UK & Ireland Joint Advisory Group (JAG) Consensus Statements for Training and Certification in diagnostic Endoscopic Ultrasound (EUS)

El Menabawey, Tareq[1]; **McCrudden**, Raymond[2]; **Shetty**, Dushyant[3]; **Hopper**, Andrew[4]; **Huggett**, Matthew[5]; **Bekkali**, Noor[6]; **Carroll**, Nicholas[7]; **Henry**, Elaine[8]; **Johnson**, Gavin[9]; **Keane**, Margaret[10]; **Love**, Mark[11]; **McKay**, Colin[12]; **Norton**, Sally[13]; **Oppong**, Kofi[14]; **Penman**, Ian[15], **Ramesh**, Jayapal[16]; **Ryan**, Barbara[17]; **Siau**, Keith[18]; **Nayar**, Manu[19].

On behalf of the Joint Advisory Group on Gastrointestinal Endoscopy (JAG)

Institutions:
[1] Department of Gastroenterology, University College London Hospitals, London, UK
[2] Department of Gastroenterology, University Hospitals Dorset NHS Trust, Bournemouth, UK
[3] Department of Radiology, Royal Cornwall Hospitals NHS Trust, Truro, Cornwall, UK
[4] Department of Gastroenterology, Sheffield Teaching Hospitals NHS Foundation Trust, UK
[5] Department of Gastroenterology, The Leeds Teaching Hospitals NHS Trust, Leeds, UK
[6] Department of Gastroenterology, Oxford University Hospitals NHS Foundation Trust, Oxford, UK
[7] Department of Radiology, Cambridge University Hospitals NHS Foundation Trust, Cambridge UK
[8] Department of Gastroenterology, NHS Tayside, Perth, Scotland, UK
[9] Department of Gastroenterology, University College London Hospitals, London, UK
[10] Division of Gastroenterology and Hepatology, Johns Hopkins Hospital, Baltimore, USA
[11] Department of Radiology, Belfast Health & Social Care Trust, Belfast UK
[12] Department of HBP Surgery, Glasgow Royal Infirmary, Glasgow Scotland UK
[13] Department of General Surgery, University Hospitals Bristol & Weston NHS Trust, UK
[14] Department of Gastroenterology, Newcastle Hospitals NHS Foundation Trust, Newcastle UK
[15] Centre for Liver & Digestive disorders, Royal Infirmary of Edinburgh, Scotland UK
[16] Department of Gastroenterology, Royal Liverpool Hospital NHS Trust, Liverpool UK
[17] Department of Gastroenterology, Tallaght University Hospital, Trinity College Dublin, Ireland
[18] Department of Gastroenterology, Royal Cornwall Hospitals NHS Trust, Truro, Cornwall, UK
[19] Department of Gastroenterology, Newcastle Hospitals NHS Foundation Trust, Newcastle UK

Corresponding author: Manu Nayar manu.nayar@nhs.net

Contributions:

Conception:	RM, NC, KS, GJ
Steering Group:	MN, RM, GJ, TEM, KS
Delphi design:	RM, KS, GJ, MN, TEM
Delphi online survey design:	TEM, RM, MN
Literature searches:	Section lead authors 1) TEM, 2) DS, 3) AH & 4) MH and All Authors
Electronic voting:	All Authors
Manuscript draft:	RM (1st&4th), TEM(2nd), MN(3rd) and All Authors
Critical review and approval of final version:	All Authors

Competing Interests: None
Word Count: 10,256, and Title page 409 **Abstract**: 323

Key Words: Endoscopic Ultrasound, DOPS, Competence based learning in Endoscopy

Supplementary Files
1: Authorship
2: JAG Formative DOPS in EUS
3: Domains for EUS Syllabus
4. Key Landmarks for Stations for EUS
5. Training ladder in Teaching & Learning in Endoscopic Ultrasound

ABSTRACT

Background & Aims
International endoscopy societies vary in their approach for credentialing individuals in Endoscopic Ultrasound (EUS) to enable independent practice, however there is no consensus in this or its implementation. In 2019 the Joint Advisory Group in GI Endoscopy (JAG) commissioned a working group to examine the evidence relating to this process for EUS. The aim of this was to develop evidence-based recommendations for EUS training and certification in the UK.

Methods
Under the oversight of the JAG quality assurance team, a modified Delphi process was conducted which included major stakeholders from the UK and Ireland. A formal literature review was made, initial questions for study were proposed and recommendations for training and certification in EUS were formulated after a rigorous assessment using the GRADE tool and subjected to electronic voting to identify accepted statements. These were peer reviewed by JAG and relevant stakeholder societies before consensus on the final EUS certification pathway was achieved.

Results
39 initial questions were proposed of which 33 were deemed worthy of assessment and finally formed the key recommendations. The statements covered 4 key domains principally: Definition of competence (13 statements), Acquisition of competence (10), Assessment of competence (5) & Post certification Mentorship (5).

Key recommendations include: 1) Minimum of 250 hands-on cases before an assessment for competency can be made, 2) Attendance at the JAG basic EUS course 3) Completing a minimum of one formative direct observation of procedural skills (DOPS) every 10 cases to allow the learning curve in EUS training to be adequately studied, 4) competent performance in formative and summative DOPS assessments, and 5) a period of mentorship over a 12 month period is recommended as minimum to support and mentor new service providers.

Conclusions
An evidence-based certification pathway has been commissioned by JAG to support and quality assure EUS training. This will form the basis to improve quality of training and safety standards in EUS in the UK & Ireland.

Introduction

Endoscopic ultrasound (EUS) is an advanced endoscopic procedure which combines endoscopy with acquisition and interpretation of radiological images. To achieve competency in EUS requires dedicated and supervised training. The provision of high-quality endoscopy services for all modalities is dependent on high quality training. In 2011 a working party published a consensus on the future of UK EUS service provision and training[1]. Their proposed training framework included (1) an understanding of safe and appropriate endoscopic practice, (2) a working knowledge of the clinical management of those conditions for which EUS may be requested, (3) an understanding of the strengths and weaknesses of EUS in comparison to alternative imaging modalities, (4) an understanding of regional anatomy, (5) the principles of medical ultrasound (6) an appreciation of tissue acquisition for cytopathology & histopathology assessment; and finally (7) a working knowledge of anorectal and endobronchial ultrasound. It did not, however, highlight specific ways in which trainees should be credentialled for independent practice.

In 2018, the European Society of Gastrointestinal Endoscopy (ESGE) published key performance indicators (KPIs) for the practice of ERCP and EUS[2]. Although the focus was primarily ERCP, recommendations for EUS included the identification of pathology in terms of tissue sampling and documenting EUS landmarks.

In the UK, the Joint Advisory Group on Gastrointestinal Endoscopy (JAG) is responsible for setting standards of endoscopy training and certification[3]. JAG certification is a national and standardised process in the UK whereby a trainee formally credentials for independent endoscopic practice. It has been awarded since 2011 for gastroscopy, flexible sigmoidoscopy & colonoscopy[4], and the pathways for ERCP and Gastroscopy have recently been published[5,6].

Following consultations with the UK Specialist Advisory Committees (SACs), an expert committee was commissioned by JAG Quality Assurance of Training (QAT) Working Group to prepare for a Delphi Process to work towards a certification process for diagnostic EUS.

Aims and Scope

The aim of this Delphi process was to develop a robust set of recommendations which would form the framework of EUS certification within the UK. Specifically, recommendations were made in the following areas:

1. Definition of competence for trainees in EUS
2. Acquisition of competence
3. Assessment of competence
4. Post certification mentorship

The following aspects were not included within the scope of this guideline:

- Therapeutic EUS procedures
- Rectal EUS and Endobronchial Ultrasound (EBUS)
- Paediatric EUS

Methods

Guideline development

A modified Delphi process was utilised to develop consensus-based recommendations on training and certification in EUS with representation from U.K. & Ireland training bodies, trainees and representation from key stakeholder societies which included:

I. Joint Advisory Group for GI Endoscopy (JAG)
II. British Society of Gastroenterology (BSG)
III. British Society of Gastrointestinal and Abdominal Radiology (BSGAR)
IV. UK & Ireland EUS Society (UKIEUS)
V. Association of Upper Gastrointestinal Surgeons (AUGIS)
VI. Pancreatic Society of Great Britain and Ireland (PSGBI)

From an invited cross section of 24 women and men representing consultants, trainees, radiology, surgery and gastroenterology, district general and teaching hospitals, 19 agreed to participate in the process. (Supplementary File 1). Meetings were conducted via teleconferencing (due to the COVID-19 pandemic) and participants were allocated to 4 working groups that were each responsible for one of the 4 domains of the guideline. Each working group was tasked with framing the questions relevant to their section, using a Population, Intervention, Comparator and Outcome (PICO) format where possible. Literature searches were conducted by independent working groups on major databases including The Cochrane Database of Systematic Reviews, Embase and Medline. Results for each question were collated and summarised into a recommendation statement.

Recommendations were appraised using the Grading of Recommendation Assessment, Development and Evaluation (GRADE) framework[7]. The level of evidence and strength of recommendation were provided for each statement. Given the paucity of evidence around EUS training, statements were permitted to receive discordant recommendations if the perceived benefits in clinical practice outweighed the level of available evidence.

Consensus process

The process started in December 2019. Two virtual meetings took place in 2020 with statements confirmed for voting in February 2021. Round 1 of anonymised voting took place online in August 2021. Statements that did not meet the 80% agreement threshold were discussed in a further group call and either discarded or amended for a further round of voting, which took place in December 2021.

Participants rated each statement on a 5-point Likert Scale (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). 80% or more agreement was the specified a priori threshold to accept a statement; ratings of "agree" or "strongly agree" indicated agreement. Upon completion of the accepted statements, the document was ratified by relevant stakeholder groups and SACs for review. Statements were then included in the final EUS certification pathway (Figure 1).

Recommendation statements

In total 33 recommendations statements were generated for the following domains:

1) Definition of competence (13 statements)
2) Acquisition of competence (10 statements)
3) Assessment of competence (5 statements)
4) Post certification mentorship (5 statements)

A full list of subsequent recommendations is highlighted on Table 1.

During the review of evidence, the group also agreed auditable KPIs that would act as a benchmark for competent independent practice and with time incorporated into the JAG Endoscopy Training System (JETS) to bring EUS in line with other endoscopic accreditation in the UK (Supplementary File).

Section 1: Definition of Competence in performing Diagnostic Endoscopic Ultrasound (EUS)

1.1 Diagnostic EUS is described as the imaging modality of endoscopic ultrasound with and without tissue acquisition with fine-needle aspiration or fine-needle biopsy needles.

(*Strong recommendation, low quality evidence).*

Consensus: 89%

EUS is both an endoscopic and imaging modality and so competency in EUS can be defined as being able to perform independently both the endoscopic and imaging component of the procedure. Much of EUS involves lesion identification and assessment so a competent operator must be able to perform tissue acquisition safely using FNA or FNB needles[1].

1.2 For a successful diagnostic endoscopic ultrasound study without biopsy the endoscopist should be able to insert the echoendoscope to the desired level within the gastrointestinal tract dictated by the remit of the study, perform a structured station assessment and identify recognised anatomical landmarks specific to that study.

(*Strong recommendation, moderate quality evidence).*

Consensus: 100%

There are two main types of study for diagnostic gastrointestinal EUS 1) upper gastrointestinal imaging (including the posterior mediastinum) and 2) hepato-pancreaticobiliary (including retroperitoneal) EUS. Both involve the placement of the echoendoscope through the oesophagus, gastro-oesophageal junction, and stomach; the latter also involves placement into the duodenal bulb and D2 in a safe manner whilst acquiring adequate imaging of relevant structures (Table 4). Operators may choose to practise in one or both disciplines and must be able to adequately visualise and if appropriate sample relevant structures.

The ASGE and ESGE recognise anatomical landmark identification as an important measure of quality endoscopy[8,9]. A multicentred prospective study examining learning curves for EUS trainees incorporated landmark identification as part of competency assessment[10]. The extent of the EUS exam will vary depending on the clinical indication. As such, KPIs relating to procedure completion must be matched to the indication (see Table 3).

1.3 EUS competence requires both cognitive and technical abilities and should be defined as the ability to independently carry out effective diagnostic procedures across a spectrum of case mix and context with acceptable safety.

(*Moderate recommendation, low quality evidence)*

Consensus: 89%

Competency is “a complex set of behaviours built on the components of knowledge, skills, attitudes, and competence as “personal ability”[11]. To achieve competency an operator must

develop both the technical ability to perform EUS (for example scope handling) and develop their knowledge base of ultrasound imaging in order to interpret real time images for diagnosis and act on their findings.

1.4 The endoscopist must be able to effectively identify and precisely describe the gastrointestinal wall layers and perilesional structures to demonstrate the likely origin of a subepithelial mass for T-stage evaluation and lymph node evaluation.

(*Strong recommendation, low quality evidence)*

Consensus: 100%

The ability to identify the layer of origin of subepithelial lesions is crucial to determining the likely underlying diagnosis and involvement of surrounding structures. T-staging has been studied and validated as a surrogate marker of competent performance[11,12].

1.5 A comprehensive understanding of the anatomical landmarks is mandatory for safe EUS guided tissue acquisition for gastrointestinal lesions and non-gastrointestinal tumours (e.g., lung cancer, sarcoma etc.) where understanding of relevant posterior mediastinal and retroperitoneal anatomical landmarks is necessary.

(*Strong recommendation, low quality evidence)*

Consensus: 95%

Many authors agree that the rationale in understanding anatomical landmarks is key to interpreting EUS imaging[2,8,14,15]. Moreover, a variety of authorities have highlighted the need for a comprehensive learning tool for trainees to be able to assess all aspects of training[16]. Tissue acquisition is undertaken frequently as part of routine EUS practice[17]. Trainees must demonstrate an understanding of landmarks to be able to safely undertake tissue acquisition in this context.

1.6 It is necessary to have a working knowledge of ultrasound, the ultrasound console, radiological descriptions of normal anatomy and pathological changes. The endoscopist must be able to acquire, optimise, capture and label ultrasound images.

(*Strong recommendation, low quality evidence).*

Consensus: 95%

The acquisition and description of images in EUS should be considered in the same way as conventional ultrasound. It is beyond the scope of this Delphi process to consider competency assessment in clinical ultrasound[18]. For endosonographers wishing to demonstrate minimum knowledge of ultrasound the following knowledge base is recommended:

- Basic Ultrasound Physics
- Operation of machine control (e.g. depth, zoom, gain, focus, image capture).
- Image optimization
- Relevant normal and abnormal sonography anatomy and physiology
- Specific application and limitations of ultrasound applied within EUS

The Royal College of Radiologists recommend guidelines for the provision of an ultrasound service[19]. Their standards for imaging interpretation outline the following framework for examination[20]:

- Remit of the study
- Normal findings
- Unequivocal abnormal findings, both anticipated and unanticipated
- Findings that may be normal (including their anatomical variants) or abnormal
- Relevant negatives

Abnormal findings must be analysed for relevant imaging characteristics such as shape, definition and contour, enhancement pattern, and echogenicity to discern whether the findings fulfil a pathological process or may represent a normal variant such as age-related change. Non-radiology trainees should consider shadowing radiologists performing transabdominal ultrasound to familiarise themselves with image acquisition techniques, radiological lexicon and, crucially, reporting.

The Delphi group were unanimous in recommending trainees from a non-radiological background undertake a period of attendance at ultrasound and cross sectional imaging lists with a radiologist to gain appreciation of indications, terminology and language of reporting of scans, as well as commencing the early phase of EUS training with a “hands-off” approach in order to familiarize themselves with ultrasound image acquisition and interpretation.

1.7 Tissue acquisition: It is desirable that 75 EUS FNA/FNB (including 50 pancreatic lesions) are performed during training and the endosonographer will be required to demonstrate proficiency in the use of FNA/FNB EUS needles

(*Strong recommendation, low quality evidence).*

Consensus: 100%

There are limited, poor-quality, retrospective studies that suggest EUS-FNA training is safe[21] and that formal training results in an increased diagnostic sensitivity in pancreatic solid lesion sampling[22]. In one study diagnostic accuracy >80% was achieved after 250 procedures therefore the learning curve may be longer and require a considerable number of procedures to achieve high diagnostic accuracy (in the absence of Rapid Onsite Evaluation)[23]. Whilst the evidence suggests that competency in sampling the pancreas is achieved around this mark, the group agreed that a lifetime procedure account of 75 reflected the additional experience required in sampling non-pancreatic lesions.

1.8 When performing tissue acquisition the endoscopist should demonstrate the ability to document sampled area, needle sizes used, type of needle along with number of passes for audit and safety purposes. A tissue adequacy rate of 85% should be the aim for solid pancreas masses.

(Strong recommendation, moderate quality evidence).

Consensus: 100%

Tissue adequacy is defined as obtaining a full diagnostic tissue sample i.e., sufficient tissue to allow an accurate diagnosis. Several studies have examined diagnostic sensitivity for different needles or analysis techniques in which tissue adequacy rate is consistently reported as >90%[24-26]. ESGE recommend an adequacy rate of ≥85% (minimum standard) with a proposed target standard of 90%[8].

1.9 An overall 30-day case complication rate of <5% of the EUS caseload is expected

(*Strong recommendation, moderate quality evidence).*

Consensus: 100%

Whilst EUS is not without risk, it is generally regarded as a relatively safe procedure. Rates of complication for FNA are low. In a multicentre retrospective observational study in tertiary referral centres in Japan focussed on adverse events with EUS-FNA the incidence was 1.7% in a cohort of 13,566 cases[27]. Multiple studies have reported complications rate of between 1- 3% [28,29]. Aspiration of pancreatic cystic lesions seems to have a higher complication rate of 6%[30] although most are mild. The ESGE technical guideline encompassing a systematic review of literature related to FNA reported a morbidity between 0 and 2.5%[31].

1.10 The endoscopist must demonstrate ability to write a comprehensive, structured, and descriptive EUS report with a final provisional diagnosis. All stations and the abnormality should be reported in detail including size, location, echogenicity, TNM staging (if appropriate) as well as peri- and post-procedural complications and recommendations.

(*Strong recommendation, low quality evidence*).

Consensus: 95%

The purpose of a report is to communicate an answer to the clinical question posed in a way the referrer will understand and be able to action if appropriate[32]. The operator should use appropriate radiological terminology and we suggest adhering to the Royal College of Radiologists quality standards, which recommend a report is structured as follows[20]:

- Clinical details, review of previous imaging, remit of the EUS study
- A description of the findings and correlation with previous findings
- A conclusion or summary of the key findings in the clinical context
- Advice on the next step of management (when appropriate)

1.11 The endoscopist is expected to photo-document ultrasonographic anatomical landmarks relevant to the focus of the examination (see table 4) in >90% of procedures and upload to PACS or appropriate software

(*Weak recommendation, low quality evidence).*

Consensus: 84%

EUS practice should be standardised with ultrasound to be able to save a representative range of images to PACS software to provide a record of the examination to allow for case review and audit purposes[19]. Photo documentation of landmarks dependent on the indication of the examination form part of the KPIs (outlined in Supplementary File 4).

1.12 The endoscopist should photo document ultrasonographic and endoscopic images of pathology identified using appropriate tools including Doppler, callipers to measure size and needle placement to upload to PACS or appropriate software

(*Weak recommendation, low quality evidence).*

Consensus: 95%

Systematic documentation of the EUS procedure through image acquisition uploaded on to an image sharing portal such as PACS allows MDTs and other clinically interested parties to easily review a case and demonstrates the operator is competent in what they are examining.

1.13 The endoscopist demonstrates a professional attitude toward procedural safety and patient care including the practice of endoscopic non-technical skills (ENTS) of EUS (i.e., communication skills, situational awareness, leadership, and judgement)

(*Strong recommendation, low quality evidence)*.

Consensus: 100%

The evidence in this area is limited predominantly to non-controlled surveys of participants undertaking non-technical skills training in the form of simulation who demonstrate increased self-reported confidence in performing non-technical skills tasks[33]. One blinded RCT did demonstrate a simulation-based curriculum (including ENTS) resulted in endoscopists performing superiorly on colonoscopies assessed using the JAG DOPS[34]. The same group published a further RCT in 2020, which demonstrated focussed non-technical skills training to novice trainees in colonoscopy improved the clinical performance of their colonoscopies[35].

Section 2: Acquisition of competence in EUS

2.1 JAG accreditation in gastroscopy is desirable. The endoscopist should be sufficiently competent to safely insert a gastroscope to D2 independently.

(*Strong recommendation, very low-quality evidence).*

Consensus: 95%

Trainees commencing EUS training should be competent at upper GI endoscopy and should be able to pass the gastroscope safely to D2. The group agreed that formal JAG accreditation is desirable however is not mandated as this may prejudice non-gastroenterology trainees wishing to embark on an EUS training programme. ESGE also acknowledge that trainees should be competent in gastroscopy before undertaking ERCP or EUS in line with their previously published quality standards[8,36]. It is likely that further scope-handling training will be required due to the differences in using forward oblique-viewing echoendoscopes.

2.2 Trainees should demonstrate their desire and commitment to perform independent practice in EUS at consultant level.

(*Strong recommendation, low quality evidence).*

Consensus: 90%
The considerable commitment on trainee and trainer to achieve trainee competence in EUS is such that forward planning and workforce management should be taken into consideration to ensure trainees' future careers will include the practice of EUS.

2.3 For EUS certification, UK trainees are required to attend a JAG accredited basic EUS skills course, ideally in the early stages of their EUS training.

***(Strong recommendation, low quality evidence)*.**

Consensus: 84%

An essential part of EUS training is the attendance at intensive skills courses[37]. Attendance at basic skills courses is already mandatory for certification in upper and lower GI endoscopy & ERCP.

2.4 Trainees are recommended to use digital resources and attend live endoscopy courses and conferences to become familiar with EUS techniques and accessories.

(*Strong recommendation, low quality evidence).*

Consensus: 100%
Theoretical knowledge acquired in addition to hands-on training can be acquired from lectures, textbooks, online seminars, and websites[33]. This further complements the training process in a safe and effective manner.

2.5 Trainees are required to show evidence of attendance at Multidisciplinary Meetings.

(Strong recommendation, very low-quality evidence).

Consensus: 100%
This an essential part of the learning process. Attendance at both benign and cancer multidisciplinary (MDT) meetings is crucial to understand the rationale for the test and the information desired by the referrer. It is also an opportunity to be exposed to cross-sectional imaging modalities that may aid the EUS examination.

2.6 Training should be delivered at specific levels to include:

a) **Assessment of indications and potential complications for the procedure, individualised consent & review of imaging immediately prior to each case.**
b) **Trainees should spend a period familiarising themselves with image acquisition and interpretation prior to echo-endoscope handling. This should be a combination of observing EUS cases and spending time with ultrasonographers.**
c) **Formal hands-on training should utilise the EUS Train the Trainers (TTT) training ladder.**
d) **Post procedure care and accurate report writing should also be a part of training.**

Trainees should audit their own practice during the training process and document any complications with evidence of reflection.

(Strong recommendation, low quality evidence)

Consensus: 89%

This highlights the importance of a safe and considered approach before, during and after each procedure. A standardised method to training, as taught on the EUS TTT course, will benefit both trainer and trainee. (Supplementary File 3).

2.7 Training in ultrasound should be an essential facet of acquiring competence:

a) **The trainee requires focused sessions on the use of the ultrasound console.**
b) **Use of appropriate terminology, image optimisation and acquisition, accurate labelling, use of Doppler etc and appropriate key images to capture.**
c) **Contrast enhanced US and elastography can be acquired post-certification.**

(Strong recommendation, low quality evidence)

Consensus: 89%

Safe endoscope handling and ultrasound image acquisition and developing a skill set for the interpretation of ultrasound images for diagnosis are essential features to competent EUS practice and should be embedded in daily teaching.

2.8 Trainers delivering training in EUS should have undertaken an endoscopy specific TTT course (preferably in EUS).

(Strong recommendation, very low-quality evidence)

Consensus: 95%

EUS trainers should have completed a TTT course, preferably in EUS to standardise key components of the training process. The EUS TTT course covers the principles of adult learning, adding to the trainer's skillset in endoscopic and sonographic teaching to provide a safe and comprehensive training experience.

2.9 Trainers should ensure that their trainees are empowered to be able to give honest and critical feedback on their training. This is generic to all forms of endoscopy training and is a JAG requirement.

(Strong recommendation, very low-quality evidence)

Consensus: 100%

Despite the introduction of Direct Observation of Trainer Skills feedback by JAG, a recent survey of UK trainees demonstrated only 57% trainees felt able to give honest feedback to their trainer[38]. Given the complexity of teaching EUS, trainers should seek feedback and engender a collaborative training environment.

2.10 All trainees should have evidence of a lifetime "hands-on" experience of a minimum of 250 EUS cases prior to assessment for certification.

(Strong recommendation, moderate quality evidence)

Consensus: 100%

The previous British expert consensus on EUS training recommended the following threshold numbers before assessment of competency: oesophagus, stomach or rectum - 80; subepithelial lesions - 20; pancreatobiliary - 150 (at least half of which are likely pancreatic cancer)[1]. A systematic review examined 8 studies assessing attainment of competency in EUS and encompassed 28 trainees and 7051 EUS procedures[39]. 3 studies examined T-staging (competency achieved in 65-231 procedures), 3 studies assessed EUS-FNA (competency achieved by 30-40 procedures) and 2 studies assessed comprehensive competency. Only 4 of 17 trainees reached competency by 225 to 295 EUS procedures. Further evidence that suggests a significant caseload of hands on training is required prior to competency assessment highlighted the median number of EUS performed was 300 (155-650) by which 82.3% trainees had achieved overall competence[40].

Section 3 Assessment of Competence in EUS

3.1 Formative EUS DOPS assessments should be performed at least every 10 training procedures to track progression and provide objective evidence of skills acquisition and targeted feedback. EUS DOPS should include ultrasound imaging and endoscopy, but also previous cross-sectional image evaluation, fulfilment of procedure indication and nontechnical skills.

(Strong recommendation, low quality evidence)

Consensus: 95%

Formative EUS assessments are used to complete endoscopic training in the UK[41-43]. The use of specific formative EUS DOPS assessments grouped to enable assessment of specific technical and non-technical endoscopic skills are to be incorporated within the JETS e-portfolio[38]. The TEESAT assessment tool has been validated in North American fellowship programmes for EUS[9,10,45]. This is not currently supported on the JETS e-portfolio although 4 similar levels of outcomes reflect the amount of supervision required (maximal to none). Increasing the frequency of formative DOPS assessment increases the reliability of competency estimation[46] and has been identified as an independent predictor of competence[43].

3.2 Trainee should preferably log all training procedures onto the JETS e-portfolio.
(Strong recommendation, low quality evidence)

Consensus: 95%

The JETS e-portfolio is recognised by all UK endoscopy trainees and trainers. Validity is supported from other training modalities[44]. The JETS system enables the formulation of unassisted KPIs which are embedded into EUS certification criteria. Evidence for a similar model using ERCP exists using of the Rotterdam self-assessment ERCP form[47,48].

3.3 Trainees must demonstrate the following key performance indicators to be eligible for summative assessment for certification in diagnostic EUS ± tissue acquisition:

1) "Competent for independent practice" overall on formative DOPS in 80% of cases in the last 3 months (minimum 10 examinations)

2) Cases should include documented images (Supplementary File 3) and include at least

1 examination including:
- Oesophagogastric assessment
- Posterior Mediastinum/Lymph node assessment

3 examinations including:
- Full Pancreas assessment
- Bile Duct examination (including Ampulla of Vater)

3) Tissue acquisition with FNA/B diagnostic adequacy >85% of cases in the last 3 months (minimum 10 cases)

(Strong recommendation, low quality evidence)

Consensus: 100%

KPI targets for competent independent practice should be measured by objective formative DOPS. Increasing the frequency of formative DOPS assessment increases the reliability of competency[46]. A prospective, multicentre US study using a similar outcome (TEESAT) to the UK formative (DOPS) form showed that at the conclusion of EUS training programme 82% of trainees achieved technical independent competence and 76% achieved cognitive independent competence in EUS[10]. Therefore, a similar level of independent practice achievement should be recorded in a significant number[48] to achieve a high chance of competence.

As the influence of EUS-fine needle aspiration or biopsy (FNA/B) is significant this must be included as a KPI. The percentage of patients with a tissue sample allowing an accurate diagnosis of solid lesions should be recorded. The frequency of successful EUS-FNB of a solid lesion has been shown to be 92 -98% in multiple clinical trials[49–52] therefore we would expect this level to be at least 85% (minimum standard in line with ESGE) and a target standard of 90% post certification.

3.4 Formative EUS DOPS and KPI should be used in conjunction with other supporting certification criteria including

a) **EUS basic skills course**
b) **Evidence of at least 250 procedure entries on JETs including 125 cases with pancreatic assessment**

(Strong recommendation, low quality evidence)

Consensus: 100%

A basic skills course is recommended to enable training pathway structure and development. Formative DOPS assessments are used to objectively evaluate competency development during training[10]. Therefore, we believe this number of procedures is required to achieve a high chance of competence for independent practice and achieve success at summative assessment.

3.5 For successful completion of the Summative DOPS assessment, the trainee should be rated as "ready for independent practice" in all items within 2 DOPS on pre-defined cases, by 2 different assessors: one of whom is not based at their current endoscopy unit.

(Weak recommendation, low quality evidence)

Consensus: 89%

Summative assessment is part of the JAG certification process and ensures objective competence assessment prior to certification[4]. Given the increased complexity and low KPIs to reduce bias, as with the JAG ERCP certification process, we recommend that trainees should perform a total of 2 summative EUS DOPS and be rated as "ready for independent practice" in all items by 2 separate assessors, of which one of these assessors should not be a current trainer based at the trainee's unit. The summative assessment cases should take place at an endoscopy unit chosen by the trainee (usually their current or recent training unit). At least one of the assessors should have attended an EUS train the trainer course.

Section 4: Post Certification Mentorship

4.1 Newly certified EUS practitioners should have a minimum period of mentorship lasting 1 year.

(Strong recommendation, very low evidence)

Consensus: 89%

Performance of EUS continues to improve after certification during the early part of independent practice before aspirational standards may be reached, it follows therefore that there should be provision for mentorship and performance review for recently certified EUS practitioners[53,54,55]. Opportunities for continuing professional development should be encouraged including upskilling courses and visiting regional tertiary units. Both mentor and mentee should have time to invest in the relationship, ideally with protected time for regular meetings. In "Coaching and Mentoring at Work", Connor and Pokora define Coaching and Mentoring as "learning relationships which help people to take charge of their own development, to release their potential and to achieve results which they value"[56] Although a universal understanding of mentorship has been historically elusive, it is now increasingly recognized in healthcare[57-61.] "EUS mentorship" may be defined as the process by which an experienced colleague who performs high quality EUS engages with a new colleague to foster their development and expertise in EUS. A period of at least 1 year is suggested to enable enough time to support and nurture a practitioner into one who can provide a high quality EUS service. For mentorship to flourish, both mentor and mentee should have time to invest in the relationship, ideally with time put aside for regular scheduled meetings.

At the initial introductory mentorship meeting, terms and conditions should be agreed, including timetable for meeting up. There should be a focus on defining the mentoring process and establishing expectations. The mentee, not the mentor, sets the agenda for the 4x key meetings during the year. It's important for openness in order to discuss any potential adverse events that the mentee will inevitably encounter. Mentorship should usually reach a conclusion after 12 years with a final sign off meeting but can continue informally afterwards, either with the same mentor or another if more appropriate.

4.2 A JAG/UKIEUS defined list of mentors who can be approached by a mentee is desirable.

(Strong recommendation, low evidence)

Consensus: 95%,

A JAG/UKIEUS list of mentors who have undertaken a mentorship qualification that can be approached by the mentee and their respective Trust is desirable. Mentors themselves should be expert in their field: consciously competent in EUS and in teaching EUS. Additional training may be required to develop specific mentorship expertise. It is strongly recommended mentors have completed the JAG EUS 'Train the Trainers' course.

4.3 EUS practitioners should perform 100 cases per year, of an adequate case mix including FNA. They should regularly review their performance via audit of KPI, presentation at morbidity and mortality (M&M) meetings, 360 assessments and via the annual appraisal system.

(Strong recommendation, very low evidence)

Consensus: 95%

Clinicians who have recently certified in EUS should have the opportunity to practise in a wide range of sub-specialty areas. Caseload selection through attendance at weekly MDT meetings is vital to this. All EUS cases should be logged on a spreadsheet, to enable

continuous audit of KPIs and to recognise post-EUS complications. Personal and unit results should be presented at regular audit meetings.

4.4 In single operator practices, EUS practitioners should have the opportunity the join local networks and if they do not exist, they should make efforts to form them.

(Strong recommendation, very low evidence)

Consensus: 89%

Single-handed EUS practitioners should aim to join local networks to allow for coaching and help with service development and joint audit of results. If such networks do not exist, then the new EUS practitioner should make efforts to form them where possible.

4.5 Independent practice in therapeutic EUS will require specific training.

Therapeutic EUS procedures are complex; robust and safe patient pathways need to be established with multi-disciplinary input and careful governance of outcomes. Although out with the scope of this document, before undertaking therapeutic EUS, clinicians should undergo a period of additional training (e.g., via a preceptorship) with further mentorship to follow. It is desirable that endosonographers embarking on therapeutic EUS should have basic ERCP skills.

(Strong recommendation, very low evidence)

Consensus: 100%

Discussion

EUS is a technically demanding modality which involves a steep learning curve principally because it is an imaging modality. Radiology trainees are at an advantage here though most trainees have a background in gastroenterology. Whilst there is an increasing number of therapeutic procedures achievable with EUS guidance there is, prior to this, an imperative to ensure a solid grounding of knowledge to become consciously competent in necessary echoendoscope handling coupled with skills in interpreting radiological ultrasound images for clinical diagnosis. Moreover during the procedure the endosonographer must lead the endoscopy team, become skilled in communication and leadership having a 360 degree vision of the endoscopy room whilst performing the procedure, show good decision making skills re ultrasound diagnosis and tissue acquisition, generate a report that answers the clinical question and at all times ensure safety. Getting to a definition of competency for EUS in comparison to, for example, ERCP or colonoscopy has been elusive. The latter studies have recognized quality performance indicators that can be assessed before/during and after the procedure whilst EUS historically does not; partly this relates to the varied examinations (remits) that can be undertaken in EUS, a lack of consensus on judging competency of ultrasound imaging for trainee gastroenterologists (by gastroenterologists), and a focus on FNA sampling adequacy and diagnostic rates which practically may not be possible at the time of the procedure.

This Delphi group have assessed a comprehensive number of published scientific papers in order to address key questions of Diagnostic EUS training including consensus on defining competence, the pathway of learning to achieve this and its assessment in order to allow trainees to credential for safe independent practice. Like ERCP, the group have also examined the rationale for mentoring newly qualified practitioners. To reflect current practice and most service providers there is an emphasis on linear echoendosonography.

The JETS ePortfolio has been instrumental in driving quality standardisation across the UK in endoscopic practice for OGD, flexible sigmoidoscopy and colonoscopy. At the time of writing, JAG is engaging with stakeholders in the development of a robust JETS ePortfolio for EUS and the KPIs agreed by this working group will inform the accreditation through the upcoming JETS update. An EUS DOPS for assessment of competence has been proposed as part of this Delphi process (Supplementary file 2).

Whilst the Delphi group advocate a period of attendance at ultrasound and cross sectional abdominal and thoracic imaging lists in addition to a period of observation “hands off” there is currently no evidence base on which to base a recommendation. However, we do recommend 250 “hands on” procedures be performed and recorded on JETS prior to an assessment of competency. It is recognized that there is a spectrum of case numbers required to reach a level deemed ready for independent practice. Designing key performance indicators (KPIs) will play a crucial role in assessing competence and in the future highlight improved strategies of training.

We propose a syllabus divided into three domains itemising 1) the early novice phase of training in cases 0-75, 2) an intermediate phase of training for cases 76-150 and 3) an advanced phase of training 151-250 prior to summative assessment in order to outline individuals’ performance targets as they progress through specific milestones during the training program. The syllabus highlights defined categories to allow trainers and trainees to focus on milestones (“way points” or stages) of learning. Categories within each Domain include: background knowledge, scope handling, ultrasound console, the study of EUS anatomy for normal and pathological lesions, and crucially the interpretation or cognition of ultrasound images, FNA/B (Domain 2 & 3) and finally, bringing each domain sections together, “The EUS procedure”. In advanced training the focus increases on arguably the

most important skill to learn which is “hands off”: Endoscopic Non-Technical Skills as highlighted above.

The practice of clinical ultrasound involves real time continuous imaging of a given study remit. In the training of EUS there are limited studies in the teaching and assessment of this: trainers and authors have focussed primarily therefore on teaching from static frozen images located at specific anatomical landmarks (so called “stations”). In the supplementary files the stations are discussed in detail with multiple examples of landmarks: for each station there is then a summary list of key images recommended for the trainee to develop competency in recognizing and capturing.

Domains 1 and 2 focus primarily in a structured approach to anatomy teaching; Domain 3 highlights the importance of moving towards the ability of real time continuous imaging: i.e. being able to “Follow the Anatomy”. The Delphi group recommend all EUS procedures provide captured images which are annotated to be stored on a PACS system; endoscopic ultrasound is an imaging modality and as such should be in line with all imaging modalities. In time we envisage the recording of small video loops on PACS to allow real time structural studies to become routinely available for the HPB, Oesophagogastric and thoracic MDTs.

Historically international EUS training programs have relied on set procedure numbers to attain competence[1,2,62 63]. The ASGE have recently advocated for standardization of the assessment of procedures to individualize the number of procedures required for training[54,64]. The direction of travel however is towards competency based training[65], though the widespread practice of this by trainers still has a focus on procedure volume[66]. For competency-based training and certification a systematic review from 2016 identified 30 studies regarding structured assessment of EUS competencies[67]. Certain technical skills were highlighted including pancreatic solid mass T-staging, EUS guided fine needle aspiration (EUS-FNA) procedure time, number of EUS FNA passes and puncture precision for EUS. An endoscopy trainers’ course, such as the JAG Train the Trainers in EUS, can potentially highlight the importance of an EUS curriculum, the milestones or “way points” in the path to learning, improving the different techniques of performance enhancing feedback and learning how to make objective and measurable assessments[68].

Feedback is a two-way street: recently a survey of UK trainees highlighted specific areas of teaching which merit attention such as improving the frequency of trainer feedback above the value of 75% surveyed, specific learning points (50%) discussed by the trainer and only 57% of trainees felt they could give objective feedback to the trainer[38]. A recent Delphi process by gastroenterology trainees highlighted 10 competencies they value from the trainer in teaching endoscopy[69].

Following the GMC commissioned “Shape of Training” review the training of physicians is undergoing considerable change due to the implementation of shorter training times in gastroenterology from 5 to 4 years which also impacts training in endoscopy[70]. Competency in specialities such as ERCP and EUS therefore may require post-CCT fellowships.

There are several limitations to our study. The group of invited participants were from the United Kingdom and Ireland to represent UKI EUS provision of service and training; thus, it may not be relevant to other international centres of EUS training. One clear limitation is the poor quality of many of the studies in literature. This has resulted in a necessary incongruity between the strength of the recommendations and the evidence quality. Whilst this leaves recommendations open to criticism it is our expectation that by setting these standards, high-quality research can be undertaken in the future to corroborate or refute our recommendations.

There are opportunities for future research using the competency framework outlined in this document. There is no previous evidence base on the facility of exposure to radiology lists and “hands-off” cases for the first 50 to 100 procedures prior to hands-on EUS training. There is a need to develop an evidence base for training: performing a prospective study of the use of national JETS data learning curves to more accurately assess how trainees achieve EUS competency in the UK will further our knowledge. An appreciation of key interventions to “accelerate” trainees up the learning curve including the use of intensive fellowships and simulation will also be important.

Conclusions

This document attempts to be specific in the training requirements desired for service providers in order to undertake high quality endoscopic ultrasound examinations. This will enable training bodies to ensure adequate provision of high quality, focused training (most likely through post-certification EUS fellowships), using the competency and training framework outlined in this document. Additionally, the training of mentors to support newly qualified service providers in their early career of EUS practice should be formalised. This will ultimately result in a high-quality service for patients.

Table 1. Summary of Recommendations for training and certification in EUS

1.1	Diagnostic EUS is described as the imaging modality of endoscopic ultrasound with and without tissue acquisition with fine-needle aspiration or fine-needle biopsy needles
1.2	For a successful diagnostic endoscopic ultrasound study without biopsy the endoscopist should be able to insert the echoendoscope to the desired level within the gastrointestinal tract dictated by the remit of the study, perform a structured station assessment and identify recognised anatomical landmarks specific to that study (Supplementary File)
1.3	EUS competence requires both cognitive and technical abilities and should be defined as the ability to independently carry out effective diagnostic procedures across a spectrum of case mix and context with acceptable safety
1.4	The endoscopist must be able to effectively identify and precisely describe the gastrointestinal wall layers and peri-lesional structures to demonstrate the likely origin of a submucosal mass for T-stage evaluation
1.5	Comprehensive understanding of the anatomical landmarks is mandatory for safe EUS guided tissue acquisition including for non-gastrointestinal tumours (e.g., lung cancer, sarcoma etc.) where understanding of relevant posterior mediastinal anatomical landmarks is necessary
1.6	It is necessary to have a working knowledge of ultrasound, the ultrasound console, radiological descriptions of normal anatomy and radiological descriptions of pathological changes. The endoscopist must be able to acquire, optimise and capture ultrasound images
1.7	Tissue acquisition: It is desirable that 75 EUS FNA/FNB (including 50 pancreatic lesions) are performed during training and the endosonographer will be required to demonstrate proficiency in the use of FNA/FNB EUS needles
1.8	When performing tissue acquisition the endoscopist should demonstrate the ability to document sampled area, needle sizes used, type of needle along with number of passes for audit and safety purposes. A tissue adequacy rate of 85% should be the aim for solid pancreas masses
1.9	An overall 30-day case complication rate of <5% of the EUS caseload is expected
1.10	The endoscopist must demonstrate ability to write a comprehensive, structured, and descriptive EUS report with a final provisional diagnosis. All stations and the abnormality should be reported in detail including size, location, echogenicity, TNM staging (if appropriate) as well as peri- and post-procedural complications
1.11	The endoscopist is expected to photo-document ultrasonographic anatomical landmarks relevant to the focus of the examination (see table 4) in >90% of procedures and upload to PACS or appropriate software
1.12	The endoscopist should photo-document ultrasonographic and endoscopic images of pathology identified using appropriate tools including Doppler, callipers to measure size and needle placement to upload to PACS or appropriate software
1.13	The endoscopist demonstrates a professional attitude toward procedural safety and patient care including the practice of endoscopic non-technical skills of EUS (i.e., communication skills, situational awareness, leadership and judgement)
2.1	JAG accreditation in gastroscopy is desirable. The endoscopist should be sufficiently competent to safely insert a gastroscope to D2 independently
2.2	Trainees should demonstrate their desire and commitment to perform independent practice in EUS at consultant level
2.3	For EUS certification, UK trainees are required to attend a JAG accredited basic EUS skills course, ideally in the early stages of their EUS training
2.4	Trainees are recommended to use digital resources and attend live endoscopy courses and conferences to become familiar with EUS techniques and accessories
2.5	Trainees are required to show evidence of attendance at Multidisciplinary Meetings
2.6	Training should be delivered at specific levels which includes 1) Assessment of indications, risk assessment, consent and reviewing imaging 2) Image acquisition and interpretation 3) Formal hands-on training should utilise the EUS Train the Trainers training ladder 4) Accurate report writing 5) Trainees are required to audit their own data and document complications with reflections
2.7	Training in Ultrasound should be an essential facet of acquiring competence 1) Use of the ultrasound console 2) Appropriate terminology, image optimisation, physics of ultrasound, image acquisition & labelling 3) Contrast enhanced ultrasound (this can be done post certification)
2.8	Trainers delivering training in EUS should have undertaken an endoscopy specific TTT course (preferably in EUS)
2.9	Trainers should ensure that their trainees are empowered to be able to give honest and critical feedback on their training. This is generic to all forms of endoscopy training and is a JAG requirement
2.10	All trainees should have evidence of experience of a minimum of 250 EUS cases prior to assessment

	for certification
3.1	Formative EUS DOPS assessments should be performed at least every 10 training procedures to track progression and provide objective evidence of skills acquisition and targeted feedback. EUS DOPS should include ultrasound imaging and endoscopy, but also previous cross-sectional image evaluation, fulfilment of procedure indication and nontechnical skills
3.2	Trainee should preferably log all training procedures onto the JETS e-portfolio
3.3	Trainees must demonstrate the following key performance indicators to be eligible for summative assessment for certification in diagnostic EUS with/without tissue acquisition 1) "Competent for independent practice" overall in formative DOPS in 80% cases in last 3/12 (min of 10 cases) 2) Cases should include - 1x case of oesophagogastric assessment, posterior mediastinal and lymph node assessment, or bile duct examination including the major papilla - 3x assessment of the pancreas as the focus for the examination 3) FNA / B diagnostic adequacy > 85% of cases in last 3/12 (min of 10 cases)
3.4	Formative EUS DOPS and KPI should be used in conjunction with other supporting certification criteria including - Attending EUS Basic Skills course - Trainee has completed 250 cases as a minimum before assessment
3.5	For successful completion of the Summative DOPS assessment, the trainee should be rated as "ready for independent practice" in all items within 2 DOPS on pre-defined cases, by 2 different assessors: one of whom is not based at their current endoscopy unit
4.1	Newly certified EUS practitioners should have a minimum period of mentorship lasting 1 year
4.2	A JAG/UKIEUS defined list of mentors who can be approached by a mentee is desirable
4.3	EUS practitioners should perform 100 cases per year, of an adequate case mix including FNA. They should regularly review their performance via audit of KPI, presentation at M+M meetings, 360 assessments and via the annual appraisal system
4.4	In single operator practices, EUS practitioners should have the opportunity the join local networks and if they do not exist, they should make efforts to form them
4.5	Independent practice in therapeutic EUS will require specific training

Figure 1 Proposed Joint Advisory Group (JAG) pathway for training and certification in Endoscopic Ultrasound (EUS), in the United Kingdom and Ireland

<table>
<tr><th colspan="3">Proposed pathway for Training and Certification in Endoscopic Ultrasound</th></tr>
<tr><td>Criteria

1) Personal
2) Unit</td><td colspan="2">PERSONAL Criteria:
Commitment to EUS training and practice at consultant level
JAG accreditation:
- Desirable: competent in diagnostic OGD +/- with some experience in therapeutic OGD
- Approval from Endoscopy Training Lead, trainer +/- Program Director

TRAINING UNIT Criteria:
- lead trainer has attended an EUS TTT course
- commitment for delivery of training within a structured training programme (e.g. within a fellowship)
- JAG accredited unit
- initial meeting with trainee (outside of Endoscopy): introduction to the program</td></tr>
<tr><td colspan="3">↓</td></tr>
<tr><th colspan="3">Training Begins</th></tr>
<tr><td rowspan="3">Early Training

Later Training</td><td>Register with JETS e-portfolio
If available, attend:
- Induction meeting and simulation sessions
- abdominal ultrasound lists
- period of “hands-off” e.g. 50 cases prior to starting

Book basic EUS skills course (& certificate)

Begin hands-on training in an EUS training Centre</td><td rowspan="3">Procedural Key Performance Indicators
- Upload hands-on procedures to JETS

- 1 DOPS every 10 procedures

- Minimum of 1 reflection every 50 cases

Regular appraisal with trainer e.g.
- at no 50, 75, 100, 150, 200 and < 250

Attendance at HPB / UGI MDT meetings
Text, journal, and online digital resources</td></tr>
<tr><td>↓</td></tr>
<tr><td>Continued hands-on + cognitive skills training
Live courses</td></tr>
<tr><td colspan="3">↓</td></tr>
<tr><th colspan="3">Completion of Training</th></tr>
<tr><td>Summative Assessment</td><td>Eligibility:
- At least 250 “hands on” EUS cases on JETS
- (including 125 cases pancreatic cases)
Within last 3 months
- KPIs achieved in >/= 15 cases
- photo documentation of anatomical ultrasound landmarks > 90%
- physically unassisted > 85% cases (min 10)
Case remit achieved in > 85%
- 75 cases should involve EUS FNA(B) of which 50 are pancreatic & adequacy > 85%
- Rated for independent practice in over 80% of 5 recent formative DOPS within 3 months and none requiring maximum supervision

DOPS to include at least:
- 3 cases of pancreas, bile ducts, ampulla of Vater
- 1 case oesophagogastric and posterior mediastinal / lymph node assessment</td><td>Summative process

- Total of 2x summative DOPS
- By 2x different assessors (1 of whom is not based in current endoscopy unit)

- Competence in all items</td></tr>
<tr><td colspan="3">↓</td></tr>
<tr><th colspan="3">JAG certification in Diagnostic EUS</th></tr>
<tr><td>Certification</td><td colspan="2">Training Lead and external JAG verification of JETS e-portfolio data
Training Lead issues statement of “Completion of EUS Training”</td></tr>
</table>

↓		
Trainee Certified as Independent in Diagnostic Endoscopic Ultrasound		
↓		
Mentorship and Service Provision		
Post Certification as a Service Provider	EUS practitioners should benefit from - arrangements for support, performance monitoring and review - Practitioners should perform > 100 cases per year, including FNA(B) - appropriate caseload selection underpinned by attending HPB MDTs and M+M meetings Candidates should have the opportunity to join their local network meeting (or create one) Independent practice in therapeutic EUS will require specific training	Period of Post - Certification Mentorship - Mentorship may take place outside their respective unit - Introduction meeting outside of the unit thus, setting expectations - then 3 monthly progress reviews - Initial 1-year time frame as a minimum - Final sign off meeting (informal agreements for further mentorship however can be made)

DOPS: direct observation of procedure skills; OGD: oesophagogastroduodenoscopy; PD: Program Director; JETS e-portfolio: Joint Advisory Group Endoscopy Training System e-portfolio

References

1. Meenan J, Harris K, Oppong K, et al. Service provision and training for endoscopic ultrasound in the UK. Frontline Gastroenterol 2011 Jul;2(3): 188-194
2. Domagk, D. Opong KW, Aabakken L, et al. Performance measures for endoscopic retrograde cholangiopancreatography and endoscopic ultrasound: A European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. United European Gastroenterol J. 2018;6(10): 14481-1460
3. Siau K. Green JT, Hawkes ND et al. Impact of the Joint Advisory Group on Gastrointestinal Endoscopy (JAG) on endoscopy services in the UK and beyond. Frontline Gastroenterol 2019;10: 93-106
4. Siau K, Anderson JT, Valori R et al. Certification of UK gastrointestinal endoscopists and variations between trainee specialties: results from the JETS e-portfolio. Endosc Int Open 2019;7: E551-E560
5. Siau, K. Keane MG, Steed H, et al. UK Joint Advisory Group consensus statements for training and certification in endoscopic retrograde cholangiopancreatography. Endosc Int Open 2022;10: E37–E49
6. Siau K, Beales ILP, Haycock A et al. JAG consensus statements for training and certification in esophagogastroduodenoscopy. Frontline Gastroenterology 2022; 0:1-13
7. Balshem H, Schunemann HM, Oxman AD, et al. GRADE guidelines: 3. Rating the quality of evidence. J. Clin. Epidemiol. 2011; 64: 401–406
8. Johnson G, Webster G, Boskoski I, et al. Curriculum for ERCP and endoscopic ultrasound training in Europe: European Society of Gastrointestinal Endoscopy (ESGE) Position Statement. Endoscopy 2021;53: 1071–1087
9. Wani S, Keswani RN, Petersen B, et al. Training in EUS and ERCP: standardizing methods to assess competence. Gastrointest Endosc 2018;87: 1371–1382
10. Wani S, Keswani R, Hall M, et al. A Prospective Multicenter Study Evaluating Learning Curves and Competence in Endoscopic Ultrasound and Endoscopic Retrograde Cholangiopancreatography Among Advanced Endoscopy Trainees: The Rapid Assessment of Trainee Endoscopy Skills Study. Clin Gastroenterol Hepatol 2017; 15: 1758–1767.e11
11. Carraccio C, Wolfsthal S, Englander D, et al. Shifting paradigms: from Flexner to competencies. Acad Med 2002;77: 361–367
12. Wani S, Cote GA, Keswani R, et al. Learning curves for EUS by using cumulative sum analysis: implications for American Society for Gastrointestinal Endoscopy recommendations for training. Gastrointest Endosc 2013; 77: 558–565
13. Park CH, Park JC, Kim EH, et al. Learning curve for EUS in gastric cancer T staging by using cumulative sum analysis. Gastrointest Endosc; 81: 898–905.e1
14. Aray N, Sahai A, Paquin SC. Credentialing for endoscopic ultrasound: A proposal for Canadian Guidelines. Endoscopic Ultrasound 2016;5: 4-7
15. Emura F, Gomez-Esquivel R, Rodriguez-Reyes C et al. Endoscopic identification of endoluminal oesophageal landmarks for radial and longitudinal orientation and lesion location. World J Gastroenterol 2019 Jan 28; 25(4): 498-508
16. Hedenström, P. & Sadik, R. The assessment of endosonographers in training. World J Clin Cases 2018; 6: 735–744
17. Ku L, Hou LA, Eysselein VE, et al. Endoscopic Ultrasound Quality Metrics in Clinical Practice. Diagnostics (Basel) 2021 Feb 4;11(2): 242
18. Strony R, Marin JR, Bailitz J, et al. Systemwide Clinical Ultrasound Program Development: An Expert Consensus Model. West J Emerg Med. 2018; 19(4): 649-653
19. The Royal College of Radiologists. Standards for the provision of an ultrasound service (2014). https://www.rcr.ac.uk/publication/standards-provision-ultrasound-service
20. Royal College of Radiologists. Standards for interpretation and reporting of imaging investigations, Second edition. (2018). https://www.rcr.ac.uk/publication/standards-interpretation-and-reporting-imaging-

investigations-second-edition
21. Coté GA, Hovis CE, Kohlmeier C, et al. Training in EUS-Guided Fine Needle Aspiration: Safety and Diagnostic Yield of Attending Supervised, Trainee-Directed FNA from the Onset of Training. Diagn Ther Endosc 2011;2011:378540
22. Nayar M, Joy D, Wadehra V, et al. Effect of dedicated and supervised training on achieving competence in EUS-FNA of solid pancreatic lesions. Scand J Gastroenterol 2011; 46: 997–1003
23. Del Vecchio Blanco G, Palmieri G, Giannarelli D, et al. Factors influencing diagnostic accuracy of endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) in pancreatic and biliary tumours. Scand J Gastroenterol. 2021;56: 498–504
24. Ardengh JC, Lopes CV, Pereira de Lima LF, et al. Cell block technique and cytological smears for the differential diagnosis of pancreatic neoplasms after endosonography-guided fine-needle aspiration. Acta Gastroenterol. Latinoam 2008; 38: 246–251
25. Aithal GP, Anagnostopoulos GK, Tam W et al. EUS-guided tissue sampling: comparison of 'dual sampling' (Trucut biopsy plus FNA) with 'sequential sampling' (Trucut biopsy and then FNA as required). Endoscopy 2007; 39: 725–730
26. Alatawi A, Beuvon F, Grabar S, et al. Comparison of 22G reverse-beveled versus standard needle for endoscopic ultrasound-guided sampling of solid pancreatic lesions. United European Gastroenterol J 2015; 3: 343–352
27. Kanno A, Yasuda I, Irisawa A, et al. Adverse events of endoscopic ultrasound-guided fine-needle aspiration for histologic diagnosis in Japanese tertiary centers: Multicenter retrospective study. Dig Endosc 2021;33: 1146–1157
28. Eloubeidi MA, Tamhane A, Varadarajulu S, et al. Frequency of major complications after EUS-guided FNA of solid pancreatic masses: a prospective evaluation. Gastrointest Endosc 2006;63: 622–629
29. Gress F, Michael H, Gelrud D, et al. EUS-guided fine-needle aspiration of the pancreas: evaluation of pancreatitis as a complication. Gastrointest Endosc 2002;56: 864–867
30. Tarantino I, Fabbri C, Di Mitri R, et al. Complications of endoscopic ultrasound fine needle aspiration on pancreatic cystic lesions: final results from a large prospective multicenter study. Dig Liver Dis 2014; 46: 41–44
31. Polkowski M, Larghi A, Weynand B, et al. Learning, techniques, and complications of endoscopic ultrasound (EUS)-guided sampling in gastroenterology: European Society of Gastrointestinal Endoscopy (ESGE) Technical Guideline. Endoscopy 2012; 44: 190–206
32. Langlotz CP. Chapter 3: Radiology Reporting Best Practices in The Radiology Report: A guide to thoughtful communication for radiologists and other medical professionals. CreateSpace Independent Publishing Platform; 1st edition (2 Nov. 2015)
33. Hitchins CR, Metzner M, Edworthy J, et al. Non-technical skills and gastrointestinal endoscopy: a review of the literature. Frontline Gastroenterol 2018; 9: 129–134
34. Grover SC, Garg A, Scaffidi MA, et al. Impact of a simulation training curriculum on technical and nontechnical skills in colonoscopy: a randomized trial. Gastrointest Endosc 2015; 82: 1072–1079
35. Walsh CM, Scaffidi MA, Khan R, et al. Non-technical skills curriculum incorporating simulation-based training improves performance in colonoscopy among novice endoscopists: Randomized controlled trial. Dig Endosc 2020;32: 940–948
36. Bisschops R, Areia M, Coron E, et al. Performance measures for upper gastrointestinal endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. Endoscopy 2016 Sep;48: 843–864
37. Cho CM. Training in Endoscopy: Endoscopic Ultrasound. Clin Endosc 2017;50: 340–344
38. Ratcliffe E, Subramaniam S, Ngu WS, et al. Endoscopy training in the UK pre-COVID-19 environment: a multidisciplinary survey of endoscopy training and the experience of reciprocal feedback. Frontline Gastroenterol 2022; 13: 39–44
39. Shahidi N, Ou G, Lam E, et al. When trainees reach competency in performing endoscopic ultrasound: a systematic review. Endosc Int Open 5 2017; E239–E243

40. Wani S, Han S, Simon V, et al. Setting minimum standards for training in EUS and ERCP: results from a prospective multicenter study evaluating learning curves and competence among advanced endoscopy trainees. Gastrointest Endosc 2019;89: 1160–1168.e9
41. Siau K, Dunckley P, Valori R et al. Changes in scoring of Direct Observation of Procedural Skills (DOPS) forms and the impact on competence assessment. Endoscopy 2018;50: 770–778
42. Siau K, Hawkes ND, Dunckley P, et al. Training in Endoscopy. Curr Treat Options Gastroenterol 2018;16: 345–361
43. Siau K, Dunckley P, Feeney M, Johnson G, & Joint Advisory Group on Gastrointestinal Endoscopy. ERCP assessment tool: evidence of validity and competency development during training. Endoscopy 2019;51: 1017–1026
44. Mehta T, Dowler K, McKaig BC, et al. P. Development and roll out of the JETS e-portfolio: a web based electronic portfolio for endoscopists. Frontline Gastroenterol 2011;2: 35-42
45. Wani S, Hall M, Wang AY, et al. Variation in learning curves and competence for ERCP among advanced endoscopy trainees by using cumulative sum analysis. Gastrointest Endosc 2016;83: 711–9.e11
46. Barton JR, Corbett S, van der Vleuten CP, et al. English Bowel Cancer Screening Programme & UK Joint Advisory Group for Gastrointestinal Endoscopy. The validity and reliability of a Direct Observation of Procedural Skills assessment tool: assessing colonoscopic skills of senior endoscopists. Gastrointest Endosc 2012;75: 591–597
47. Ekkelenkamp VE, Koch AD, Rauws EAJ et al. Competence development in ERCP: the learning curve of novice trainees. Endoscopy 2014;46: 949–955
48. Ekkelenkamp VE, Koch AD, Haringsma J, et al. Quality evaluation through self-assessment: a novel method to gain insight into ERCP performance. Frontline Gastroenterol 2014;5: 10–16
49. Bang JY, Herbert-Magee S, Navaneethan U, *et al.* Randomized trial comparing the Franseen and Fork-tip needles for EUS-guided fine-needle biopsy sampling of solid pancreatic mass lesions. Gastrointest Endosc 2018; 87: 1432–1438
50. Facciorusso A, Del Prete V, Buccino VR, *et al.* Diagnostic yield of Franseen and Fork-Tip biopsy needles for endoscopic ultrasound-guided tissue acquisition: a meta-analysis. Endosc Int Open 2019; 7: E1221–E1230
51. Leung KE, Lemaistre AI, Gincul R, et al. Macroscopic onsite evaluation using endoscopic ultrasound fine needle biopsy as an alternative to rapid onsite evaluation. Endoscopy International Open 2019; 07: E189–E194
52. Mukai S, Itoi T, Yamaguchi H, et al. A retrospective histological comparison of EUS-guided fine-needle biopsy using a novel franseen needle and a conventional end-cut type needle. Endosc Ultrasound 2019; **8**: 50–57
53. Wilkinson M, Charnley R, Morris J et al. ERCP - The Way Forward. A Standards Framework. A BSG Document by the ERCP Working Party 2014 https://www.bsg.org.uk/resource/ercp---the-way-forward--a-standards-framework-pdf.html
54. Wani S, Keswani RN, Han S, et al. Competence in Endoscopic Ultrasound and Endoscopic Retrograde Cholangiopancreatography, From Training through Independent Practice. Gastroenterology 2018; 155: 1483-1494
55. Keith S, Hodson J, Valori RM et al. Performance indicators in colonoscopy after certification for independent practice: outcomes and predictors of competence Gastrointest Endosc 2019;89: 482-92
56. Coaching and Mentoring at Work: Developing Effective Practice. Mary Connor & Julia Pokora 3rd Edition McGraw Hill Education, Open University Press 2017
57. SCOPME. Standing committee on postgraduate medical and dental education supporting doctors and dentists at work: an enquiry into mentoring: SCOPME 1998
58. Good medical practice. GMC London 2013 (Updated 2014 & 2019). Domain 3: Section 42. www.gmc-uk.org/guidance

59. General Medical Council. *Leadership and Management for All Doctors*. London; GMC; 2012. http://www.gmc-uk.org/guidance/ethical_guidance/management_for_doctors.asp (accessed 15th May 2022).
60. Royal College of Surgeons, England United Kingdom 2015. Mentorship: A Guide to Good Practice (Professional and Clinical Standards). www.rcseng.ac.uk/standards-and-research/standards-and-guidance/good-practice-guides/mentoring/
61. Smith KH, Hallett RJ, Wilkon-Smith V, et al. Results of the British Society of Gastroenterology supporting women in gastroenterology mentoring scheme pilot. Frontline Gastroenterology 2019;10: 50-55.
62. Wani S, Wallace MB, Cohen J et al. Quality indicators for EUS. Gastrointest Endosc 2015 Jan;81(1): 67-80
63. Domagk D, Oppong KW, Aabakken L. Performance measures for ERCP and Endoscopic Ultrasound: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. Endoscopy. 2018 Nov:50(11): 1116-1127
64. Wani S, Keswani RN, Petersen B et al. Training in EUS and ERCP: standardizing methods to assess competence. Gastrointest Endosc 2018 Jun:87(6): 1371-1382
65. Carraccio C, Englander R, Van Melle E, et al. Advancing Competency Based Medical Education: A Charter for Clinician Educators. Acad Med. 2016;91: 645-649
66. Patel SG, Keswani R, Elta G et al. Status of Competency-Based Medical Education in Endoscopy Training: A Nationwide Survey of US ACGME-Accredited Gastroenterology Training Programs. Am J Gastroenterol. 2015 Jul; 110(7): 956-62
67. James PD, Antonova L, Martel M, et al. Measures of trainee performance in advanced endoscopy: A systematic review. Best Pract Res Clin Gastroenterol 2016;30: 421-52
68. Waschke KA, Anderson J, Macintosh D et al. Training the gastrointestinal endoscopy trainer. Best Pract Res Clin Gastroenterol. 2016 Jun;30(3): 409-419
69. Fuchs M, Sewell JL, Kumar NL. Best practices in teaching endoscopy according to a Delphi survey of gastroenterology trainees. Gastroenterology Report. 2021;9(6): 600-602
70. Clough J, FitzPatrick M, Harvey P, et al. Shape of Training Review: an impact assessment for UK gastroenterology trainees. Frontline Gastroenterology 2019;10: 356-363