Pediatric endoscopy training across Europe: a survey of the ESPGHAN National Societies Network 2016–2019

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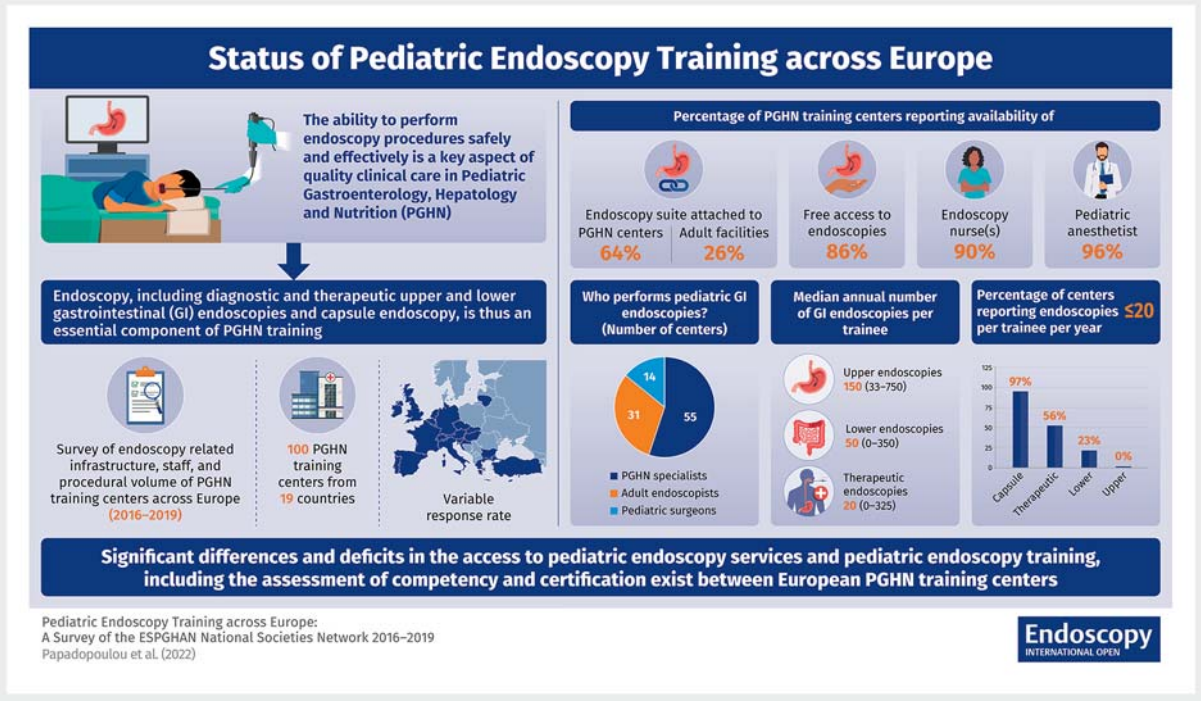

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ABSTRACT

Background and study aims The ability to perform endoscopy procedures safely and effectively is a key aspect of quality clinical care in Pediatric Gastroenterology, Hepatology and Nutrition (PGHN). The aim of this survey, which was part of a global survey on PGHN training in Europe, was to assess endoscopy training opportunities provided across Europe.

Methods Responses to standardized questions related to endoscopy training were collected from training centers across Europe through the presidents/representatives of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition National Societies from June 2016 to December 2019.

Results A total of 100 training centers from 19 countries participated in the survey. In 57 centers, the endoscopy suit was attached to the PGHN center, while in 23, pediatric endoscopies were performed in adult endoscopy facilities. Ninety percent of centers reported the availability of specialized endoscopy nurses and 96 % of pediatric anesthetists. Pediatric endoscopies were performed by PGHN specialists in 55 centers, while 31 centers reported the involvement of an adult endoscopist and 14 of a pediatric surgeon. Dividing the number of procedures performed at the training center by the number of trainees, ≤ 20 upper, lower, or therapeutic endoscopies per trainee per year were reported by 0 %, 23 %, and 56 % of centers, respectively, whereas ≤ 5 wireless capsule endoscopies per trainee per year by 75 %. Only one country (United Kingdom) required separate certification of competency in endoscopy.

Conclusions Differences and deficiencies in infrastructure, staffing, and procedural volume, as well as in endoscopy competency assessment and certification, were identified among European PGHN training centers limiting training opportunities in pediatric endoscopy.

Introduction

Endoscopy, including diagnostic and therapeutic upper and lower gastrointestinal endoscopic procedures and capsule endoscopy, is an essential part of training in Pediatric Gastroenterology, Hepatology and Nutrition (PGHN) [1].

Trainees should have up-to-date knowledge about the techniques available in relation to the relevant indications, risks, and benefits of such procedures. A current Endoscopy Training Position Paper of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) is mandatory reading in this context [2] Training, technical skills, health services provided, facilities, staff availability, clinical quality and patient and caregiver experience are quality indicators for endoscopic procedures [3–8] that provide better health outcomes, better patient and caregiver experience and fewer repeat interventions [9, 10]. The increasing frequency and variability of complex endoscopic procedures in children has led to

the need for dedicated, child-friendly facilities equipped with advanced endoscopy equipment and experienced medical, nursing and administrative staff – a prerequisite for high-quality endoscopy services [11].

Furthermore, training programs in endoscopy should include mechanisms for monitoring and documenting trainees' performance longitudinally, as the learning curves of different trainees vary widely [12]. The ESPGHAN and North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) Guidelines for training in Pediatric Gastroenterology define appropriate training and the minimum number of procedures recommended to achieve competency in endoscopy, and emphasize the need for trainees to become familiar with endoscopic procedures and understand their use, interpretation and limitations [2, 9]. However, a recent European survey found that training in pediatric endoscopy in Europe is variable and often inadequate, as reported by trainees themselves [13].

The aim of this survey, which is part of a global survey on PGHN training in Europe, was to assess the endoscopy training opportunities offered in different European countries and centers.

Methods

Questions related to the endoscopy training, the availability of specialists performing GI endoscopies, endoscopy nurses and pediatric anesthetists at the training centers, annual numbers of outpatients and of upper, lower, therapeutic and capsule endoscopies and numbers of trainees in post were included in thestandardized questionnaires prepared by the members (AP, AB and CRC) of the Executive Committee of the ESPGHAN National Societies Group 2015–2017 which have been published previously [14]. The questionnaire was assessed by the participants of the 2016 National Societies Group meeting held during the ESPGHAN 49th Annual meeting (Athens, Greece) for feasibility, readability, consistency of style and formatting, and clarity of language used, and sent to the presidents/representatives of the ESPGHAN National Societies network who distributed it to the heads of PGHN training centers in their countries and collected the responses. In countries where no official representative of the National Society participated in the survey (Italy, Portugal and Switzerland), a volunteer among the ESPGHAN members of the respective country (AG for Italy and RF for Switzerland) was asked to distribute and collect the questionnaires, or individual centers provided their data after direct communication with the study coordinators (Portugal). The project was approved by the ESPGHAN Council in 2016 and supported by ESPGHAN. It was conducted from June 2016 to December 2019, before the Covid-19 pandemic that is currently affecting the availability of endoscopies and thus training worldwide [15]. The manuscript was sent to the Chair of the ESPGHAN Endoscopy Special Interest Group (MT) for review and constructive comments.

Results

One hundred PGHN training centers from 17 European countries, Turkey and Israel participated in our survey. The list of centers participating in this survey has been published previously [14]: 30 training centers were capital based and 70 were based in other cities.

Infrastructure and staffing of PGHN training centers

All of the training centers performed upper endoscopies, 94 of 96 (98 %) performed lower endoscopies, 96 of 98 (98 %) therapeutic endoscopies, while 64 of 89 (72 %) capsule endoscopies. Therapeutic endoscopies were performed in the vast majority of training centers: endoscopic polypectomies in 95 of 98 centers (97 %) that answered the corresponding question, endoscopic removal of foreign bodies in 89 of 99 (90 %), hemostasis techniques in 77 of 97 (79 %), esophageal balloon dilatation in 78 of 98 (80 %) and gastrostomy placement in 89 of 99 (90 %) centers. No differences existed in the performance of therapeutic endoscopies between centers located in European capitals and those located in other cities: endoscopic polypectom-

▶ **Table 1** Annual procedural volume of upper and lower endoscopies as well as therapeutic endoscopies performed at the total cohort of European training centers in Pediatric Gastroenterology, Hepatology and Nutrition.

No endoscopies	No (%) of training centers Upper endoscopies (n = 96)	No (%) of training centers Lower endoscopies (n = 96)	No (%) of training centers Therapeutic endoscopies (n = 97)
≤ 100	6/96 (6 %)	51/96 (53 %)	81/97 (84 %)
101–150	9/96 (9 %)	15/96 (16 %)	5/97 (5 %)
151–200	11/96 (11 %)	15/96 (16 %)	6/97 (6 %)
201–250	10/96 (10 %)	3/96 (3 %)	1/97 (1 %)
251–300	10/96 (10 %)	2/96 (2 %)	2/97 (2 %)
301–350	5/96 (5 %)	1/96 (1 %)	0/97 (0 %)
351–400	11/96 (11 %)	2/96 (2 %)	1/97 (1 %)
401–450	1/96 (1 %)	2/96 (2 %)	0/97 (0 %)
> 450	33/96 (34 %)	5/96 (5 %)	1/97 (1 %)

▶ **Table 2** Annual number of gastrointestinal endoscopies performed by training centers[1] according to their annual outpatient volume.

No of endoscopies	Type of endoscopies	<500 (n=3)	501–1500 (n=18)	1501–3000 (n=33)	3001–5000 (n=25)	>5000 (n=20)
≤100	Upper	0/3 (0%)	1/18 (6%)	4/32 (13%)	1/24 (4%)	0/18 (0%)
	Lower	2/3 (67%)	11/18 (61%)	24/32 (73%)	9/24 (38%)	4/18 (22%)
	Interventional	3/3 (100%)	16/17 (89%)	30/33 (91%)	17/24 (71%)	15/20 (75%)
101–150	Upper	1/3 (33%)	3/18 (17%)	3/32 (9%)	1/24 (4%)	1/18 (6%)
	Lower	1/3 (33%)	3/18 (17%)	4/32 (13%)	2/24 (8%)	5/18 (28%)
	Interventional	0/3 (0%)	0/17 (0%)	2/33 (6%)	2/24 (8%)	1/20 (5%)
151–200	Upper	0/3 (0%)	1/18 (6%)	6/32 (19%)	2/24 (8%)	2/18 (11%)
	Lower	0/3 (0%)	2/18 (11%)	3/32 (9%)	6/24 (25%)	4/18 (22%)
	Interventional	0/3 (0%)	0/17 (0%)	1/33 (3%)	3/24 (13%)	2/20 (10%)
201–250	Upper	1/3 (33%)	2/18 (11%)	4/32 (13%)	2/24 (8%)	1/18 (6%)
	Lower	0/3 (0%)	1/18 (6%)	1/32 (3%)	1/24 (4%)	0/18 (0%)
	Interventional	0/3 (0%)	0/17 (0%)	0/33 (0%)	1/24 (4%)	0/20 (0%)
251–300	Upper	1/3 (33%)	5/18 (28%)	1/32 (3%)	2/24 (8%)	1/18 (6%)
	Lower	0/3 (0%)	0/18 (0%)	0/32 (0%)	1/24 (4%)	1/18 (6%)
	Interventional	0/3 (0%)	0/17 (0%)	0/33 (0%)	0/24 (0%)	2/20 (10%)
301–350	Upper	0/3 (0%)	0/18 (0%)	4/32 (13%)	0/24 (0%)	0/18 (0%)
	Lower	0/3 (0%)	0/18 (0%)	0/32 (0%)	1/24 (4%)	0/18 (0%)
	Interventional	0/3 (0%)	0/17 (0%)	0/33 (0%)	0/24 (0%)	0/20 (0%)
351–400	Upper	0/3 (0%)	4/18 (22%)	2/32 (6%)	2/24 (8%)	3/18 (17%)
	Lower	0/3 (0%)	0/18 (0%)	0/32 (0%)	2/24 (8%)	0/18 (0%)
	Interventional	0/3 (0%)	0/17 (0%)	0/33 (0%)	1/24 (4%)	0/20 (0%)
401–450	Upper	0/3 (0%)	0/18 (0%)	0/32 (0%)	1/24 (4%)	0/18 (0%)
	Lower	0/3 (0%)	0/18 (0%)	0/32 (0%)	1/24 (4%)	1/18 (6%)
	Interventional	0/3 (0%)	0/17 (0%)	0/33 (0%)	0/24 (0%)	0/20 (0%)
>450	Upper	0/3 (0%)	2/18 (11%)	8/32 (25%)	13/24 (54%)	10/18 (56%)
	Lower	0/3 (0%)	1/18 (6%)	0/32 (0%)	1/24 (4%)	3/18 (17%)
	Interventional	0/3 (0%)	1/17 (6%)	0/33 (0%)	0/24 (0%)	0/20 (0%)

[1] Ninety-nine of 100 training centers answered the question on the annual number of outpatients. In all of the shown ratios, the numerators show the annual numbers of endoscopies performed by the centers, while the denominators are the number of centers that answered the relevant question.

ies were performed in 29 of 29 centers (100%) located in European capitals which answered the corresponding question and in 66 of 69 (96%) of those located in other cities; endoscopic removal of foreign bodies in 27 of 29 (93%) and in 62 of 70 (89%), respectively; hemostasis techniques in 23 of 27 (85%) and in 54 of 70 (80%), respectively; esophageal balloon dilatation in 24 of 29 (83%) and in 54 of 69 (78%), respectively; and gastrostomy placement in 28 of 29 (97%) and in 61 of 70 (87%), respectively.

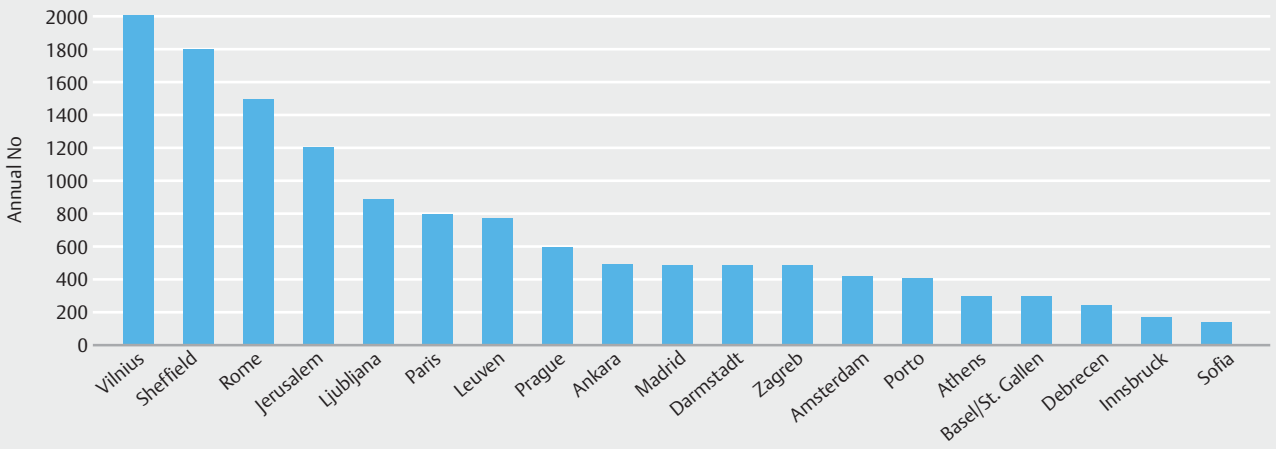
The availability of an endoscopy suit attached to the PGHN training center was reported by 57 of 89 centers (64%) that answered the corresponding question, while in 23 centers the endoscopies were performed in an adult endoscopy suit. Free access to endoscopic procedures (i.e. based solely on the gastroenterology specialist's decision) was available in 82 of 95 (86%) of training centers.

In 55 centers, the endoscopies were performed by a PGHN specialist, in 31 by an adult gastroenterologist (with or without the presence of a PGHN specialist), while in 14 by a pediatric surgeon (with or without the presence of a PGHN specialist). Availability of specialized endoscopy nurses was reported by 71 of 79 (90%) centers. Availability of an anesthetist to perform anesthesia or sedation for pediatric endoscopy was reported by 91 of 95 centers (96%), while in 4 centers the sedation was given by the endoscopist (3 of 4 of the above centers reported the involvement of an adult endoscopist in performing pediatric endoscopies).

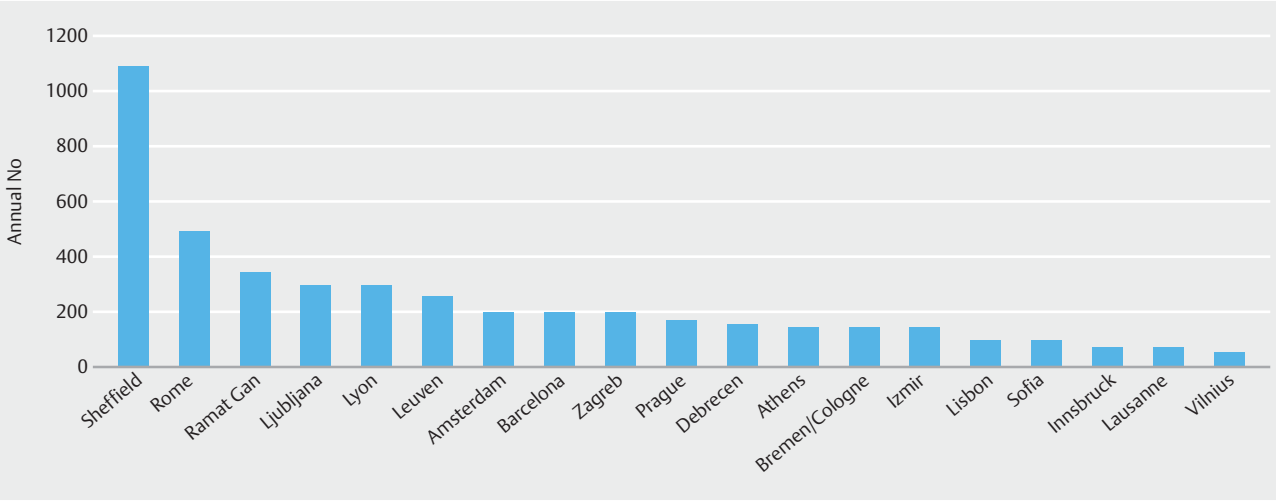
Number of endoscopic procedures performed at PGHN training centers

The annual procedural volume of endoscopies performed in the total cohort of PGHN European training centers is shown in ▶ **Table 1**. Wireless capsule endoscopy was performed in 64 centers. The median (range) annual numbers of upper, lower, interventional and wireless capsule endoscopies were 350 (100–2000), 100 (0–1100), 30 (0–650) and 5 (0–78) respectively.

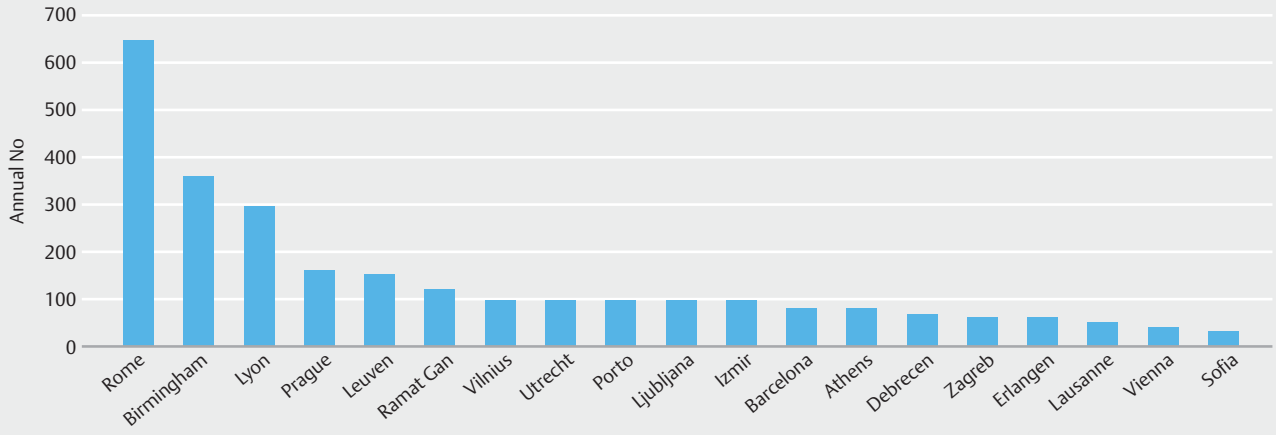
We were interested to know if the largest volume of endoscopic procedures was related to the outpatient volume of a training center. However, this was not the case for lower and therapeutic gastrointestinal endoscopies: 22% of training centers with an annual number of >5000 outpatients per year reported ≤100 lower endoscopies annually, while 75% of them, reported ≤100 therapeutic endoscopies annually (▶ **Table 2**).



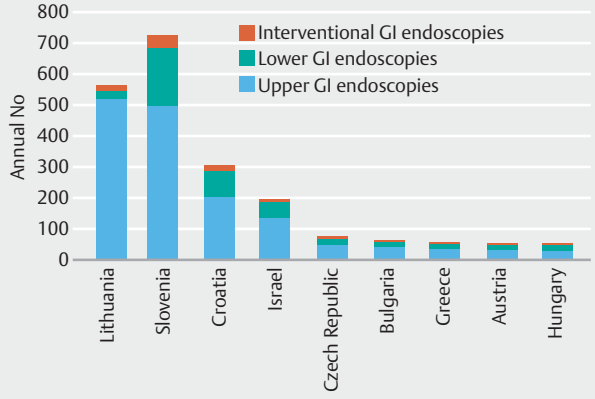
▶ **Fig. 1** Annual numbers of upper gastrointestinal endoscopies performed by the PGHN centers with the largest procedural volume among the participating in the survey centers which answered the corresponding question, in each country. The centers shown in the figure are the following: Vilnius (Vilnius University Hospital Santaros Klinikos, Vilnius, Lithuania); Sheffield (Sheffield Children's Hospital, Sheffield, UK); Rome (Bambino Gesù Children's Hospital, Rome, Italy); Jerusalem (Shaare Zedek Medical Center, Jerusalem, Israel); Ljubljana (Ljubljana University Medical Center, Ljubljana, Slovenia); Paris (University Hospital Robert Debré, Paris, France); Leuven (University Hospitals Leuven, Leuven, Belgium); Prague (Motol University Hospital, Prague, Czech Republic); Ankara (Ankara University Hospital, Ankara, Turkey); Madrid (Niño Jesús University Hospital, Madrid, Spain); Darmstadt (Darmstädter Children's Hospital Prinzessin Margaret, Darmstadt, Germany); Zagreb (Children's Hospital Zagreb, Croatia same numbers with the University Hospital Center, Zagreb, Croatia), Amsterdam (Emma Childrens Hospital, Academic Medical Center, Amsterdam, The Netherlands); Porto (São João hospital center, Porto, Portugal); Athens (Agia Sofia Children's Hospital, Athens, Greece); Basel (Basel University Children's Hospital, Basel, Switzerland) same numbers with St. Gallen (Children's Hospital of Eastern Switzerland, St. Gallen, Switzerland); Debrecen (Debrecen University Children's Hospital, Debrecen, Hungary); Innsbruck (Innsbruck Medical University Hospital, Innsbruck, Austria); Sofia (Sofia Medical University Hospital, Sofia, Bulgaria). PGHN: Pediatric Gastroenterology, Hepatology and Nutrition; No: number.



▶ **Fig. 2** Annual numbers of lower gastrointestinal endoscopies performed by the PGHN centers with the largest procedural volume among the participating in the survey centers which answered the corresponding question, in each country. The centers shown in the figure are the following: Sheffield (Sheffield Children's Hospital, Sheffield, UK); Rome (Bambino Gesù Children's Hospital, Rome, Italy); Ramat Gan (Sheba Medical Center, Ramat Gan, Israel); Ljubljana (Ljubljana University Medical Center, Ljubljana, Slovenia); Lyon (Hospital Woman Mother Chil, Lyon, France); Leuven (University Hospitals Leuven, Leuven, Belgium); Amsterdam (Emma Childrens Hospital, Academic Medical Center, Amsterdam, The Netherlands); Barcelona (Hospital San Juan de Dios, Barcelona, Spain); Zagreb (University Hospital Center, Zagreb, Croatia); Prague (Motol University Hospital, Prague, Czech Republic); Debrecen (Debrecen University Children's Hospital, Debrecen, Hungary); Athens (Agia Sofia Children's Hospital, Athens, Greece); Bremen (Bremen Children's Hospital, Bremen, Germany) same numbers with Cologne (Cologne University Children's Hospital, Cologne, Germany); Izmir (Dokuz Eylül University, Izmir, Turkey); Lisbon (University Hospital de Santa Maria, Lisbon Academical Medical Centre, Lisbon, Portugal); Sofia (Sofia Medical University Hospital, Sofia, Bulgaria); Innsbruck (Innsbruck Medical University Hospital, Innsbruck, Austria); Lausanne (Lausanne University Hospital, Lausanne, Switzerland); Vilnius (Vilnius University Hospital Santaros Klinikos, Vilnius, Lithuania). PGHN: Pediatric Gastroenterology, Hepatology and Nutrition; No: number.



▶ **Fig. 3** Annual numbers of therapeutic gastrointestinal endoscopies performed by the PGHN centers with the largest procedural volume among the participating in the survey centers which answered the corresponding question, in each country. The centers shown in the figure are the following: Rome (Bambino Gesù Children's Hospital, Rome, Italy); Birmingham (Birmingham Children's Hospital, Birmingham, UK); Lyon (Hospital Woman Mother Chil, Lyon, France); Prague (Motol University Hospital, Prague, Czech Republic); Leuven (University Hospitals Leuven, Leuven, Belgium); Ramat Gan (Sheba Medical Center, Ramat Gan, Israel); Vilnius (Vilnius University Hospital Santaros Klinikos, Vilnius, Lithuania); Utrecht (Wilhelmina Childrens Hospital/University Medical Center Utrecht, Utrecht, The Netherlands); Porto (São João Hospital Center, Porto, Portugal); Ljubljana (Ljubljana University Medical Center, Ljubljana, Slovenia); Izmir (Dokuz Eylül University, Izmir, Turkey); Barcelona (Hospital San Juan de Dios, Barcelona, Spain); Athens (Agia Sofia Children's Hospital, Athens, Greece); Debrecen (Debrecen University Children's Hospital, Debrecen, Hungary); Zagreb (University Hospital Center, Zagreb, Croatia); Erlangen (Children's Hospital Erlangen, Erlangen, Germany); Lausanne (Lausanne University Hospital, Lausanne, Switzerland); Vienna (Vienna University Children's Hospital, Vienna, Austria); Sofia (Sofia Medical University Hospital, Sofia, Bulgaria). PGHN: Pediatric Gastroenterology, Hepatology and Nutrition; No: number.



▶ **Fig. 4** Annual number of upper/lower/therapeutic gastrointestinal endoscopies per 100.000 pediatric inhabitants 0–19 years [16] in countries with full representation of training centers in Pediatric Gastroenterology, Hepatology and Nutrition. GI, gastrointestinal; no, number.

The reported annual numbers of upper, lower, and therapeutic gastrointestinal endoscopies performed by the training centers with the largest volume of procedures among the participating in the survey centers in each country which answered the corresponding question, are shown in ▶ **Fig. 1**, ▶ **Fig. 2** and ▶ **Fig. 3**. We should note that Necker hospital in Paris, France is included only in the analysis shown in ▶ **Fig. 3** and not in that shown in ▶ **Fig. 1** and ▶ **Fig. 2**, as the representative of the center in the survey did not report annual numbers of upper or lower endoscopies but only of therapeutic ones.

We were interested to know the performance of training centers in countries that had a full representation of PGHN training centers in our survey. Therefore, we calculated the number of endoscopies performed by all PGHN training centers per 100,000 population aged 0 to 19 years in the countries where the training centers were fully represented (▶ **Fig. 4**). The numbers of the population aged 0 to 19 years are taken from the international database of the United States Census Bureau [16]. Interestingly, the volume of diagnostic endoscopic procedures carried out by PGHN training centers differed among countries, with Lithuanian and Slovenian PGHN training centers performing many more upper endoscopies compared to the training centers of other countries, while Slovenia performed many more lower endoscopies.

Exposure of trainees in PGHN to pediatric endoscopies

We assessed the exposure of trainees in PGHN to pediatric endoscopies by dividing the total number of endoscopies performed in the training center by the number of trainees in post (where exact numbers were given). The median (range) annual number of upper, lower, and therapeutic endoscopies per trainee per year in the whole cohort of training centers were as follows: 150 (33–750); 50 (0–350); 20 (0–325), respectively.

Exposure to ≤ 50 upper, lower or therapeutic endoscopies per trainee per year was reported by five of 84 (6 %), 45 of 84

(54 %) and 78 of 84 (93 %) training centers respectively, while an even lower number (≤ 20) of lower or therapeutic endoscopies per trainee per year was reported by 19 of 84 (23 %) and 47 of 84 (56 %) training centers respectively. A very low number (≤ 10) of therapeutic endoscopies per trainee per year was reported by 25/84 (30 %) of the training centers and an even lower (≤ 5) number of wireless capsule endoscopies per trainee per year was reported by 57of 76 (75 %) of training centers.

We were interested to know the availability of training curricula and of clinical leads to supervise the training in PGHN, an important part of which comprise training in pediatric endoscopies. Training curricula were available in 76 of 98 centers (78 %) and training leads to supervise the training in 80 of 97 (82 %). We were interested also to know the certification policy of competence in pediatric endoscopies in different European countries. Only one country (United Kingdom; UK) mandates a formal certification of competence in endoscopy at the end of training. In two countries (Austria and Bulgaria) where PGHN is officially recognized, a general certification in PGHN is granted after an overall assessment of a trainee's portfolio, while in other countries (Czech Republic, Croatia, Hungary, Israel, Germany, Lithuania, Portugal, Switzerland, and Turkey) where PGHN is formally recognized as subspecialty, certification of training in PGHN involves also, a formal examination at the end of training.

Discussion

This survey shows that access to endoscopy varies widely across PGHN training centers in Europe. In more than half of the training centers the endoscopy suit was attached to the PGHN training center, while in more than one fifth it was affiliated with adult endoscopy facilities. In about half of the training centers pediatric endoscopies were performed by PGHN specialists, while one third of centers reported the involvement of an adult endoscopist and more than one tenth, of a pediatric surgeon. The vast majority of training centers reported the availability of specialized endoscopy nurses (90 %) and the involvement of an anesthetist (96 %) in endoscopy procedures. Small (≤ 20) numbers of lower endoscopies per trainee per year were reported by 23 % of centers, ≤ 10 therapeutic endoscopies per trainee per year were reported by 30 % of centers, while ≤ 5 wireless capsule endoscopies per trainee per year were reported by 75 % of centers. The volume of endoscopic procedures performed at the facility was not related to the outpatient volume of a training center, as even larger centers with > 5000 outpatients per year reported a total annual number of ≤ 100 lower (22 %) or therapeutic (75%) gastrointestinal endoscopies at the facility. The rates of performance of diagnostic endoscopic procedures by the PGHN training centers differed among European countries but the reasons for these differences are not known. Training programs, supervision of training, monitoring and certification of training in pediatric endoscopies at the end of training in PGHN differ among European countries with only one (UK) mandating a formal certification of competence in endoscopy at the end of PGHN training.

Training on real-life cases can only take place if there is the possibility of being confronted with such cases. This survey shows that the number of endoscopies performed varies widely between training centers in Europe. However, the availability of rapid access to endoscopy based on well-defined local or regional pathways under the supervision of a well-organized network of specialists is of paramount importance [11]. The UK Inflammatory Bowel Diseases Audit has indicated that 99 % of relevant services in the UK have the appropriate framework in place to ensure access to endoscopy within 72 hours [17]. Other more urgent indications for endoscopy, e. g. foreign body ingestion or upper GI bleeding, require an appropriate framework to ensure the feasibility of endoscopy procedures even faster, within 24 hours [10]. Specialized endoscopy nurses to assist the endoscopist and pediatric anesthetists should be part of the medical and multidisciplinary team in an endoscopy unit, but this has no relevance to training as such [10, 18].

This survey showed wide variation in trainee exposure to endoscopy procedures, even if all endoscopy procedures were partially or fully performed by trainees. However, according to a recent web-based survey on endoscopy training published in abstract form [19], which included 20 of the training centers that participated in our survey, it was estimated that only ~ 30 % of endoscopies were performed by trainees. Based on the above estimate, the deficits in access to endoscopy procedures reported in our survey are even greater, and thus, the limitations in training opportunities in pediatric endoscopy. It should be noted, however, that the traditional model of training based on numbers performed is generally being replaced by a competency-based model of direct observation [20–22]. According to the Paediatric Guidance Checklist Gastroenterology and Hepatology reviewed by the UK PGHAN College Specialty Advisory Committee [21], each trainee must perform at least 100 upper GI endoscopies and 75 colonoscopies, but this is hopelessly out of date and today it is recognized that competency assessment is the correct model. Several Societies recommend a “competency threshold” for the number of procedures during PGHN training, ranging from 100 [23] to 130 [24] for upper endoscopies and from 50 [23] to 275 [24] for ileo-colonoscopies. Apart from the volume of interventions, the intensity of training and the absence of interruptions in training [25], the use of training aids such as simulation [26], the quality of teaching and feedback received, and a trainee's innate skills are all factors that influence the acquisition of the technical, cognitive, and integrative skills required for a more effective diagnostic, management, and therapeutic approach [27, 28]. Recently, a comprehensive pediatric-specific endoscopy curriculum has been proposed that incorporates the best evidence in endoscopy skills training and a competency-based training model [2]. A competency-based prospective training model is enhanced by setting appropriate expectations at the beginning of the training process, maintaining the trainer's engagement in the training process, and final assessment through performance-based feedback [28]. To standardize endoscopic training through a process of skill acquisition and assessment, it is critical to ensure the effectiveness of those who teach endoscopic skills [29]. Recognition of the importance of defined instructor competence

has led to the development of train-the-trainer courses [30], while improvement in procedural outcomes can be achieved if formal curricula for teaching endoscopic skills are developed [31]. Surprisingly, we found that training curricula and training leads to supervise training programs were lacking in 22 % and 18 % of training centers, respectively, while official certification of competence in endoscopy at the end of training was mandatory only in the UK. However, ensuring competence for basic and advanced endoscopy skills and developing strategies to assess and accredit competence where these are lacking are issues of paramount importance.

The ESPGHAN curriculum [1] suggests that trainers assess and evaluate trainee progress, with assessment consisting of identifying what is needed and what evidence is required to show that this has been achieved, while evaluation assesses progress against targets. They must set the training contract for the trainee at the beginning of the training and review progress at 3-month intervals during the first year of training to appraise the individual. The ESPGHAN curriculum [1] suggests that an annual assessment is undertaken, ideally at national level, to review the competences achieved and to enable progress within the teaching program. Assessments should be detailed and include statements about the theoretical and practical experience of the trainee, who should provide a report on the training and any problems encountered (portfolio). It should be noted, however, that although the primary aim of training programs is to train clinicians with a high level of competence, a broader training mission should be considered, recognizing and accepting that a proportion of trainees will choose other career paths as researchers and/or medical educators. Therefore, a more thorough training plan is needed that takes into account the evolving career expectations of trainees [32] as well as their service constraints [33]. In the UK, the Joint Advisory Group on Gastrointestinal Endoscopy (JAG) awards accreditation for high-quality gastrointestinal endoscopy services, while JAG Endoscopy Training System (JETS) is a booking portal (https://www.jets.thejag.org.uk/) for endoscopic training courses that provides an electronic portfolio where evidence of endoscopy training can be recorded to apply for JAG certification for trainees.

In addition to learning with “live” cases, which may be limited by availability, as described in this survey, other, more varied and imaginative ways of teaching pediatric endoscopy should be pursued: Hands-on courses at the start of training, use of endoscopy simulators, use of online lesion detection modules, some exposure to adult endoscopy training if available to acquire technical skills, and other opportunities such as the Endoscopy Learning Zone at the ESPGHAN annual meeting [2]. The availability of structured direct observation tools such as Gastrointestinal Endoscopy Competency Assessment Tool for pediatric colonoscopy (GiECATkids) is important to provide a framework for teaching, support trainee learning through instructive feedback, assess trainee progress toward specific competency-based milestones, facilitate identification of skill deficits and ensure readiness for independent practice [34]. Despite the widely acknowledged need for a structured training program in pediatric endoscopy, there is wide variation across Europe in the opportunities for and quality of endoscopic training, as demonstrated by the earlier ESPGHAN survey of trainees [13] and this more comprehensive Europe-wide survey of training centers.

This study has a number of limitations. First, it was a cross-sectional study, that relied on volunteers who were willing to self-report the requested information and secondly, the response rate was fluctuating as there were countries that were fully represented with their PGHN training centers such as Austria, Bulgaria, Chech Republic, Croatia, Greece, Hungary, Israel, Lithuania and Slovenia, while other countries such as Germany and Turkey had limited representation as only a few centers participated in the survey. However, with regard to the German PGHN training centers, the criteria [35] that a trainee should fulfill in order to be certified as a PGHN subspecialist by the State Medical Association include performing ≥100 upper endoscopies (25 of which in children under 6 years of age), including therapeutic upper endoscopies, and ≥ 50 ileocolonoscopies (including polypectomies). Notwithstanding the above limitations, this collaborative work of the ESPGHAN National Societies Network provides the largest dataset on infrastructure, staff, number of procedures and training programs in pediatric endoscopy across Europe. It demonstrates the heterogeneity across Europe and highlights the need for harmonization of training programs and service infrastructure that provides appropriately timed access to endoscopic procedures in child-friendly, dedicated endoscopy units with specialized nurses and anesthetists. Considering that the number of procedures performed per trainee is much lower than the number of procedures performed at the training center, it is clear that the deficiencies in access to endoscopy training are even greater than reported in this article, so PGHN Societies are urged to take action for change.

Conclusions

In conclusion, this survey reveals significant differences in training opportunities in pediatric endoscopy across Europe. National Societies need to take initiatives to ensure the acquisition of basic and advanced endoscopy skills, participation in Endoscopy Schools, the use of endoscopy simulators, and the establishment of fellowships for beginner and advanced endoscopy fellowships, such as those now offered annually through ESPGHAN. National Societies also need to develop strategies for assessment and accreditation of competence where these are lacking. JETS and JAG could provide an attractive opportunity to introduce this across Europe in conjunction with ESPGHAN.

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Competing interests

The authors declare that they have no conflict of interest.

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