F Qualitative Study Interview Topic Guide Endoscopists [version 4, 29/01/2020]

NED:APRIQOT Qualitative Study

IRAS ID 251770

1) Introduction
    a. Tell me a bit about yourself as an endoscopist?
        i. Demographics: Age, Gender, Professional background
        ii. Professional: Role, experience, time in unit, Background, Lists/week
    b. What do you think about your own endoscopy performance?
        i. How was your training? Challenges and difficulties

2) Feedback and targeted behaviours in endoscopy
    a. Tell me about a time when your received written feedback about your performance in endoscopy?

	Feedback Intervention Theory	Theory Planned Behaviour
Tell me about the content of the feedback?		
Task motivation process		
Were any specific behaviours targeted? Was a discrepancy identified? Any action or behaviour change required?	Feedback standard discrepancy.	
Did changing behaviour feel effective?	Perception of discrepancy reduction with effort.	
Did you believe the change would be successful?	Task beliefs of success.	Behavioural beliefs.
What outcome do you think would happen if you changed behaviour? How likely do you think success would be with this action plan?		Behavioural beliefs.
Meta-tasks and the self		
How did receiving this feedback feel? Why?	Self esteem	
Was it in keeping with your own goals? Any conflict with your own goals? Why?	Self goals	
Would changing your behaviour impact on your relationship with any others? Others approval or disapproval?	Self goals	Normative beliefs
How much control did you have over this behaviour?	Self goal of control	Control beliefs
What barriers stopped you from performing this behaviour?		Control beliefs
Prompts: Skills, Time, Cooperation of others, Resources, environment, enables/barriers		Control beliefs

Task learning processes and task dominance		
Was the behaviour easy or automatic?	Task dominance	Control beliefs
Did you have to learn something new? If so, how was this learnt? (training/mentor/peers)	Learning	
Did this new behaviour interfere with your performance? How?	Interference	
How did you find this experience? Why?	Positive or negative learning experience	

3) Tell me about a time when you have been observed scoping/observed others scoping, or discussed performance? (Normative beliefs)
   a. When would you seek out being observed? How, what opportunities are there?
   b. Feeling:
      i. Would having a buddy be appreciated/concerning?
      ii. Do you feel isolated as an independent endoscopist?
   c. Can detection be improved with buddying?
   d. Skill sharing:
      i. How easy is it?
      ii. What are the barriers to sharing skills currently?
   e. DO you have time for your own learning and reflection on practice?

4) Here's an example of feedback we may use, using your performance data. Talk me through your first impression?

BCI element	Question	Theoretical basis
KPI	Tell me what you understand by these numbers?	Task motivation, able to identify feedback standard discrepancy.
Recommendation	How credible are the targets you have been set? Do they apply to you? Why?	Self
	Are these targets achievable? Why?	Control beliefs
	Which elements are you most focussed on? Prompt green, amber and red highlighted numbers.	Task motivation
Action plans	What change is required from your report? Do you believe you will change behaviour?	Task motivation
	What outcome do you think would happen if you changed behaviour? How likely do you think this is?	Task motivation
	Is the plan in keeping with your own goals? Any conflict with own goals?	Meta-task
	Would changing your behaviour impact on your relationship with any others? Others approval or disapproval?	Meta-task, normative beliefs

	How comfortable are you engaging the nursing team regarding reminders and prompts? Does this impact on your role/relationships?	Normative beliefs, Control.
	How much control did you have over this behaviour?	Meta-task, control beliefs
	What barriers stopped you from performing this behaviour?	Meta-task, control beliefs
	Will changing this behaviour be easy or automatic?	Task learning
	Will you have to learn something new?	Task learning
	Will this new behaviour interfere with your performance? How?	Task learning
Feedback source	How credible do you think about the source of the feedback is? Do you believe this data?	Behavioural beliefs
Trend over time	What do you think about your trend over time?	
	Is this significant change?	
	How motivated would you be to change if you saw improvement or deterioration in performance?	Task motivation effort and discrepancy reduction. Behavioural beliefs.
	Do you think you would see an improvement in your performance next month?	Task motivation belief in success. Behavioural beliefs. Control beliefs.
Normative comparison: National/ Subgroup/ Local data	What do you feel about performance being compared to other endoscopists?	Self and affective response
	Which comparison is most important to you?	Normative beliefs
	Are you motivated by unit data? Who do you compare yourself to from unit data? Is being average OK?	Normative beliefs
Effort of BCI	How much effort is required to take in this information? Is it easily understood?	Meta-task – ease of intervention
	How long would this take to review? Where and when would you review it?	Meta-task – ease of intervention
	Would you look at the further information?	
	How much time would you be willing to look at more data each month?	
	Which is easier to interpret: Prompt three versions: descriptive, table and extended table.	Meta-task – ease of intervention
	Would seeing your action plan trend over time be helpful?	Meta-task – ease of intervention

5) If areas arise not covered in depth by Feedback Intervention Theory or Theory of Planned Behaviour, use of the Theoretical Domains Framework to explore current practice, perceptions of behaviours and barriers:
   a. Skills
      i. Interpersonal skills
      ii. Coping strategies
   b. Beliefs about capabilities
      i. Self-confidence and professional confidence
      ii. Empowerment
      iii. Optimism/pessimism
   c. Beliefs about consequences
      i. Appraisal/evaluation/review
      ii. Unrealistic optimism
   d. Memory, attention and decision-making processes
   e. Environmental context and resources
      i. Resource availability
      ii. Environmental stressors
      iii. Person and environment interaction
      iv. Knowledge of task environment
   f. Social influences
      i. Social support
      ii. Leadership
      iii. Team working
      iv. Organisatioanl climate/culture
      v. Power/hierarchy
      vi. Professional boundaries
      vii. Management commitment
      viii. Negotiation
   g. Emotion
      i. Cognitive overload
      ii. Anxiety/depression
   h. Behavioural regulation
      i. Generating alternatives
      ii. Project management
   i. Nature of behaviours - Breaking habits

6) Thanks and concluding remarks
   a. Many thanks again for undertaking this interview, all your responses will remain anonymous in any dissemination of this work.
   b. Have you any questions for me?

Appendix G Logic map of all themes, subthemes and code clusters

Please see separate Supplementary Appendix G PDF version for clear text.

Figure G1 shows a full map of the analytical framework with all themes, subthemes and code clusters. Themes are shown in solid colour boxes, subthemes are in bold and code clusters in bullet points. Themes relationships are summarised with arrows.

Purple shows the task performance of colonoscopy. Blue shows themes with identification of A&F. Orange shows themes with paradoxical outcomes of rejecting A&F. Red shows themes with potential harms or adverse consequences of A&F interventions. Green shows themes of intended positive outcomes from A&F. The grey box shows Effectiveness and clinical context themes are task moderators impacting on engagement of all other A&F processes, these themes include cognitive interference, critical incidents, enablers and barriers.
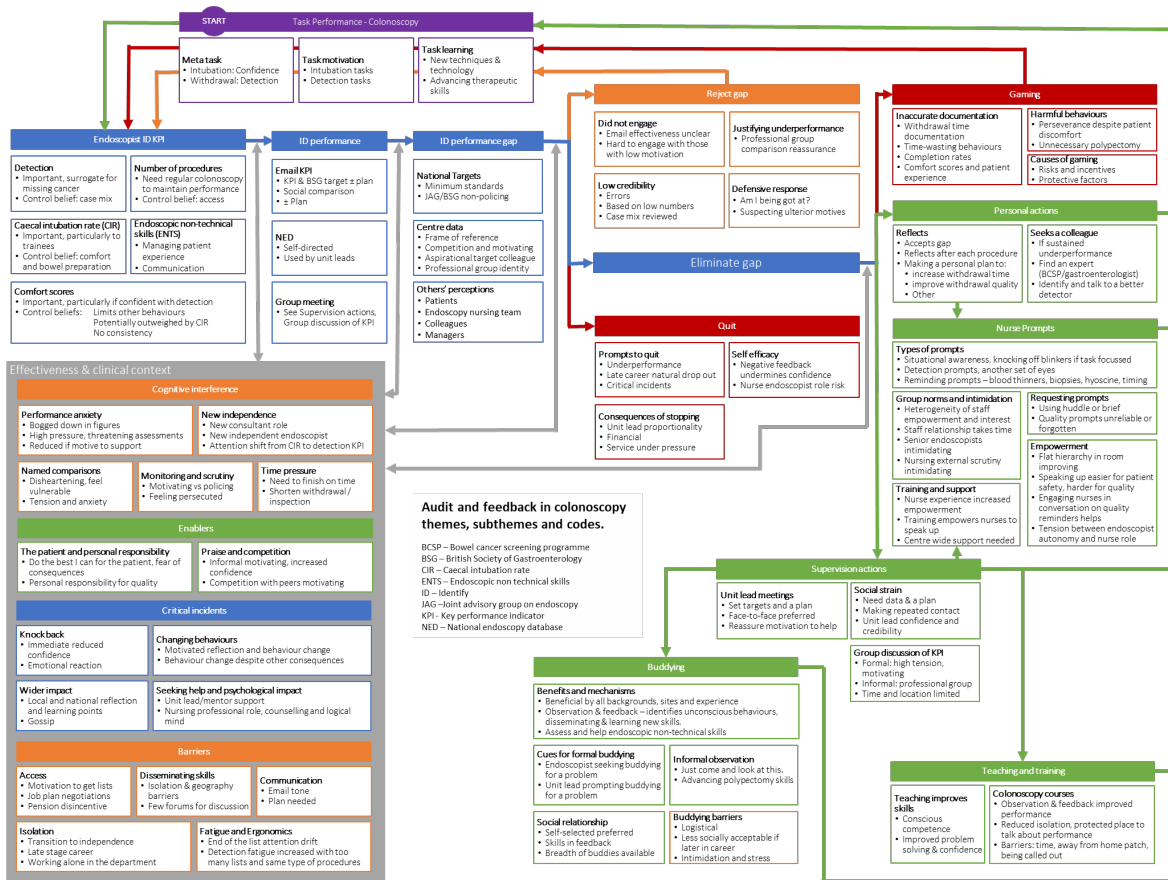

Figure G1 Logic map of all themes, subthemes and code clusters