**Appendix**

**Appendix Table 1:** Studies demonstrating the impact of JAG on quality of care. \*Full publications.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Year** | **Source** | **Division** | **Design** | **Outcome** | **Results / Study Conclusion** | **Impact of JAG** |
| **Quality of Care** |
| Dhayatker14 | 2009 | UK | GRS | Prospective cohort (Colonoscopy; N=2025) | Quality of bowel preparation, PDR, CIR | Poor bowel preparation results in lower PDR and failure of completion. | Audit/validation of JAG standards |
| Moore15 | 2010 | UK | GRS | Retrospective multicentre audit(All endoscopy excluding ERCP, N=29868) | Readmission rates post endoscopy | 147 endoscopy related readmissions (0.49%), with highest rates for therapeutic GI (1.75%) to diagnostic lower (0.38%). Vascular events and post-procedural symptoms were the commonest reason for readmission. 30-day mortality was 6.8%.  | Audit of JAG standards |
| Chatterjee16 | 2011\* | UK | GRS | Prospective, multicentre (N=14) audit(ERCP, N=481) | ERCP standards of care | ERCP completion, sedation, complication rates all within standards set by JAG. | Audit of JAG standards |
| Gavin17 | 2011 | UK | SAAS | Retrospective cohort (Colonoscopy, N=11679) | Tattoo practice  | BCSP accredited screeners have greater yield of advanced polyp detection, perform resection at index endoscopy, and place tattoos appropriately. | SAAS improves polypectomy standards |
| Kurien18 | 2011\* | UK | GRS | Web-based PEG survey (215 centres) | PEG referrals, antibiotic use, local guidelines, aftercare | No significant differences in antibiotic use and PEG indicated for dementia between JAG and non-JAG centres. | Audit of JAG standards |
| Horner19 | 2011 | UK | SAAS | Retrospective cohort(Colonoscopy; N=10026) | CIR, TIIR, PDR, ADR  | CIR and TI intubation rate, PDR, ADR, use of sedation were significantly better amongst Bowel Cancer Screening accredited colonoscopists (all P < 0.0001) compared to unaccredited colonoscopists. | SAAS improves KPIs |
| Bodger20 | 2011\* | UK | GRS | Retrospective multicentre(ERCP; N=40938) | All cause post-ERCP mortality  | Crude mortality 1.5% at 7 days and 5.3% at 30 days. Predictors of 30-day mortality included age, male sex, emergency admission, cancer, and non-cancer comorbidity. | Audit of JAG standards |
| Leyden21 | 2011\* | Ireland | GRS, Training | Retrospective audit(Trainee colonoscopies; N=3079) | CIR, PDR, ADR | CIR, PDR, ADR significantly greater in gastroenterology vs. surgical trainees. “The observed disparity suggests the need for a combined approach to endoscopy training for specialist medical and surgical trainees.” | Audit of JAG standards;JAG as a model for training |
| Butt22 | 2011 | UK | GRS | Retrospective review (Colonoscopy; N=169) | Photodocumentation of caecum | Photodocumentation by gastroenterologists in 97% and general surgeons in 63%. | Audit of JAG standards |
| Verma23 | 2012 | UK | GRS, SAAS | Retrospective multi-centre audit(Colonoscopy, N=16064) | CIR | CIR higher in bowel cancer screening colonoscopy (97.7%) vs. non-screening (88.3%). CIR improves with volume of procedures. | SAAS improves CIR |
| Nayagam24 | 2012 | UK | GRS, Training | Retrospective cohort of JAG certified trainees(colonoscopy; N=2917) | CIR, PDR, sedation | Unsupervised CIR 94.9% in JAG certified trainees, PDR 30%. Senior UK gastroenterology registrars contribute significantly to service delivery, providing high quality colonoscopy, meeting JAG auditable outcome standards. | JAG certification |
| Travers25 | 2012 | UK | SAAS | Retrospective cohort: BCSP vs. non-BCSP endoscopists(Colonoscopy; N=4023) | Tattoo rates in high risk lesions | Tattoo rates significantly higher in BCSP endoscopists (57%) vs. non-BCSP endoscopists (29%). | SAAS improves standards of tattoo practice |
| Butt26 | 2012 | UK | GRS | Retrospective audit(Colonoscopy; N=1261) | Bowel preparation quality, CIR, PDR | Bowel preparation quality correlates with CIR and PDR. | Audit of JAG standards |
| Bhangu27 | 2012\* | UK | GRS | Retrospective audit(Colonoscopy; N=10026) | ADR, PDR, CIR | ADR 19.2%, CIR 90.2%. Higher PDR in surgeons and higher CIR in physicians. Endoscopists accredited for screening and those performing >100 procedures per year had higher ADR. | SAAS improves KPIs |
| Kong28 | 2013 | UK | GRS | Retrospective, multicentre (Colonoscopy, N=2505) | CIR, ADR, PDR | CIR, ADR, PDR improve with increasing endoscopy volume (>100/year vs. <100/yr). Supports JAG recommendations that >100 procedures per year are required to maintain competency. | Audit/validation of JAG standards |
| Verma29 | 2013 | UK | SAASGRS | Retrospective multicentre audit (Colonoscopy; N=6704)  | CIR | CIR lower for female patients vs. male patients.  | Audit of JAG standards |
| Gavin30 | 2013\* | UK | GRS | Retrospective national audit(Colonoscopy; N=20085) | CIR, PDR, polyp retrieval, comfort | CIR 92.3%, PDR 32.1%, polyp retrieval rate 92.3%, 90.2% acceptable levels of patient discomfort. “Significant improvement in the performance of colonoscopy in the UK since previous study (CIR 76.9%), and that performance is above required national standards”. | Impact of JAG on national colonoscopy practice between 2004 and 2011 |
| McGlacken-Byrne31 | 2013 | UK | GRS | Retrospective audit (N=29) | Gastric ulcer follow-up | 48% of gastric ulcers undergo follow-up. JAG standards not met. | Audit of JAG standards |
| El Menabawey32 | 2014 | UK | GRS | Retrospective audit (Colonoscopy, N=10055) | CIR, PDR, Polyp retrieval | Improvements in CIR, TI intubation rates, polyp detection rates across specialties between 2004 and 2012, coinciding with JETS | Potential impact of JAG due to improvements in training |
| Verma33 | 2014\* | UK | GRS | Retrospective cohort (Colonoscopy, N=12594) | CIR | 90% CIR achieved in endoscopists maintaining procedural numbers >120/year. | Validation of JAG standards |
| Lee34 | 2014 | UK | SAAS | Observational BCS(Colonoscopy; N=158) | Completeness of adenoma resection, CIR | Resection of 20mm polyps complete in 92.3% at 1 year, CIR 96.8% | Audit of JAG standards |
| Britton35 | 2014 | UK | GRS | Retrospective cohort(Colonoscopy; N=1743) | Post colonoscopy CRC rates | Post colonoscopy CRC incidence of 2.7%, without variation by endoscopist grade. The incidence of PCCRC in this UK cohort was lower than previously published United States, Canadian, and European studies. Advances in endoscopy quality and safety, driven by the introduction of JAG and BCSP may have attributed toward this. | Potential impact of JAG |
| Valori36 | 2014 | UK | GRS | Retrospective cohort(Colonoscopy; N=20085) | Predictors of Composite CIR (CIRC)  | CIRC (a novel composite outcome combining CIR, patient comfort and sedation) achieved in 54.1%. CIRc associated with increased PDR. JAG unit accreditation was an independent predictor or CIRC (OR 1.26; 95% CI 1.16–1.35). | JAG unit accreditation improves composite outcome of colonoscopy |
| Rafferty37 | 2014 | UK | GRS | Prospective cohort(Colonoscopy, OGD, FS; N=139) | Discomfort scores reported by endoscopists, nurses and patient | Endoscopy nurses gave a higher discomfort score than patients and endoscopists for OGD and colonoscopy. Significant difference between nurse and patient comfort scores, but not patient and endoscopist comfort scores. | Audit/validation of JAG standards.  |
| Cretu38 | 2014 | Ireland | GRS | Retrospective audit (ERCP; N=1192) | JAG ERCP standards | The cannulation, completion and complication rate met the quality assurance standards set by JAG. | Audit of JAG standards |
| Sheppard39 | 2014 | UK | GRS | Retrospective audit(ERCP; N=795) | Successful cannulation of virgin papillae | Procedure success rates per consultant ranged from 79 - 89% for virgin, and 94 - 99% for non-virgin cannulation. | Audit of JAG standards |
| Davies40 | 2014 | UK | GRS | Retrospective audit(Colonoscopy; N=357) | Accurate location of cancer  | Cancer accurately sited on endoscopy in 74%. 13.9% of rectal cancers incorrectly sited, which may delay magnetic resonance imaging and treatment. | Audit of JAG standards |
| Easaw41 | 2015 | UK | GRS | Retrospective audit(Colonoscopy; N=407) | Random colonic biopsies in cases of diarrhoea | Colonic biopsies performed in 79.9%, with microscopic colitis diagnosed in 5.2%. | Audit of JAG standards |
| Aslam42 | 2016 | UK | GRS | Retrospective multicentre audit (Gastroscopy, N=171) | Gastric ulcer follow-up | Malignancy detection rate of 1.2% in follow-up gastroscopy for gastric ulcers. | Audit of JAG standards |
| Ahmed43 | 2016\* | UK | SAAS | Retrospective cohort: Screening vs. non-screening procedures(Colonoscopy; N=1961) | CIR, ADR, polyp retrieval | Screening patients have higher rates of CIR (96.3% vs 90%), higher ADR (46.8% vs. 26.3%), higher polyp retrieval (97.5% *vs* 86.7%) than non-screeners. | SAAS improves KPIs |
| Rees44 | 2016\* | UK | GRS | Guidelines |  | UK guidelines developed by BSG, JAG and ACPGBI, setting minimal and aspirational standards for KPIs and QA in colonoscopy | National standards for colonoscopy |
| **Implementation affecting Quality of Care** |
| Falvey45 | 2009 | UK | GRS | Prospective cohort(Colonoscopy; N=210) | Discomfort scores reported by endoscopists and nurses | Implementing JAG suggestion to include comfort assessment by assisting nurses for endoscopists failing to reach standard. Significant correlation of comfort scores by colonoscopists and nurses, but higher levels of discomfort recorded by nurses. Nurse scoring enabled identification of outlying performance. | Audit/validation of JAG standards. Implementation |
| Dewi46 | 2015 | UK | SAAS | Retrospective multicentre(Screening colonoscopy; N=17699) | Perforation | Root cause analysis of perforations occurring after screening colonoscopy. Perforation rate 0.073% (lower than expected). Management of perforations was less conservative than expected, and was addressed with individual feedback, education and training. | Implementation |
| Thompson47 | 2015\* | UK | GRS | Retrospective review (FS; N=3619) | Conversion from colonoscopy to FS; CIR | 4.7% of FS were originally requested as colonoscopy. Factoring in conversion rates changed endoscopist CIR by median of 1.7%. The frequency of conversion in an endoscopy unit should be audited as it has important repercussions on planning, resource allocations and patient experience. | QA of care; Implementation |

**Appendix Table 2:** Studies demonstrating the impact of JAG on service provision. \*Full publications.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Year** | **Source** | **Division** | **Design** | **Outcome** | **Results / Study Conclusion** | **Impact of JAG** |
| **Quality of Service** |
| Challand54 | 2011\* | UK | GRS | Retrospective observational(Colonoscopy; N=3884) | Clinical performance (composite index of CIR and points per list) | Mean CIR 89.6%, mean points per list: 8.3. 30% of endoscopists met JAG standard in cost effective way. Endoscopists offering training and those with >150 procedures per year associated with better clinical performance. Training was not associated with reduced volume. | Trainer status improves KPIs, Novel performance index based on JAG tool |
| Rostom55 | 2013\* | Canada, UK | GRS | Prospective, multicentre study of validity and reliability of novel comfort score (N=300) | Nurse-Assessed Patient Comfort Score (NAPCOMS) | UK-GRS used to measure acceptability of procedure, and used in development and validation process of novel comfort score. | Novel performance index based on JAG tool |
| Sewitch56 | 2013\* | Canada | GRS | Multicentre patient focus group discussions and survey | Patient derived indicators of care, compared to GRS | Three quality indicator themes were identified by 66 participants in 12 focus groups: communication, comfort and service environment. Of the 29 patient-identified indicators, 17 (58.6%) were novel, suggesting that patients and health professionals differ in their perspectives with respect to quality in colonoscopy services. | Derivation of patient derived indicators in assessing quality of care (based on GRS) |
| Williams57 | 2013\* | UK | GRS | Patient focus group interviews | Validation of GRS items | From the patients’ perspective, the 12 items of the GRS covered all areas of the endoscopy experience. There were no specific concerns identified that were not already covered within the GRS.  | Validation of GRS tool |
| Boereboom58 | 2014 | UK | Training | Survey of adverts for colorectal consultant posts; N=183 | Desirability of JAG certification | JAG colonoscopy certification essential in 13% and desirable in 8% of advertised posts, although 95% included endoscopy sessions. | Quality of service |
| O’Brien59 | 2014 | Ireland | GRS | Retrospective audit(Endoscopy; N=11) | Adherence to JAG surveillance timeframe | 64% of surveillance procedures performed within JAG recommended time. | Audit of JAG standards |
| Mahmood60 | 2015 | UK | GRS | Prospective qualitative – staff opinion of GRS measures (N=21) | Dignity, privacy, quality of endoscopy and resource utilisation | >75% of staff felt that changes brought in the endoscopy unit upon recommendations from JAG improved patient dignity, privacy, and quality of care. | Improvements in quality of service |
| Kilmartin61 | 2015 | Ireland | GRS | Retrospective audit(Colonoscopy; N=57) | Adherence to JAG surveillance timeframe | 75% were scheduled and carried out within 6 weeks of the requested time, with 81 % being carried out within 13 weeks of the requested time. | Audit of JAG standards |
| Valliani62 | 2015 | UK | GRS | Retrospective audit(FS; N=500) | Rate of descending colon intubation | 46% of FS procedures did not reach descending colon, with valid reasons for the majority of cases. Descending colon intubation rate of >90% therefore inappropriate as an eligibility criterion for certification. | Service evaluation; evaluation of proposed JAG standard |
| **Implementation of Endoscopy Service** |
| Caronia63 | 2009 | UK | GRS | Retrospective audit at an independent centre | GRS scores | "A" status was achieved for all the GRS key quality and safety indicators. Patient satisfaction was rated as 98% in both means of testing. | Service implementation - GRS within independent sector |
| Valori64 | 2009 | UK | GRS | Observational, based on nationwide GRS entries from 216 UK units | Waiting times for endoscopy >6 weeks | Patients waiting more than 6 weeks for their procedure reduced from >250,000 in 2004, to <2,000 in October 2008.  | National improvement in waiting times due to GRS |
| Shah65 | 2009 | UK | GRS | Prospective audit (Overdue recall endoscopy procedures; N=974) | Appropriateness of endoscopy | 48% of overdue recall (surveillance) procedures deemed not clinically indicated, and 31% could have been postponed by a median of 23 months. This audit significantly contributed to reducing endoscopy demand and assisting in attaining our 18-week target. | Service implementation |
| De Jonge66 | 2010\* | Canada | GRS | GRS-based patient survey, 4 Canadian units | Feasibility of GRS | High levels of patient satisfaction. Improvements can be made in areas such as information provision before and after the procedure experiences. The results provide an important base from which further quality enhancement can be framed. | GRS as an international benchmark,Service implementation |
| Sint Nicolaas67  | 2011\* | Holland | GRS | Pilot survey, 11 Dutch units | Feasibility of GRS | Use of the GRS in a range of hospitals identified relevant service gaps, in particular pertaining to monitoring of Clinical Quality items, but also in items covering patient experiences. The results indicate that the GRS is a useful QA tool for endoscopy and may guide further quality initiatives in other countries as well. | GRS as an international benchmark,Service implementation |
| Stebbing2 | 2011\* | UK | GRS | Review |  | Describes the implementation process of endoscopy unit accreditation across the UK, with improvements in GRS scores over time.  | Service implementation |
| Coleman68 | 2011 | UK | SAAS | Review |  | Review of BCSP, including accreditation requirements for screening centres and endoscopists. | SAAS and GRS underpinning BCSP |
| Sint Nicolaas69 | 2012\* | Holland | GRS | Survey, 12 Dutch units(N=3434) | Patient experiences using GRS | Significant variations in endoscopy waiting times, recovery room privacy, discomfort during colonoscopy, post-procedural information and willingness to repeat procedure. GRS is feasible in the Dutch endoscopy setting for the assessment of patient experience. The significant variability between endoscopy units can be used to benchmark services and enable shortcomings to be identified. | GRS as an international benchmark,Service implementation |
| Muhammed70 | 2012\* | UK | GRS | Survey (Paediatric units; N=25) | Service provision | There is wide variation in paediatric endoscopy provision. The British Society of Paediatric Gastroenterology, Hepatology and Nutrition (BSPGHAN) endoscopy working group is collaborating with JAG to provide specific standards for paediatric endoscopy services in the UK. | Implementation of standards |
| Kyte71 | 2012 | UK | SAAS | Review |  | Overview of the role of specialist screening practitioners within Bowel Screening Wales, with descriptive of induction, job plan, educational and departmental support. | Service implementation; SAAS |
| Rogers72 | 2012 | UK | GRS | Descriptive of new service: colonoscopy under propofol(N=100) | CIR | 93% of colonoscopies previously failed under conscious sedation were successful with propofol. There has been a sustained demand for propofol sedation, which is well-tolerated and safe in appropriately selected patients. | Service implementation |
| Macintosh73 | 2013\* | Canada | GRS | Descriptive of working group consensus  | Canadian GRS (GRS-C), modified from UK GRS | Development and use of GRS-C based on the Canadian consensus of quality standards, with the aim of encouraging widespread use of the GRS concept in Canada. | Service Implementation |
| Dube74 | 2013\* | Canada | GRS | Review: Impact of GRS in 39 Canadian endoscopy units |  | Over the past two years, >35% of the units that completed the C-GRS at least twice achieved improvements in scoring in 8 out of 12 domains. Score improvements were seen most commonly for “ability to provide feedback to the service”, “comfort” and “privacy” where 50%, 45% and 43%, of units improved, respectively. Conversely, with respect to timeliness of access to the service, improvement in scoring was achieved by only 15%. | Service Implementation |
| Hawkes75 | 2014 | Iraq | GRS | Survey, 24 Iraqi units | Quality of service measured with GRS | Using the UK GRS as a benchmark, this survey demonstrated substantial gaps in service provision and quality of care in Iraqi hospitals. “Resource and training gaps will inform a planned BSG sponsored visit to deliver targeted training on QA, safety and training for endoscopy.” | GRS as an international benchmark, Service implementation |
| Hitchen76 | 2014 | UK | GRS | Descriptive: 5- year experience of a JAG accredited mobile endoscopy service (UGI + LGI; N=26599) | GRS audits | Implementation of community-based endoscopy via a mobile unit is feasible, safe, and can be fully JAG-compliant. | Service implementation |
| Hawkes77 | 2014 | UK | SAAS | Semi-structured interviews: adverse event analyses during Bowel Screening Wales (BSW) | Performance Management Framework (PMF) | Development of a framework for providing safe and supportive environment during complex therapeutic interventions, aiming to provide early identification of problems through central data analysis and specific, targeted training interventions where required. | Implementation of QA process within BSW |
| El Ouali78 | 2015 | Canada | GRS | Prospective dual-centre survey(Colonoscopy; N=500) | Impact of patient satisfaction survey (PSS) on GRS scores | Several items of the GRS improved post administration of the PSS at one of the sites, including equality of access (P=0.0253), booking (p=0.0143), privacy and dignity (P=0.0253). The overall number of "yes" answers increased significantly post PSS at both sites: site 1, 76.7% vs 46.7% (P=0.0037), and site 2 75% vs 60.3% (p<0.0001).  | Service implementation - GRS |
| Carpentier79 | 2016\* | Canada | GRS | Prospective, multicentre (N=3) study in Canada | Canadian GRS (GRS-C): Validity and reliability | GRS-C demonstrated good validity and test-retest reliability. Following a series of process change initiatives over 6 months, 2 units demonstrated significant post-implementation improvements in GRS-C scores. | GRS as an international benchmark,Service implementation |
| Nyahoda80 | 2016 | Malawi | GRS;Training | Observational – setup of endoscopy unit in Malawi | DOPS performance, GRS, endoscopy volume | Following intensive training with donated endoscopes, DOPS undertaken showed gradual improvements in endoscopic skills. GRS scores improved with regard to patient consent, clinical monitoring, reporting and audit. Endoscopies undertaken increased from 108 to 376, with variceal band ligation increasing from 17 to 51. | Service implementation |
| Rossos81 | 2016 | Canada | GRS | Review | Pilot of novel endoscopy informatics system | Implementation of the Structured Notes Auditing and Reporting in Endoscopy (SNARE) Project using GRS elements – the first national initiative to combine standardized reporting, quality indicators and endoscopist practice and performance feedback. | Service implementation; based on GRS tool |
| Narula82 | 2017\* | UK | GRS | Prospective observational, 8 pilot sites | Feasibility of paediatric GRS | Level B or above achieved in 12-63% for the clinical quality domain, 0-38% in the quality of patient experience domain, 12-38% in the workforce domain, and 0% in the training domain. | Service implementation |
| Wan83 | 2017 | UK | GRS | Retrospective audit(N=47) | Feasibility of paediatric GRS | Audit allows comparison of performance against endoscopy and patient domains in the P-GRS, and highlighted the need for collaboration with other stakeholders, e.g. anaesthetics and theatre staff to implement change. | Service implementation |

**Appendix Table 3:** Studies demonstrating the impact of JAG on endoscopy training. \*Full publications.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Year** | **Source** | **Division** | **Design** | **Outcome** | **Results / Study Conclusion** | **Impact of JAG** |
| **Quality of Training** |
| Cornish87 | 2010 | UK | Training | Survey of higher surgical trainees | Satisfaction with endoscopy training | Nine final year trainees (mean 33 months colorectal experience) had completed a median of 200 colonoscopies, 45 polypectomies, with only one stent insertion and EMR procedure. Over 33% felt that their endoscopy training had been inadequate. | QA of training |
| Haycock88 | 2009 | UK | Training | UK trainee survey (N=249) | Standards of teaching, training and supervision in endoscopy | 52.3% attend the recommended minimum of 2 endoscopy sessions per week. 78% are fairly or very satisfied with their endoscopy training. The most common complaint from trainees was lack of access to regular supervised training lists. | QA of training – trainee satisfaction |
| Haycock89 | 2010\* | UK | Training | UK trainee survey; comparison between 2007 and 2002 | Quality of training over time | Significantly more trainees said that they had been formally taught the principles of colonoscopy (91 vs. 65%; P = 0.02) and polypectomy (81 vs. 52%; P = 0.02) than in 2002, and reported lower complication rates. Trainers displayed more appropriate teaching strategies and course attendance had significantly increased (84 vs. 48%, P = 0.003). 87% of trainees thought that their training had been adequate or better than adequate, compared with 25% in 2002. | QA of training – trainee satisfaction and quality of training |
| Kelly90 | 2010\* | UK | Training | Literature review | Evidence for accreditation assessment (“driving test”) for BCSP | For trained colonoscopists with proven satisfactory performance outcomes, it is not clear if the addition of a "driving test" is necessary to select screening colonoscopists. | Research based on JAG service. |
| Samji91 | 2011 | UK | Training | Prospective analysis of trainer feedback on JETS (N=376) | Trainer feedback | The majority of UK trainees that gave feedback anonymously on the JETS website feel they receive a high standard of training. | QA of training - trainee satisfaction |
| Griffiths92 | 2011 | UK | Training | Retrospective analysis of JETS data | Service provision by registrars  | 28% of registrar procedures were on service lists. High quality training will result in competent, experienced, independent trainee endoscopists who can support the service of the trust in which they work | QA of training |
| Hussain131 | 2011 | UK | Training | Comparative study of 4 experienced endoscopists(Colonoscopy, N=598) | Colonoscopy KPIs  | Attendance of JAG-certified advanced colonoscopy course improves polyp retrieval and biopsies for chronic diarrhoea, with increase in CIR (87.7 to 93.3%) and mild-minimal discomfort scores (71% to 82%). | JAG course improves KPIs |
| Dharmasiri93 | 2012 | UK | Training | Survey of trainees achieving e-certification(N=33) | Satisfaction with e-certification | 69.2% agreed and 23.1% strongly agreed that JAG e-certification was better than the previous certification process it replaced. The majority felt that the process was quicker and less time consuming. | QA of training; certification process |
| MacDougall94 | 2013 | UK | Training | Observational; trainer performance at trainer courses | Reliability of novel trainer assessment tool (DOTS) | The DOTS tool showed a high level of internal consistency, but limited reliability. | QA of training; JAG supported research |
| Hammond95 | 2013\* | UK | Training | National survey of general surgery trainees (N=233) | Satisfaction with endoscopy training | There were high rates of dissatisfaction with endoscopy training nationally. Two thirds of trainees had no scheduled training lists. Conflicting elective/emergency commitments, competition and absence of training lists were the most common reasons for a failure to access endoscopy training. | QA of training |
| Ansell96 | 2013 | UK | Training | Prospective validation of polypectomy simulator; N=40 trainees, 4 levels of experience | DOPyS scores | DOPyS scores higher and procedural times shorter in more experienced trainees, with favourable interrater reliability. This simulator demonstrates good construct and concurrent validity for use in colonic polypectomy training. | Research based on JAG tool |
| Hawkes97 | 2014 | UK | SAAS | Qualitative semi-structured interviews in Bowel Screeners | Learning opportunities analyses | The structured learning diary proved to be a practical and useful tool to identify learning opportunities in the context of routine BSW screening lists. Participants identified a number of learning needs - most commonly reported were cognitive skills related to lesion assessment and decision-making. | QA of training |
| Ward98 | 2014\* | UK | Training | Retrospective analysis of JETS data (Colonoscopy) | Procedures to achieve colonoscopy competence (CIR>90%) | By moving average analysis, the cohort of trainees reached a CIR of 90% at 233 procedures. By LC-Cusum analysis, 41% of trainees were competent after 200 procedures. | QA of training; JAG supported research |
| Ansell99 | 2014\* | UK | Training | Comparison of trainee self-assessed vs. assessor scores in polypectomy | DOPyS scores | There was a weak correlation between assessors' scores and self-assessment scores for all groups. There was a strong correlation between scores from assessor 1 and 2 for polyp A (rho =.80, P <=.01) and polyp B (rho =.80, P <=.01). | Research based on JAG tool; Interrater reliability of DOPyS |
| Ansell100 | 2014\* | UK | Training | Prospective cross-sectional study (20 novice, 20 intermediate, 20 advanced, 20 expert endoscopists) | Validity of porcine polypectomy simulator model, scored using DOPyS | Median DOPyS scores correlated with endoscopist experience. There were no differences between real-life DOPyS scores and simulator scores.  | Research based on JAG tool |
| Beejooa101 | 2014 | UK | Training | Deanery-level gastroenterology trainee survey (N=29) | Quality of training | 62% of trainees were satisfied with the level of supervision during endoscopy. There is considerable variability in opportunities and quality of colonoscopy training in the NW Deanery. It is reassuring that STs seem to achieve these targets by ST7 despite the challenges identified. | QA of training – trainee satisfaction and quality of training |
| Ewing102 | 2014 | UK | Training | Retrospective analysis (Colonoscopy; N=5307) | CIR | Trainees performing colonoscopy on dedicated training lists delivered comparable completion rates to consultants and outperformed their predecessors.  | QA of training |
| Jones103 | 2015\* | UK | Training | UK trainee survey (N=216) | Delivery of endoscopy training | Gastroenterology trainees attended more endoscopy lists and training lists than surgical trainees. A significantly higher proportion of gastroenterologists than surgeons had already achieved accreditation in endoscopy.  | QA of training |
| Chadwick104 | 2015 | UK | Training | Nationwide BSG trainee survey (N=263) | Quality of training | Only 45% of ST6 trainees achieved provisional certification and 21% full colonoscopy certification, with a third of ST7 trainees having not completed full colonoscopy certification by their final few months of training. Access to endoscopy training lists is inadequate, with 39% of trainees not having access to the minimum of one training list per week recommended by JAG. | QA of training |
| Bhatt105 | 2015 | UK | Training | Retrospective JETS analysis (All training procedures; N=126,448) | Procedure numbers, dedicated training lists  | Variation in procedural exposure by deanery and trainee grade. Only 17% of trainees met nationally recommended numbers of diagnostic endoscopic procedures per annum set by the SAC. | QA of training |
| Axe106 | 2015 | UK | Training | Qualitative interviews of novice UGI endoscopy trainees | Developmental phases during learning | Qualitative investigation provides important detail on learning needs of trainees at varying stages of the UGIE learning pathway. These vary considerably over time and trainers need to be aware of affective and cognitive factors and adjust techniques and training environment to optimise skills development. | Learning Theory; use of JAG tools |
| Everett107 | 2015 | UK | Training | Regional survey of general surgery trainees (N=62) | Quality of training | 57% were JAG registered, 30% were inputting procedures into the JAG logbook and 25% were using the assessment tools. 67% of trainees stated that they attended no training lists per week. None were JAG accredited for any procedures. | QA of training |
| Amadio108 | 2015 | UK | Training | Cohort analysis – novice colonoscopists (N=22) | Correlation between self and assessor DOPS scores | There was excellent inter-rater reliability between the two expert raters, but correlation between trainee and trainer rating was poor. | Research based on JAG tool; validation of DOPS |
| Anderson12 | 2016\* | UK | Training, GRS, SAAS | Review |  | Review of accreditation processes within the UK | Accreditation and training |
| Rajendran109 | 2016 | UK | Training | Retrospective JETS analysis (Polypectomy) | Time to competence (DOPyS) | 75% of trainees analysed achieved competent polypectomy scores in a time frame of 6 months to a year.  | QA of training |
| Van Doorn110 | 2016 | Holland | Training | Prospective cohort study: impact of lectures on trainee polypectomy skills (N=8) | Competence measured by DOPyS pre- and post-lecture training | No significant difference in DOPyS pass rates before and after lecture-based training. To optimize polypectomy training and competency, direct feedback in the endoscopy suite and hands-on training by dedicated teachers are essential. | Research based on JAG tool |
| Ward111 | 2017\* | UK | Training | Retrospective analysis of JETS data (Gastroscopy) | Procedures to achieve gastroscopy competence (D2 intubation >95%) | By moving average method, trainees attained a 95% completion rate at 187 procedures. By LC-Cusum analysis, after 200 procedures, >90% trainees had attained a 95% completion rate. Total number of OGDs performed, trainee age and experience in lower GI endoscopy were independently associated with OGD completion. | QA of training; JAG supported research |
| Grover112 | 2017\* | Canada | Training | Prospective RCT: curriculum based simulation training vs. self-directed learning (N=33)  | Trainee performance (measured using DOPS) in first 2 colonoscopies | Participants in the simulation-based training group performed better in their first 2 colonoscopies, had significantly greater knowledge after training, demonstrated better communication, global performance, and colonoscopy-specific performance.  | Research based on JAG tool |
| Patel113 | 2017\* | UK | Training | International survey (N=610 colonoscopists) from 19 countries | Experiences of polypectomy training and guidelines for assessment | Respondents comprising 57% trainers and 43% trainees. 6.6% of trainers assessed competency once per year or less. 53.1% of trainees had ever had any form of polypectomy assessment. Only 4 of 19 countries surveyed had specific guidelines on polypectomy training.  | QA of training |
| **Implementation of Training** |
| Mehta116 | 2010 | UK | Training | Descriptive: implementation of JETS e-portfolio | Uptake of JETS | After 3 months of release, nearly one quarter of English Trusts are using the JETS e-Portfolio. A staged release in Wales and Northern Ireland is also planned. Initial data suggest that trainees are very willing to input data into the JETS e-Portfolio.  | Implementation of JETS |
| Dunckley1 | 2011\* | UK | Training | Review |  | Review on the implementation process for QA of training, covering JETS and the training domain of GRS. | Implementation of training/service |
| Sinha114 | 2011 | UK | Training | Observational | Uptake of JETS e-portfolio | Nearly 12 months after its release, 76.2% of the trusts in UK have set up the JETS e-portfolio and 55.6% are actively using it. This steady uptake across the UK shows that the service finds this a valuable tool.  | Implementation of JETS |
| Walker115 | 2011 | UK | TrainingGRS | Prospective comparison (N=22 trainees) | Impact of e-booking on utilisation of training lists | Dedicated e-booking system for endoscopy training significantly improves utilisation of dedicated training lists (17.7% in 2007 to 61.0% in 2010). | Implementation of training; JAG QA of training |
| Mehta6 | 2011 | UK | Training | Review  |  | Review article describing national implementation of the JETS e-portfolio and certification. | Implementation of JETS  |
| Lamb117 | 2011 | UK | Training | Prospective audit: impact of generic training lists | Training endoscopy exposure | Implementation of generic training lists increased mean training lists from 7.8 to 13.6 per quarter per trainee. This was associated with a mean increase in CIR, number of procedures and DOPS per trainee. | Implementation of training; QA of training  |
| Gupta118 | 2011\* | UK | Training | Prospective multicentre study: Deconstruction of polypectomy into DOPyS with validation | Reliability analysis of DOPyS | The majority of the assessors agreed across the pass/fail divide for the global assessment scale in 58 of 59 (98%) polyps.  G-theory analysis suggested that DOPyS is a reliable assessment tool, provided that it is used by 2 assessors to score 5 polypectomy videos all performed by 1 endoscopist. | Implementation/validation of DOPyS |
| Gupta119 | 2012\* | UK | Training | Prospective video analysis of polypectomies | DOPyS scores | DOPyS could reliably differentiate between polypectomies performed by endoscopists of different levels of experience, but only if the assessors were trained in the use of the assessment tool. | Implementation/validation of DOPyS |
| Barton120 | 2012\* | UK | Training | Observational; DOPS analysis for BCSP cohort | Reliability analysis of DOPS | DOPS had high relative reliability: G=0.81. The DOPS grades correlated highly with a global expert assessment. The candidates and assessors believed that the DOPS was a valid assessment of competence. | Implementation of DOPS; validation of DOPS in BCSP assessment |
| Geraghty86 | 2012 | Malawi | Training | Descriptive of delivering JAG courses (N=14) in Malawi | JAG format DOPS and course evaluations | Training models and audit, reporting and assessment tools were introduced. A Basic Skills in Gastroscopy course appropriate to local circumstances was delivered, evaluated and modified over each visit, and ultimately delivered by two locally-trained Trainers. | Implementation of training; applying JAG training model internationally |
| China121 | 2014 | UK | Training | Derivation of novel framework for assessing competence in upper GI bleeding | Feasibility, validity and educational impact of new DOPS | This novel UGIB DOPS has demonstrated significant educational impact by leading to effective feedback on trainee performance and results in an action plan for further training. The DOPS is feasible for routine use in the clinical setting. The tool is currently fit for purpose to improve training in UGIB management. | Implementation of novel DOPS |
| Hawkes122 | 2015 | UK | Training | Comparative: Accelerated (SPRINT) vs. standard endoscopy training; N=14 | Time to milestones | Median time to each landmark was significantly faster at all stages in the SPRINT group. A well-structured training pathway, incorporating evidence-based training methods can enhance training quality and experience and improve efficiency of training - in this case halving training time in UGI endoscopy compared to historic controls. | Implementation of training pathway facilitated by JAG resources (DOPS, e-portfolio, courses) |
| Bonnington135 | 2015 | UK | Training | Survey and DELPHI process involving 43 professionals | DOPS for PEG insertion | Statements agreed by the survey and DELPHI consensus methods were used to form the structured assessment document for PEG assessment (DOPS), to be made available via JETS. | Implementation of novel DOPS |
| Watson123 | 2015 | UK | Training | Descriptive of novel learning course (supported by JAG)  | Implementation of National Nurse Endoscopist Course | 45 course participants so far ranging from trainee nurse endoscopists already in post to nurses applying to become trainee endoscopists. They all rated the course very good or excellent. A course such as this raises the profile of the nurse endoscopist role and helps address the national workforce shortfall for endoscopists. | Implementation of training; JAG supported course |
| Axe124 | 2015 | UK | Training | Descriptive of novel teaching programme, validated from trainee interviews (N=7) | Impact of endoscopic lesion recognition programme | Processes at baseline, 3 months and 4 months are described. Initial exposure should focus on common pathologies, to develop confidence and observation skills. Once handling skills are secure, structured observation and classification structures link knowledge at a deeper level. | Implementation of training; novel endoscopic lesion recognition programme |
| Lee125 | 2016 | UK | Training | Descriptive: implementation of NED |  | NED is based on the successful JETS. It has been developed to gather data for calculation of KPIs for OGD, flexible sigmoidoscopy, colonoscopy and ERCP.  The ability to centrally collect endoscopy performance data will be an invaluable tool for monitoring and improving endoscopy quality and will provide a platform for endoscopy research. | Implementation of training, service implementation in conjunction with JAG |
| Kaminski132 | 2016\* | Poland | SAAS, Training | RCT: Polish Bowel Cancer Screeners with ADR<25% | ADR | Training Colonoscopy Leaders (TCL) intervention superior to feedback in improving ADR. Teaching centre leaders in colonoscopy training improved important quality measures in screening colonoscopy. | SAAS based training can improve ADR |
| Siau126 | 2017 | UK | Training | Retrospective analysis of DOPS(All modalities; N=8601) | Validation of Endoscopic non-technical skills (ENTS) scores | ENTS is an assessable domain within endoscopy training, with scores that correlate with other procedure-related skills, demonstrating construct validity of the ENTS scoring system. | Implementation of training; impact of JAG tools (DOPS) |
| Siau127 | 2017 | UK | Training | Retrospective comparison of new and old DOPS scoring scale (N=8219) in junior trainees  | Distribution of scores, Competent scores. | Endoscopy assessors are applying a greater range of scores using a new DOPS rating scale based on degree of supervision, in two cohorts of trainees matched for experience. This indicates better construct validity with the new rating scale. | Implementation of training; impact of JAG tools (DOPS) |
| Siau128 | 2017 | UK | Training | Retrospective analysis of JETS data (N=885) | Quality of training | Training on endotherapy prior to certification is limited. The current UGI certification process does not ensure competency in endotherapy for UGIB. In response, the JAG QA team have recently released new DOPS forms specific to UGIB, and are consulting on introducing formal certification in endotherapy for UGIB. | QA of training; Implementation of GI bleed certification |
| Siau7 | 2017 | UK | Training | Retrospective analysis of JETS data | Certification numbers over time, post certification KPIs | Increase in uptake of certification awarded over time. Endoscopy certification is a transparent and robust benchmark for assessing competency, as evidenced by trainee KPIs. | Implementation of certification |
| Hui134 | 2015\* | Hong Kong | SAAS, Training | RCT comparing nurses with medical endoscopists (Screening colonoscopy, N=731) | ADR, CIR, intubation time, pain and patient satisfaction scores | Nurse endoscopists in Hong Kong, when trained according to JAG curriculum, had better ADR (43.8% vs 32.7%), longer withdrawal times, better patient satisfaction and pain scores. ADR lower when adjusting for withdrawal times. | JAG curriculum improves screening outcomes abroad |
| Patel129 | 2017\* | UK | Training | Retrospective JETS analysis | Polypectomy experience at colonoscopy certification | Since introduction of DOPyS, there was a significant increase in the number of logged polypectomy assessments, experience of endoscopic mucosal resection, and formative colonoscopy assessments  | Implementation of DOPyS |
| Biswas130 | 2017\* | UK | Training | National survey (N=281) | Satisfaction with training | 85% of trainees were satisfied with the level of supervision of their training. 12.5% of trainees had no access to a regular training list. Strategies for addressing these deficits discussed. | Implementation of training |