

Global trends in training and credentialing guidelines for gastrointestinal endoscopy: a systematic review

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ABSTRACT

Background and study aims Credentialing, the process through which an institution assesses and validates an endoscopist's qualifications to independently perform a procedure, can vary by region and country. Little is known about these inter-societal and geographic differences. We aimed to systematically characterize credentialing recommendations and requirements worldwide.

Methods We conducted a systematic review of credentialing practices among gastrointestinal and endoscopy societies worldwide. An electronic search as well as hand-search of World Endoscopy Organization members' websites was performed for credentialing documents. Abstracts were screened in duplicate and independently. Data were collected on procedures included in each document (e.g. colonoscopy, ERCP) and types of credentialing statements (procedural volume, key performance indicators (KPIs), and competency assessments). The primary objective was to qualitatively describe and compare the available credentialing recommendations and requirements from the included studies. Descriptive statistics were used to summarize data when appropriate.

Results We screened 653 records and included 20 credentialing documents from 12 societies. Guidelines most commonly included credentialing statements for colonoscopy, esophagogastroduodenoscopy (EGD), and ERCP. For colonoscopy, minimum procedural volumes ranged from 150 to 275 and adenoma detection rate (ADR) from 20% to 30%. For EGD, minimum procedural volumes ranged from 130 to 1000, and duodenal intubation rate of 95% to 100%. For ERCP, minimum procedural volumes ranged from 100 to 300 with selective duct cannulation success rate of 80% to 90%. Guidelines also reported on flexible sigmoidoscopy, capsule endoscopy, and endoscopic ultrasound.

Conclusions While some metrics such as ADR were relatively consistent among societies, there was substantial variation among societies with respect to procedural volume and KPI statements.

Introduction

Credentialing of endoscopic procedures is an essential component of high-quality endoscopic care [1] yet varies widely based on country and region. While clinical guidelines often provide recommendations based on procedural volume, procedure-specific performance indicators, and assessment of competence, these recommendations are not standardized [2]. With an increasing focus on quality and safety and an expanding array of complex endoscopic procedures, systematic knowledge regarding credentialing requirements and/or recommendations worldwide is needed.

Credentialing refers to the process designed to assess and validate independent practitioners' qualifications to provide patient care [3]. Credentialing is contingent on determining competence, which requires demonstration of the minimum knowledge and skill to safely and effectively perform a task or procedure [4], and can lead to authorization by an institution to perform said task or procedure independently. In endoscopy, competence requires cognitive, technical, and integrative skills and is attained independently for each procedure (e.g. colonoscopy, esophagogastroduodenoscopy [EGD]) [3].

Competence and subsequent credentialing recommendations or requirements have traditionally been based on procedural volume [5, 6] and procedure-specific key performance indicators (KPIs). For example, the American Society of Gastrointestinal Endoscopy (ASGE) recommends that credentialing for endoscopic retrograde cholangiopancreatography (ERCP) be considered after 200 ERCPs and a cannulation rate of 90% [3]. More recently, competence assessment tools have been used to judge endoscopists' readiness for independent practice [7]. For example, several American institutions and the Joint Advisory Group on Gastrointestinal (GI) Endoscopy (JAG) in the United Kingdom use the Assessment of Competence in Endoscopy (ACE) [8, 9] and Direct Observation of Procedural Skills (DOPS) tools respectively for competence assessments in colonoscopy [10, 11].

A growing awareness of procedural quality and patient safety has spurred the implementation of competency-based education systems and a renewed focus on credentialing practices [12]. Despite this, widely accepted minimal standards for independent practice in endoscopy are lacking. Additionally, geographic and societal variations for such standards are not well described. To address these gaps, we systematically identified and qualitatively compared credentialing recommendations and requirements across a wide range of settings.

Methods

We conducted this systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [13]. In addition, we registered our protocol on PROSPERO (ID: CRD42022321149).

Study definitions

We defined credentialing based on the ASGE definition: the process through which an institution assesses and validates an endoscopist's qualifications to independently perform an endoscopic procedure in a manner that is safe and effective [3]. We will herein refer to credentialing requirements as statements which mandate meeting a threshold (e.g. procedure volume, adenoma detection rate) prior to the provision of clinical privileges to perform a procedure, and credentialing recommendations as statements which suggest meeting a threshold without an explicit or binding mandate. Key performance indicators refer to measures that reflect the quality of specific procedures (e.g. adenoma detection rate for colonoscopy, selective duct cannulation rate for ERCP).

Search strategy

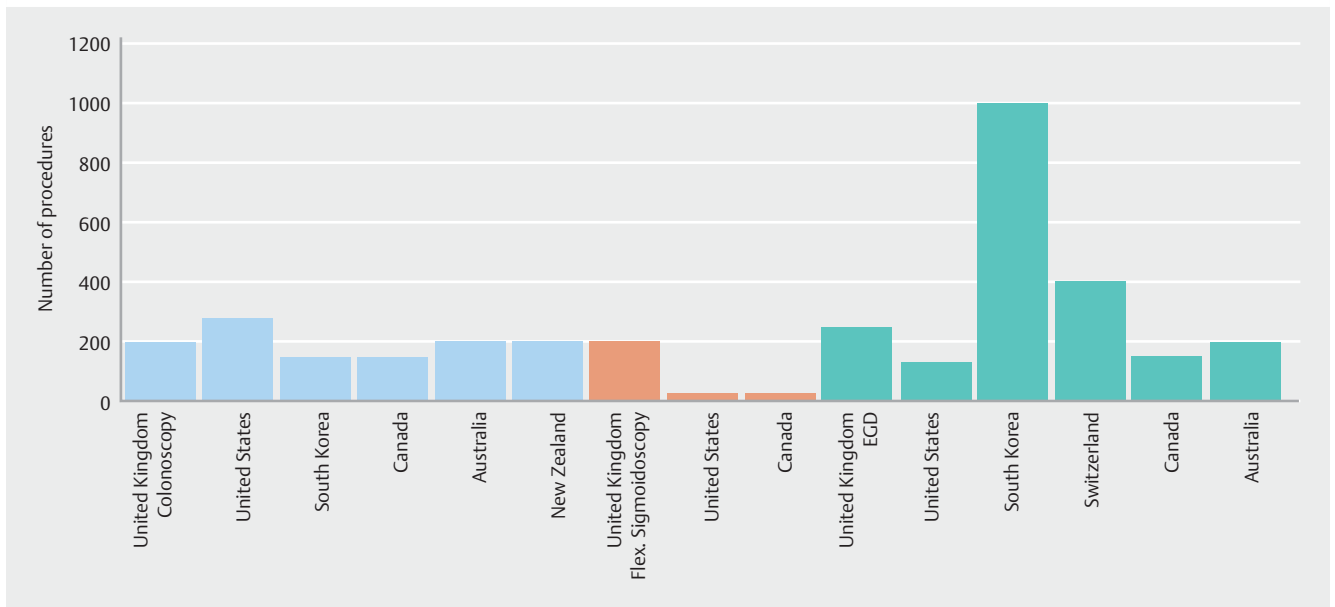
We conducted a systematic search in MEDLINE, EMBASE and PUBMED for published credentialing recommendations or requirements in endoscopy training by gastroenterology and endoscopy societies, or affiliated training committees up to January 31, 2022 (Supplemental Fig. 1). We also conducted a gray literature search through the World Gastroenterology Organization (WGO) website (<https://www.worldgastroenterology.org/>). This organization is a global body with over 100 member societies in gastroenterology, hepatology, and endoscopy. Through the WGO website, which contains hyperlinks to member societies' websites, we searched for all credentialing recommendations and/or requirements within each of the individual member societies. We used our web browser's (Google Chrome, Alphabet Inc, Mountain View, California, United States) automatic web-based language detection and translation services for websites in non-English languages.

Study selection

Two reviewers (N.S. and S.S.) independently screened all titles and abstracts. A third author (S.C.G.) adjudicated disagreements for study inclusion. Records were included if they provided any credentialing recommendations or requirements regarding colonoscopy, EGD, flexible sigmoidoscopy, capsule endoscopy, ERCP, and endoscopic ultrasound (EUS). We excluded other endoscopic procedures such as balloon enteroscopy. We anticipated that some societies would provide credentialing statements that were not peer-reviewed, so we decided a priori to include sources such as white papers and webpage-based recommendations. If there were multiple versions of guidelines from specialty societies that provided credentialing statements for the same procedures, we only included the most updated version.

Data extraction

N.S. independently extracted the data using a standardized data collection form. R.K. and S.C.G. reviewed all data collected to ensure accuracy. For each record, we collected the year of issuing (if available), the authors, the corresponding society, conflicts of interest (COI), and funding sources. We identified the procedures included in each study and categorized creden-



► **Fig. 1** Minimum number of procedures prior to credentialing for colonoscopy, flexible sigmoidoscopy, and EGD by country of society.

tialing statements for each procedure as related to a) procedural volume, b) KPIs, and c) observational assessment using a tool such as the DOPS.

Statistical analysis

Our primary aim was to qualitatively describe and compare the available credentialing recommendations and requirements from the included studies. We used descriptive statistics to summarize the data from individual studies. We did not conduct pooled analyses as this was not the aim of this study.

Results

We identified 653 records from our electronic search, with 646 remaining after de-duplication. We assessed 51 full-text studies from the electronic search along with seven from the gray literature hand search, with 20 studies included in the final sample [2,3,14–31] (Supplementary Fig.1). Some of these guidelines commented on a single procedure, such as colonoscopy, while others offered credentialing recommendations for multiple procedures.

Of the 20 credentialing guidelines, five were from Canada [18–22], three from the United States [2,3,27], three from the United Kingdom [28–30], two from Singapore [14,15], two from Korea [25,26], one from international societies [31], one from Australia [17], one from New Zealand [16], one from Switzerland [23], and one from Poland [24]. Guidelines were reported between 2001 and 2022. Five guidelines were identified through the gray literature search of GI society websites [16,17,23,24,30]. Four guidelines reported on the presence or absence of conflicts of interest [26,28,29,31]. Guidelines contained credentialing statements for one or more of the included procedures (Supplementary Table5).

Colonoscopy

Six colonoscopy guidelines [3,16,17,19,26,30] recommended a minimum procedural volume ranging from 150 to 275 procedures, with 100 to 180 of these being unassisted (► **Fig. 1**). With respect to KPIs, the minimum cecal intubation rate (CIR) and the minimum ADR ranged from 85–90% and 20%–30% respectively (► **Table 1**). The minimum volume for snare polypectomy ranged from 10 to 50, however there was minimal guidance as to threshold polyp detection rates (► **Table 1**). The New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy (NZCCRTGE), the Australian Conjoint Committee for the Recognition of Training in GI endoscopy (CCRTGE), and the JAG recommended the use of the lower GI DOPS tool in credentialing [16,17,30].

Esophagogastroduodenoscopy

Seven EGD guidelines recommended a minimum procedural volume ranging from 130–1000 procedures [3,16,17,20,23,26,30] and four guidelines recommended a minimum GI bleeding management volume of 20 to 45 cases [3,20,23,26] (► **Fig. 1**). With respect to KPIs, four guidelines recommended a minimum duodenal or pylorus intubation rate ranging from 95%–100% [3,16,20,29] (► **Table 2**). The NZCCRTGE, CCRTGE, and the JAG recommended the use of the EGD DOPS tool in credentialing [16,17,28].

Flexible sigmoidoscopy

Three flexible sigmoidoscopy guidelines recommended a minimum procedural volume ranging from 30 to 100 procedures [3,21,30] (► **Fig. 1**). With respect to KPIs, the ASGE recommended a depth of insertion of 50 cm [3] and the Canadian Association of Gastroenterology (CAG) recommended a depth of insertion sufficient to examine the rectum and sigmoid colon [21]

► **Table 1** Key performance indicators for colonoscopy.

Society or training committee, country/region (year)	Assessment tool	Key performance indicators					
		Minimum procedures	Min. adenoma detection	Min. ce-cal intubation rate	Withdrawal time	Min. polypectomy/polyp detection	Max complication rate
JAG, United Kingdom	>20 lower gastrointestinal DOPS, competent as per 5 most recent	200 (incl. 180 unassisted, 15 in last 3 months) + 100 for full certification	–	90 %	–	Polyp detection and removal > 10 %	≤ 0.5 %
ASGE, United States (2017)	–	275	'Above recommended threshold' but not specified	90 %	–	–	–
KSGE, Korea (2017)	–	150	30% at-risk men, 20% women (mean age >50)	90 %	>6 minutes	10 supervised, 10 unassisted	–
CAG, Canada (2008)	–	150 (incl. 100 unassisted)	25% men; 15% women (mean age >50)	>85%–90 %	>7 minutes	30 unassisted snare polypectomies	0.2; ≤ 1 % post polypectomy bleeding
Conjoint Committee, Australia ¹ (2015)	DOPS required	200 (incl. Flex sigmoidoscopy)	–	90 %	–	50 successful snare polypectomies	–
NZCCRTGE, New Zealand ² (2022)	4 DOPS recommended by at least 2 different assessors	200 (incl. Flex sigmoidoscopy, supervised)	–	90 %	–	40 successful snare polypectomies, 10 larger polypectomies with hot or cold snare	–

–, not reported; ASGE, American Society of Gastroenterology; JAG, Joint Advisory Group on Gastrointestinal Endoscopy; KSGE, Korea Association of Gastrointestinal Endoscopy; CAG, Canadian Association of Gastroenterology; NZCCRTGE, New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy.
¹ Conjoint committee for recognition of training in gastrointestinal endoscopy (including the Royal Australasian College of Surgeons, Gastroenterological Society of Australia and Royal Australasian College of Physicians)
² New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy (including the New Zealand Society of Gastroenterology, the New Zealand Committees of the Royal Australasian College of Physicians and Royal Australasian College of Surgeons)

(Supplementary Table 3). The JAG recommended the use of lower GI DOPS tool [30].

Capsule endoscopy

Five capsule endoscopy guidelines recommended a minimum procedural volume ranging from 15 to 50 cases [2, 3, 17, 25, 30] and one guideline recommended formal training in capsule endoscopy during gastroenterology fellowship or 8 hours of continuing medical education with 10 supervised capsule studies (Supplementary Table 2) [5]. There were no credentialing statements with respect to KPIs. The JAG recommended the use of the capsule endoscopy DOPS tool [16, 30].

Endoscopic retrograde cholangiopancreatography

There were 10 ERCP guidelines [3, 14, 16, 17, 22–24, 26, 30, 31]. Nine guidelines recommended a minimum procedural volume ranging from 100 to 300 procedures [3, 14, 16, 17, 22–24, 29,

31 (► **Fig. 2**). With respect to KPIs, eight guidelines recommended a duct cannulation success rate ranging from 80% to 90% [3, 14, 16, 22, 24, 29, 31] (► **Table 3**). The JAG recommended the use of the ERCP DOPS tool and the European Society of Gastrointestinal Endoscopy (ESGE) recommended the use of the DOPS tool and The EUS and ERCP Skills Assessment Tool (TEESAT) [29, 31].

Endoscopic ultrasound

There were 7 EUS guidelines [3, 15, 17, 18, 26, 27]. Four guidelines recommended a minimum procedural volume ranging from 150 to 250 EUS procedures [17, 18, 27, 31] and six guidelines recommended an EUS fine needle aspiration (FNA) volume of 50 to 75 procedures. (Supplementary Table 1) [3, 14, 17, 18, 27, 31]. There were no credentialing statements with respect to KPIs. The ESGE recommended the use of the DOPS tool and the TEESAT [31].

► **Table 2** Key performance indicators for esophagogastroduodenoscopy (EGD).

Society or training committee, country/region (year)	Assessment tool	Key performance indicators				
		Minimum procedures	Min. duodenal (or pylorus) intubation rate	Min. endoscopic hemostasis	Min. number of other therapeutic procedures	Max complication rate
JAG, United Kingdom ¹ (2022)	>25 EGD DOPS, competent as per 5 most recent (90%+)	250 (incl. 190 unassisted, 15 in last 3 months)	95% D2 intubation, with J maneuver for 95% of cases	–	–	–
ASGE, United States (2017)	–	130	95% pylorus intubation	45 procedures (20 variceal and 25 non-variceal hemorrhages)	–	–
KSGE, Korea (2017)	–	1000	–	20 procedures (10 supervised and 10 unassisted)	10 foreign body removals (5 supervised and 5 independent)	–
SSG, Switzerland (2013)	–	400 supervised	–	20 procedures	–	–
CAG, Canada (2008)	–	150 (incl. 100 unassisted)	100% D2 intubation	40 supervised procedures (20 variceal and 20 non-variceal hemorrhages)	20 supervised stricture dilations 200 supervised PEG Tube insertions	<0.1%
Conjoint Committee, Australia ¹ (2015)	DOPS required for gastroscopy	200 supervised (unassisted)	–	–	20 non-specified additional procedures (i. e., banding, clipping, adrenaline injection, etc.)	–
NZCCRTGE, New Zealand ² (2022)	4 DOPS by 2 different assessors	200 supervised	95% D2 intubation (in last 100 procedures)	–	20 non-specified additional procedures (i. e., banding, clipping, adrenaline injection, etc.)	–

–, not reported; ASGE, American Society of Gastrointestinal Endoscopy; JAG, Joint Advisory Group on Gastrointestinal Endoscopy; KSGE, Korea Association of Gastrointestinal Endoscopy; CAG, Canadian Association of Gastroenterology; SSG, Swiss Society of Gastroenterology; NZCCRTGE, New Zealand Conjoint Committee for recognition of Training in Gastrointestinal Endoscopy.

¹ Siau et. Al have recently published a JAG consensus statement for EGD credentialing in January, 2022, which have increased the minimum number of EGD's from 200 to 250 and the minimum number of DOPS from 20 to 25.

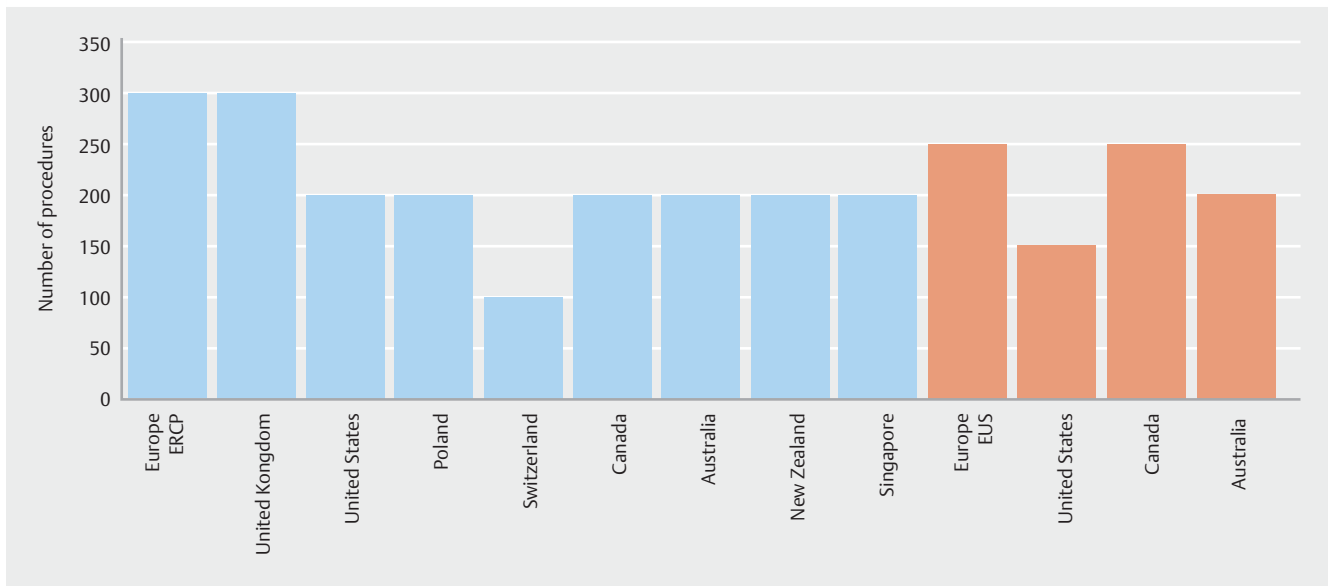
² New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy (including the New Zealand Society of Gastroenterology, the New Zealand Committees of the Royal Australasian College of Physicians and Royal Australasian College of Surgeons).

Discussion

We systematically identified and compared 20 endoscopy credentialing guidelines covering colonoscopy, EGD, flexible sigmoidoscopy, capsule endoscopy, ERCP, and EUS. Credentialing statements that referenced minimum procedural volume and KPIs were most common, with some guidelines also issuing statements recommending the use of validated endoscopy assessment tools. Colonoscopy, EGD, and ERCP were the most commonly reported on procedures with relatively sparse recommendations for sigmoidoscopy, capsule endoscopy, and EUS. While we identified some consistency among guidelines, such as recommendations for ADR in colonoscopy and bile duct cannulation success rate in ERCP, there was substantial variation among societies with respect to number of recommended procedures and KPI metrics.

Credentialing guidelines recommended 150 to 275 colonoscopies, 130 to 1000 EGDs, and 100 to 300 ERCPs. While guidelines generally included KPIs for the above procedures, the Swiss Society of Gastroenterology (SSG) and the CCRTGE recommended minimum procedural volumes of 400 supervised EGDs and 200 unassisted ERCPs respectively with no KPI recommendations. Relying on procedural volume alone may jeopardize quality of care, given the wide variation in skills among endoscopists with similar experience. For example, some endoscopists may struggle to reach 90% CIR despite having performed over 500 colonoscopies [32]. Indeed, large societies such as the ASGE and JAG recommend crossing a threshold of minimum colonoscopies, EGDs, and ERCPs in addition to adequate performance with respect to the KPIs [3, 30].

We identified several important KPIs in the included credentialing guidelines. KPIs for colonoscopy, which include ADR,



► **Fig. 2** Minimum number of procedures prior to credentialing for ERCP and EUS by country of society.

CIR, and withdrawal time, are grounded in robust evidence demonstrating their association with detection of colorectal cancer [33,34]. For ERCP, the KPI of selective duct cannulation is consistent across guidelines and is a useful adjunct to mitigate dissonant estimates of minimum procedural volume, as studies on ERCP learning curves have reported a range of less than 100 to greater than 400 ERCPs to attain proficiency [35,36]. Several guidelines also included KPIs related to biliary stent insertion and stone extraction success rates [16,22,24,29,31], reflecting the transition of ERCP to an almost exclusively therapeutic modality [37]. In contrast to colonoscopy and ERCP, EGD has sparse data on clinically relevant KPIs, with the duodenal (D2) intubation rate being the only consistent indicator in most guidelines [3,16,20,28]. Moving forward, credentialing guidelines may consider the addition of measures such as EGD duration [38] and mucosal visualization [39], akin to withdrawal time and bowel preparation in colonoscopy respectively, which are being explored for their relevance to clinical outcomes.

The JAG, NZCCRTGE, CCRTGE, and ESGE recommended the use of validated observational assessment tools in addition to procedural volume and KPIs [16,17,30,31], wherein an endoscopist is observed and graded on a set of items specific to the procedure by an expert assessor. When tools with strong evidence of clinical validity, such as the DOPS and TEESAT, are used, they can provide a more rounded assessment of individuals' endoscopic skills, help identify areas where endoscopists need additional support, guide ongoing development, and inform decisions regarding readiness for independent practice [7]. In contrast to number of procedures performed and KPIs, assessment tools encompass the full breadth of technical, cognitive, and non-technical skills needed for high-quality endoscopy [7], the latter of which are associated with patient safety [40]. While specific barriers have not been studied, widespread implementation of these tools may be limited by lack of time,

data collection and storage infrastructure, and financial resources.

Our study has several important limitations. First, systematic reviews and their conclusions are contingent on the underlying primary literature, some of which was not peer-reviewed and largely based on expert opinion and low-quality evidence. Second, we only identified qualitative trends in the data, and were not able to conduct meaningful pooled analyses. Third, there was substantial variability with respect to year of guideline publication. This is an important factor considering the advancements made in endoscopic care over time. Finally, we may have missed sources that were not indexed in the databases included in our electronic search or from organizations that are not a part of the WEO. Despite these limitations, we present the first systematic review on credentialing recommendations and requirements for six endoscopic procedures. These data are crucial in understanding trends in global credentialing practices and identifying deficiencies.

Conclusions

Many national or international guidelines provide recommendations and leave credentialing and granting clinical privileges to institutions at which procedures are performed. Inconsistent implementation of these recommendations can create challenges in ensuring endoscopists' competence and may jeopardize patient safety. For example, in the US, hospital participation in ASGE credentialing recommendations for ERCP is less than 50% [41]. In contrast, credentialing in the UK is largely managed by the JAG [43]. While adoption of JAG credentialing guidelines is not mandatory, it is strongly incentivized as it is required for endoscopy units to have trainees or participate in the national bowel screening program [42]. Similarly in Australia, the CCRTGE provides credentialing thresholds and recognizes endoscopists who meet those thresholds [43]. Many endoscopy

► **Table 3** Key performance indicators for endoscopic retrograde cholangiopancreatography (ERCP).

Society or training committee, country/region (Year)	Assessment tool	Key performance indicators						
		Minimum procedures	Min. number of stents placed	Min. number of stone extractions	Min. rate of duct cannulation	Min. success rate for stent placement	Min. success rate for stone extraction	Post-ERCP pancreatitis
ESGE, Europe (2021)	DOPS and TEESAT recommended to track competency	300	–	–	80% (in native papilla)	90% (for distal biliary strictures)	85%	10% post-ERCP pancreatitis
JAG, United Kingdom	Min. 30 formative DOPS, “ready of independent practice” in at least 85% of items as per 5 most recent	300 (incl. 240 unassisted in last 3 months)	–	–	80% (native papilla)	75% (for distal biliary strictures)	70%	5% post-ERCP pancreatitis (Schutz 1 or 2 cases)
ASGE, United States (2017)	–	200 (supervised, unassisted) & 80 sphincteromies (unassisted)	60 biliary stents	–	90%	–	–	–
KSGE, Korea (2017)	–	–	–	–	80%	–	85%	–
PSG, Poland	–	200 ‘with therapeutic intention’	–	–	80% (past 50 cases)	80%	80%	–
SSG, Switzerland (2015)	–	100 (incl. 50 sphincteromies)	25 drainages (stents, plastic endoprosthesis, nobiliary tubes, etc.)	25	–	–	–	–
CAG, Canada (2008)	–	200 (incl. 80 supervised)	60 biliary stents or no-biliary drains	–	80–85%	85%	85%	–
Conjoint Committee, Australia ¹ (2015)	–	200 unassisted (incl. 80 sphincteromies)	60 biliary stents	–	–	–	–	–
NZCCRTGE, New Zealand ² (2022)	–	200 supervised (incl. 80 sphincteromies)	60 biliary stents	–	80% (in last 50 cases)	–	–	–
ERCP working group (under the auspices of the Academy of Medicine, Singapore) (2011)	–	200	–	–	85% (in native papilla)	85%	85%	–

–, not reported; ASGE: American Society of Gastrointestinal Endoscopy; JAG, Joint Advisory Group on Gastrointestinal Endoscopy; KSGE, Korea Association of Gastrointestinal Endoscopy; ESGE, European Association of Gastrointestinal Endoscopy; CAG, Canadian Association of Gastroenterology; SSG, Swiss Society of Gastroenterology; NZCCRTGE: New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy; PSG, Polish Society of Gastroenterology.

facilities require that their practitioners carry CCRTGE recognition. The merits of local versus national or regional credentialing are not clear. Moving forward, societies that produce credentialing guidelines should continuously evaluate and update their statements to ensure they are grounded in evidence and support their implementation at individual facilities. Future research should be aimed at clarifying the impact of credentialing practices on quality of care.

Competing interests

R Khan has received research grants from AbbVie (2018) and Ferring Pharmaceuticals (2019) and research funding from Pendopharm (2019).

S. C. Grover has received research grants and personal fees from AbbVie and Ferring Pharmaceuticals, personal fees from Takeda, education grants from Janssen, and has equity in Volo Healthcare. The remaining authors disclose no conflicts.

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