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Entrustable professional activities for residency in general internal medicine: a systematic review

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Summary

CONTEXT: Entrustable Professional Activities (EPAs) are observable tasks that are regular parts of a physician's daily clinical work. Before being permitted to accomplish these tasks independently, trainees must gain their supervisors' trust. Defining the list of EPAs that should be mastered by the end of a residency is critical to setting clear expectations about autonomous practice.

OBJECTIVE: To collect all the lists of EPAs defined for residencies in general internal medicine and synthesise them into a reference work useful for developing new lists of EPAs or improving existing ones.

METHOD: This systematic review searched five databases and relevant grey literature using keywords related to EPAs and postgraduate education, from 2005, when the first article on EPAs was published, to April 2022. Inclusion criteria were the availability of an EPAs list and a focus on general internal medicine. Two reviewers independently selected the studies, extracted data and performed a quality assessment using QATSDD and AACODS tools. Mean values and inter-rater reliability were calculated.

RESULTS: The review yielded 3292 records, with 16 articles meeting the inclusion criteria, mostly from North America. Synthesising their 16 lists generated 395 EPAs. The reviewers then inductively categoried those EPAs, 308 of which fell into 6 domains, 14 themes and 24 subthemes. The domains were: (1) care and management of the general adult population (n = 103 EPAs); (2) care and management of patients with specific needs (n = 67); (3) care coordination and communication (n = 52); (4) management and leadership (N = 21); (5) healthcare quality, education, and research (n = 41); and (6) miscellaneous (n = 24). The remaining 87 EPAs were disease-specific and did not fit into this categorisation.

CONCLUSIONS: Categorising EPAs created a unique synthesis of the existing lists of EPAs for educating residents in general internal medicine. This synthesis could be used as a reference for anyone tasked with developing new lists of EPAs or improving existing ones.

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Introduction

Physicians supervising medical students and residents have shown a growing interest in the concept of *e*ntrustable professional activities (EPAs) since Ten Cate introduced this term in 2005 [1–3]. EPAs are concrete tasks performed in day-to-day clinical work [2, 4]. These activities are described as "entrustable" because medical trainees must gain their supervisors' trust before being permitted to accomplish them independently [2].

EPAs were developed as a necessary complement to competency-based medical education [5, 6]. Whereas competencies describe physicians' characteristics, EPAs represent concrete clinical tasks that require proficiency in several competencies [7]. As a complement to competencies, EPAs facilitate assessment processes because they are easily observable [8, 9]. Therefore, EPAs help clarify the expectations for both trainees and supervisors [5]. Finally, EPAs highlight the critical issue of entrustment and thereby the appropriate level of supervision needed in clinical environments [10–12].

Defining the EPAs that trainee doctors should have mastered by the end of their residency is essential to setting clear expectations about their future autonomous practice. Numerous residency programmes in various disciplines, including general internal medicine, have begun defining which EPAs need to be mastered [13–19]. Defining a particular residency programme's EPAs is a multistep process, usually requiring an initial selection of EPAs by a panel of experts and then the formation of a consensus among them [20]. To facilitate this process for general internists, we aimed to collect all the available lists of EPAs defined for residency programmes in general internal medicine and synthesise them into a useful reference.

Methods

This systematic review had the following research question: "Which entrustable professional activities have been defined for residency programmes in general internal medicine?" The study protocol was registered and published online on the PROSPERO website (CRD42021169755). There was no deviation from this protocol. We followed the PRISMA guideline recommendations for reporting systematic reviews [21].

Data sources and searches

The present systematic review searched the following databases: Medline Ovid SP, Embase.com, Education Resource Information Center (ERIC), Web of Science, and ProQuest Dissertations and Theses A&I. We based our search on the following keywords: (1) "entrustable professional activities" and (2) "postgraduate education" or "training" or "residency" (appendix 1). The search algorithms, developed with the help of a medical librarian, are shown in appendix 2.

We also performed complementary searches introducing the same keywords on Google Scholar. For practicality and relevance, we limited the search to the first 200 results yielded by Google Scholar. We hand-searched literature in two leading medical education journals (*Medical Education* and *Medical Teacher*) the abstract books of several medical education conferences and medical societies' recommendations. The details of our grey literature search are also available in appendix 2.

The search extended from January 2005, when Ten Cate published his first article on EPAs [2], to February 2020, when the initial search was performed. Due to the COVID-19 pandemic, the review has been delayed, requiring a complementary search we performed in April 2022, covering the period between the initial search and April 2022. We gathered all the references using EndNote, version 20.1 (Clarivate Analytics).

Study selection

Inclusion criteria

Although our focus was on residency programmes for general internal medicine, we knew this was probably not a uniform specialty across healthcare systems internationally. We therefore considered multiple existing definitions of general internal medicine [22–25] and chose to define it as the medical discipline responsible for the holistic care of patients in both inpatient and outpatient settings. We included every article meeting our definition of general internal medicine. This is why our inclusion criteria extended more broadly to residency programmes in internal medicine and family medicine (FM). Only articles in English, French or German were included. The last inclusion criterion was the availability of an EPA list.

Exclusion criteria

We excluded articles concerning healthcare professionals other than medical doctors, focusing on undergraduate medical education or addressing only a limited clinical activity (e.g., patient handovers [26]) rather than a full residency programme. In addition, we excluded articles using terms other than EPAs for their proposed lists (e.g., lists of "competencies in practice" or "observable professional activities"). If the authors of such articles had not explicitly mentioned that their term was a synonym for EPAs, we considered that their list reflected a different concept and excluded the source. Finally, publications that used previously published lists of EPAs without further work were not included in the study.

Two authors (BV and DG) performed every phase of the study selection process independently. After the removal of duplicates, the titles and abstracts of the retrieved articles were screened using Rayyan QCRI website [27]. Full-text articles were obtained when needed to help decide on final inclusion. BV and DG resolved disagreements through discussion. Finally, a forward and backward citation search was performed on the included articles to identify any possible additional records.

Data extraction and quality assessment

Two authors (BV and DG) independently extracted the following data from the articles: year of publication, country, language, type of residency programme (e.g., the medical discipline as designated by the publication's authors), practice setting for the EPAs (e.g., EPAs developed for outpatient practice only, inpatient practice only, or both), number of EPAs on the list, methods used to develop that list and methods authors used to assess the quality of each EPA on the list (e.g., the EQual protocol). BV and DG resolved any disagreements concerning data extraction through discussion. A final, common version of the extraction form was established.

BV and DG independently assessed the methodological quality of the process leading to each article's EPA list but not the EPAs themselves. This assessment followed the guidelines of the Quality Assessment Tool for Studies with Diverse Designs (QATSDD), a 16-item tool used in healthcare services research and dedicated to the quality assessment of studies with diverse designs [28]. QATSDD was previously used by Kerth, O'Dowd and Pinilla in their respective systematic reviews concerning EPAs [16, 20, 29]. We used the specifically developed AACODS tool to critically appraise the quality of grey literature [30]. The AACODS acronym represents each section of the tool — Authority, Accuracy, Coverage, Objectivity, Date and Significance — with each section including from 1 to 12 closed questions. To synthesise our quality assessment of the reports in the grey literature, we converted the AACODS results into a score (with 0 to 1 point scored for each section).

The mean of the two raters' scores was then computed for each item of both tools. Finally, a total score was computed for each article. The inter-rater reliability was calculated using an intraclass correlation coefficient (ICC (2,k)) [31].

Data synthesis and analysis

We could not perform a meta-analysis because of the types of studies examined; rather, we planned a qualitative approach to the data synthesis, with a thematic categorisation of the available EPAs. Categories were not defined in ad-

vance, and we favoured an inductive approach to creating themes.

Our broader inclusion criteria extended to internal medicine and family medicine residency programmes, for the previously mentioned reasons. We planned to conduct a secondary analysis of our data to consider each residency programme's exact title or designation (e.g., family or internal medicine). To do so, we would simply refer to the designation used by the EPA lists' authors.

Results

Description of the articles

Our research algorithms found 1664 records in selected databases and an additional 249 in our grey literature search, making a total of 1913. This number was reduced to 1132 after the removal of duplicates, but only 14 articles fitted our criteria [13, 32–44] (fig. 1). Another reference [45] was found after a forward and backward citation search from the articles selected. The complementary search performed in April 2022 found 1379 records, that were reduced to 547 after duplicate removal. Out of those, only one new article fitted our criteria [46].

The list of selected articles is available in table 1. The articles were numbered from 1–16, allowing us to number each EPA easily using a four-digit code: in EPA 0534, for example, the first two digits represent article number 05, and the last two digits represent the EPA's position in its particular list.

All 16 articles were available in English, with most from North America (USA [n = 6], Canada [n = 6]), two from Australia, one from the UK and one from Iran. The oldest articles were published in 2012, and most (n = 9) were published between 2017 and early 2021. Half of the articles (n = 8) described residency programmes identified as family medicine by their authors; the other half (n = 8) were identified as internal medicine programmes.

Thirteen of the 16 articles described the methods used to define their EPAs [13, 32–41, 43, 46]. They referred to literature reviews or previous work completed on the matter. One article used a scoping review, but none reported the completion of a systematic literature review. All 13 articles described involvement of an expert panel in the definition of the EPAs.

The methodological quality assessment of the articles included showed that the literature had a medium level of quality (QATSDD mean score 30.6, standard deviation [SD] 5.3; maximum possible tool score 48) (AACODS mean score 3.9, SD 0.2; maximum possible tool score 6). The scores for each item are available in a supplementary table (appendix 3).

The highest scoring items for QATSDD were the description of the objectives of the studies, the description of the research settings and the fit between the research question and the method used (items 2, 3 and 10). The two items that scored highest for AACODS were the assessment of bias and the reference to current content (items O and D). The lowest scoring items in the QATSDD test were the evidence for the sample size (e.g., size of the expert panel), the assessment of reliability and the evidence of user's involvement in the design (item 4, 14 and 15). The lowest scoring items in AACODS were the accuracy (e.g., not peer-reviewed, no stated methodology) and the coverage (e.g., no clear question of research, no clear limit) (items A2 and C). The reliability was assessed between the reviewers using an ICC (ICC (2,k)) [31], and is considered good for the QATSDD score (0.89) and moderate for the AACODS score (0.69).

Lists of EPAs

The analysis of the 16 lists yielded a total of 395 different EPAs. The mean number of EPAs per list was 25 (median 25 EPAs). The number of EPAs in the lists created for FM residency programmes (median 25 EPAs) is slightly higher than the number of EPA in the lists created for internal medicine residency programmes (median 21 EPAs).

EPA classification

A total of 395 EPAs were retrieved from the 16 different lists. Using an iterative approach, we were able to organise 308 of them into a three-level categorisation of 6 domains, 14 themes and 24 subthemes. Our categorisation was not predefined; rather, it developed inductively from the EPAs themselves, thus providing a more meaningful synthesis. The six domains were: (1) care and management of the general adult population (n = 103 EPAs); (2) care and management of patients with specific needs (n = 67 EPAs); (3) care coordination and communication (n = 52 EPAs); (4) management and leadership (n = 21 EPAs); (5) healthcare quality, education, and research (n = 41 EPAs); and (6) miscellaneous (n = 24 EPAs). The themes and subthemes are detailed in table 2. The full list of EPAs is available as supplementary information.

Eighty-seven EPAs, originating from two articles [38, 43], were not included in our three-level categorisation because of their disease-based nature (e.g., managing patients with headache, joint pain or chronic asthma). These EPAs had been written in a style too different from the other lists to be included in the final categorisation.

Finally, we examined the representation of the 14 themes across IM and FM residency programmes separately. Results are available in the appendix 4.

Discussion

To the best of our knowledge, this systematic review is the first to include the EPAs defined for residency programmes in general internal medicine. We identified 16 articles meeting our inclusion criteria, published from 2012 onwards; their 16 different lists provided a total of 395 EPAs. Although this seems a large number, many expressed similar concepts with different wording or specific details. We found it useful to categorise these heterogeneous descriptions using a pragmatic, inductive approach. Categorisation resulted in five main domains: (1) care and management of the general adult population; (2) care and management of patients with specific needs; (3) care coordination and communication; (4) management and leadership; and (5) healthcare quality, education, and research. There was also a sixth, broader domain called miscellaneous. The EPAs were further divided into 14 themes and 24 subthemes.

Table 1:
List of articles and extracted data

N°	Authors (Years)	Title	Country	Specialty	Nbr of EPA	Method and design used to create EPAs
1	Caverzagie et al. (2015)	The development of entrustable professional activities for internal medicine residency training: a report from the Education Redesign Committee of the Alliance for Academic Internal Medicine	USA	Internal medicine	16	First draft by the authors, using previous literature as guidance, as well as exchanges with authors of the said literature.Two rounds of feedbacks by AAIM experts and the Internal Medicine Education Redesign Advisory Board. Total of 18 different sources of feedbacks.
2	Chang et al. (2013)	Transforming primary care training--patient- centered medical home entrustable professional activities for internal medicine residents	USA	Family medicine	25	Designed EPAs for PCMH. Developed by workgroups during the SGIM PCMH Education Summit where each group presented preliminary work on PCMH EPAs. EPAs revised during the summit using the 2011 National Committee for Quality Assurance (NCQA) PCMH standards.After refining the EPAs, a non-binding multivote was performed to generate a high priority EPA list.The list of EPAs was further refined by the competency work group, presented in the 2011 SGIM annual meeting, and revised again using feedbacks.
3	Hauer et al. (2013)	Identifying entrustable professional activities in internal medicine training	USA	Internal medicine	27	30 EPAs drafted by 3 of the authors, after a literature review. After drafting, used a 2-step survey study with IM educators on the created EPAs. Calculated afterward the validity index of the EPAs, considering a rating of 3–4 as validated (scale 0–4). Included EPAs with more than 80% of VI. Also used t-test to compare resident-educators ratings, variance between primary-care, internists and specialists, and variances between rounds to assess the validity of the selection method.
4	Quraishi et al. (2019)	Development of a GMC aligned curriculum for internal medicine including a qualitative study of the acceptability of "capabilities in practice" as a curriculum model	UK	Internal medicine	14	Not focused on creating set of EPAs, but on how to implement them. Referred to the work of the Joint Royal College of Physicians Training Board, but no further methodology on the creation process could be found. Also, only article mentioning CiPs, but defines them as equals to EPAs.
5	Schultz et al. (2015)	The Application of Entrustable Professional Activities to Inform Competency Decisions in a Family Medicine Residency Program	Canada	Family medicine	35	Expert panel invited to create the EPAs through 6 meetings. Used objectives of their previous family medicine residency programme as base, and discussed what "operationally defined us as a profession". All EPAs shall fall into one of the 9 curricula defined by the authors, that reflect all the objectives the residents shall learn across a patient's lifespan.
6	Shah et al. (2019)	EPAs for the Ambulatory Internist in Translation: Findings from a Canadian Multi-Center Survey	Canada	Internal medicine	8	Drafted EPAs to reflect the objectives of the Royal College of Physician GIM and IM resident documents. Also performed a scoping review to gather activities that should be included as EPAs. Six faculty members reviewed the EPAs in two iterative cycles, yielding 8 core EPAs for ambulatory practice.
7	Shaughnessy et al. (2013)	Entrustable professional activities in family medicine	USA	Family medicine	76	Used curricula from the Royal College, textbooks and local diagnostic code recorded by residents to gather the most common diagnosis that should be included.Then residents in clinical practice had to code for each EPA as they encountered one for the next 18 month. In the meantime, Delphi process (2 rounds) to obtain opinion of local experts in Family Medicine. Included EPAs were ranked as "must include" by more than 66% of the experts in the Delphi process.
8	Soran et al. (2019)	Identifying Entrustable Professional Activities forInternal Medicine Residents in Ambulatory Continuity Practice	USA	Internal medicine	16	Delphi method with two rounds. 20 IM physician educators from 3 settings, all from San Francisco. Used Validity Index. If <80%, EPA are rejected.
9	Taylor et al. (2018)	Creating Entrustable Professional Activities to Assess Internal Medicine Residents in Training: A Mixed-Methods Approach	Canada	Internal medicine	29	Activities chose by experienced clinicians that could become EPAs, according to literature. Delphi method to selection final activities (needed 80% VI). Experts from the education field reviewed activities with online survey. The results from phase 2 were reviewed during a meeting of experts to assess if the activities fulfilled the criteria of an EPA.
10	Valentine et al. (2019)	Entrustable professional activities for workplace assessment of general practice trainees	Australia	Family medicine	13	EPAs created following a literature review and expert consultation. 3 rounds of reviews of the EPAs by (1) medical educators and trainee, (2) supervisors and (3) the medical college. Also aimed to define the level of entrustment one should expect for a trainee, given his or her year of training.
11	Association of Family Medicine Residency Directors (2015)	Entrustable Professional Activities (EPAs) for family medicine : Overview	USA	Family medicine	20	No information regarding the methodology of production of the EPAs. List of EPA common to multiple medical associations (AAFP, ABFM, AFMRD).
12	Royal College of Physician and Surgeon of Canada (2019)	Entrustable Professional Activities for General Internal Medicine	Canada	Internal medicine	26	No information regarding the methodology of production of the EPAs. GIM defined here as a subspecialty of Internal Medicine.
13	University of Calgary (2017)	Department of Family Medicine Residency Program Entrustable Professional Activities (“EPA’s)	Canada	Family medicine	26	No information regarding methodology of production of the EPAs.
14	Saltis et al. (2015)	Using trust in assessment A trial of Entrustable Professional Activities (EPA’s) in GP Training	Australia	Family medicine	11	Literature review of EPAs in general practice. Then, surveyed GPs and Medical Educators of Australia to generate a list of the most meaningful EPAs. Final list of 11 EPAs refined by a group of medical educators of Valley to Coast through focus group. Study was unfinished, as the EPAs shall all be evaluated, but nothing was found.
15	Departement of Family Medicine of Manitoba University (2018)	Departement of Family Medicine of Manitoba University - Competency Framework	Canada	Family medicine	25	Very little information regarding methodology, but work based on previous work from American and Canadian medical associations.

16	Poudeh et al. (2021)	Entrustability levels of general internal medicine residents	Iran	Internal medicine	28	Performed a scoping review of published EPAs. Developed EPAs with consideration of national residency curriculum. Refined the EPAs through focus groups discussions. Final set of EPA evaluated by academics who did not participate in the focus groups.

AAIM: Alliance for Academic Internal Medicine; ABFM: American Board of Family Medicine; AFMRD: Association of Family Medicine Residency Directors; CiPs: capabilities in practice; EPA: entrustable professional activity; GIM: general internal medicine; GP: general practitioner; IM: internal medicine; PCMH: patient-centred medical home; SGIM: Society of General Internal Medicine; VI: validity index

Table 2:
Domains, themes, and subthemes and their representation among the selected articles.

			N° of article figuring topic (n = 14)	Example of EPA
Care and management of general adult population				
Care and management of unstable and/or acute patients	Care and management of acute patients		13 (93%)	Manage care of patients with acute common diseases across multiple care (EPA 0101)
	Care and management of unstable patients		10 (71%)	Assessing, resuscitation, and providing initial management for patients with acute, unstable medical presentation (EPA 1202)
Preventive care; longitudinal care and management of chronic patients	Longitudinal care and management of chronic patients		14 (100%)	Manage longitudinal care of patients with chronic multisystemic disease (EPA 0602)
	Preventive care and screening		10 (71%)	Provide preventive care that improves wellness, modifies risk factors for illness and injury, and detects illness in early, treatable stages (EPA 1104)
Procedural skills			8 (57%)	Perform common procedures in the outpatient or inpatient setting (EPA 1110)
Care and management of specific population or needs				
Needs according to specific stage of life	Pregnancy, maternity and newborn care		6 (43%)	Assessing and managing pregnant patients with common or emergent obstetrical medical presentations (EPA 1209)
	Children and adolescent care		4 (29%)	Manage the care of children and adolescent (EPA 1007)
	Elderly care		3 (21%)	Assess, manage, and follow up elderly presenting with undifferentiated symptoms and common (key) conditions (EPA 1506)
	Palliative and end-of-life care		8 (57%)	Managing end-of-life and palliative care (EPA 0408)
Needs according to specific medical or social context	Vulnerable populations		6 (43%)	Identify and proactively intervene to promote the health of vulnerable populations (e.g., functional impairment, cognitive impairment, multiple or high risk medications, multiple chronic diseases, substance abuse) (EPA 0208)
	Psychiatry and mental health		5 (36%)	Diagnose and manage mental health conditions (EPA 1108)
	Perioperative tasks		5 (36%)	Provide perioperative assessment and care (EPA 0106)
Care coordination and collaboration				
Care coordination		Collaboration with other speciality or profession	9 (64%)	Working with other physicians and health care professionals to develop collaborative patient care plans (EPA 0927)
		Discharge planning	5 (36%)	Plan and coordinate discharge of adult patients from hospital (EPA 1319)
		Transition of care	5 (36%)	Facilitate and manage care transitions (EPA 1511)
Communication		Breaking bad news	4 (29%)	Discuss serious news with patient and/or family (bad news, end-of-life care) (EPA 0807)
		Motivational speaking and behavioural counselling	4 (29%)	Providing lifestyle counselling/behavioural modification (EPA 0523)
		Plan and goal of care	5 (36%)	Discussing and establishing patients' goals of care (EPA 0909)
		Communication with patients and families	5 (36%)	Demonstrate time management and practice management skills (EPA 0532)
Management and leadership				
Service and practice management			6 (43%)	Carrying out practice management (EPA 1011)
Team leader			10 (71%)	Provide leadership within interprofessional healthcare teams (EPA 1119)
Healthcare quality, educational and research activity				
Healthcare quality and safety		Continuous learning	6 (43%)	Identify learning needs in clinical practice and addressing them with a personal learning plan (EPA 0928)
		EBM practice	3 (21%)	Care for acute illness, chronic disease, and healthcare maintenance needs using evidence-base guidelines and other forms of decision support (EPA 0211)
		Patient safety & healthcare quality improvement	6 (43%)	Optimize the quality and safety of health care through the use of best practices and application of Quality Improvement (EPA 1524)
		EHR use and data management	5 (36%)	Access, document, and share patient medical information via an electronic health record (EPA 0209)
Educational & research activity		Teaching and supervision	7 (50%)	Acting as a clinical teacher and clinical supervisor (EPA 0412)
		Research activity	3 (21%)	Conduct or participate in a scholarly project (research, QI, education, other) (EPA 0327)
Miscellaneous				
Patients' advocacy			3 (21%)	Advocate for individual patients (EPA 0114)
Uncertain diagnosis			3 (21%)	Assessing and managing patients in whom there is uncertainty in diagnosis and/or treatment (EPA 1222)
Professionalism			3 (21%)	Demonstrate professional behaviour (EPA 0116)

EBM: evidence-based medicine; EPA: entrustable professional activity

Two lists of EPAs [38, 43] were based on specific diseases, contrasting with the 14 other lists that referred to daily clinical tasks rather than the cause of a patient's consultation. A disease-based approach for EPAs does exist, but it seems more suitable for specialties with a focused scope of practice (e.g., cardiology [14]) rather than more holistic disciplines (e.g., GIM). In addition, using disease-based approaches seems to increase the total number of EPAs required to properly encompass professional practice, as demonstrated in Shaughnessy et al. [38], where the number of EPAs (n = 76) was well beyond the average number found in the lists in the literature [4]. An argument can be made about the generic nature of some EPAs gathered in this review (e.g., manage care of patients with acute common diseases across multiple care (EPA 0101)). However, each EPA should come with a full description or specification, adding precious details about what is finally covered by a given EPA [7]. In addition, a list of EPAs does not stand alone in a training programme. They usually supplement a number of competences in the paradigm of competency-based medical education. EPAs can also supplement a list of relevant clinical contexts, as it is done in the framework for undergraduate medical training in Switzerland with "situation as starting points" [47].

It is worth noting that all the articles included came from only five countries, with 75% from North America. Those countries appear leaders in publishing EPAs for postgraduate training in general internal medicine; however, our research algorithm was limited to three languages and likely missed lists that were not translated.

The articles' overall level of methodological quality could be considered moderate. The QATSDD quality scores identified a particular lack of rigour in the constitution of expert panels and in the justifications for sample sizes. Low quality scores were also obtained for user involvement, namely the residents themselves, who were rarely consulted during the process of defining the EPAs. The quality scores for assessing the grey literature using ACCODS were undermined by either a lack of accuracy in the method itself or in the way in which the method was described.

For assessing the quality of EPAs themselves, only one team of authors [48] had used a validated tool – the EQual protocol assessment score [49]; others had relied on their experts' opinions. This could be explained simply by the fact that quality assessment tools for EPAs were only developed recently and thus published after half of the articles in this systematic review. This underscores the need to include this last, critical, quality verification step in any approach to developing EPAs. We were unable to assess each of the 395 EPAs found in our literature review because we would have had to have been fully informed about each list's professional context. Indeed, one EQual protocol item pertains to how important the task is to the profession [49]. Finally, for authors undertaking future efforts to define EPAs for a given educational programme, it is important to know that a validated assessment tool exists [49] and that recommendations on formulating EPAs have been published [4].

This review was limited by the relatively small amount of literature available on residency programmes using EPAs in general internal medicine, even though it is one of the most studied specialties [20]. As already mentioned, our three-language research algorithm may have missed lists that have not been translated into any of them. A final limitation was our commitment to focus solely on EPAs, which therefore excluded work that has been undertaken on very similar concepts, such as "capabilities in practices" (CiPs). Our rationale was to avoid concepts that were deliberately named anything other than entrustable professional activities because they were meant to entail some type of nuance from the original concept (i.e., EPAs).

Regarding this review's strengths, it is, to the best of our knowledge, the first systematic review on residency programmes using EPAs in general internal medicine. It is also the first review of EPAs in postgraduate medical education that provides a thematic categorisation of EPAs drafted for a particular specialty. It will give readers a useful tool with which to begin the development of their own lists of EPAs for residency programmes in general internal medicine. Future authors will be able to use this review and adapt its large number of EPAs to the context of their own clinical practice.

Conclusions

Entrustable professional activities (EPAs) have become an important complement to competency-based medical education. Since general internal medicine programmes, like those of most other medical disciplines, have embarked on the complex, multi-step process of defining lists of EPAs for postgraduate training, it is important to be able to make sense of all the efforts already invested in this process internationally. Our systematic review not only collected 16 lists of EPAs developed for general internal medicine residency programmes but also produced a useful reference document with a unique, thematic categorisation of those EPAs.

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Conflict of interest statement

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest was disclosed.

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Appendix

Appendix 1 – Keywords used for algorithms

EPAs defined for residency programs in General Internal Medicine?		
EPAs	**Residency Programs**	**GIM**
Entrustable Professional Activit*	Residenc*	Internal Medicine
Entrustability	Resident*	Primary Care
EPAs	Internship	Primary Health Care
EPA	Interns	Ambulatory Medicine
Work place assess*	House (medical) officer*	(General) Hospital Medicine
Workplace assess*	Medical education	Internist*
Competency-based education	Residency Education	General Practitioner*
Trust	Trainee*	Clinical Medicine
	Registrar*	Family Medicine
	Postgraduate or Post-graduate	General Practice
	Curriculum	Community Medicine
	Graduate	Outpatient Care

Appendix 2 – Search strategies

This systematic review searched the following databases: Medline Ovid SP, Embase.com, Education Resource Information Center (ERIC), Web of Science, ProQuest Dissertations & Theses A&I.

In this appendix, we provide all the algorithms used for the different databases, plus Google Scholar, as well as the number of results for each algorithm. We also include in this appendix our search strategy for grey literature.

The literature search was conducted from January 1st 2005 to February the 13th 2020, since the first mention of entrustable professional activities was in a paper of ten O Cate published in 2005(2). The review being delayed due to the COVID-19 pandemic, a complementary search has been performed on April the 1st 2022, using the same algorithms, and covering the time between the initial search and april 2022.

1. Medline Ovid SP

(((Education, Medical, Graduate/ OR exp Professional Competence/ OR Competency-Based Education/ OR "Internship and Residency"/ed) AND Trust/) OR ((entrust* adj5 activit*) OR entrustability OR entrustment OR EPAs).ti,ab,kf. OR (EPA.ti,ab,kf AND education.ti,ab,kf,sh.)) AND (Education, Medical, Graduate/ OR "Internship and Residency"/ OR exp Internal Medicine/ed OR Physicians, Family/ed OR exp General Practice/ed OR General Practitioners/ed OR ((house ADJ2 officer*) OR interns OR internship OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*).ti,ab,kf.)

2. Embase.com

((((('medical education'/de AND 'graduate':ti,ab,de,kw) OR 'professional competence'/de OR 'residency education'/de OR ('resident'/de AND education:ab,ti,de,kw) OR 'competency-based education':ti,ab,kw) AND 'trust'/de) OR ((entrust* NEAR/5 activit*):ti,ab,kw) OR entrustability:ti,ab,kw OR entrustment:ti,ab,kw OR epas:ti,ab,kw OR (EPA:ti,ab,kw AND 'education':ti,ab,de,kw)) AND (('medical education'/de AND 'graduate':ti,ab,de,kw) OR 'residency education'/de OR 'resident'/de OR (('general practice'/de OR 'general practitioner'/de OR 'internal medicine'/exp OR 'internist'/de) AND ('education'/exp OR 'education':ti,ab,kw,de)) OR ((house NEAR/2 officer*) OR interns OR internship OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*):ti,ab,kw)

3. ERIC (Education Resource Information Center) Ovid
Limit to year = "2005-Current" and "2020-Current"

(((entrust* adj5 activit*) OR entrustability OR entrustment OR EPAs).ti,ab. OR (EPA.ti,ab. AND education.ti,ab,hw.)) AND (Graduate Medical Education/ OR Internship Programs/ OR Trainees/ OR ((Internal Medicine/ OR "Family Practice (Medicine)"/) AND education.ti,ab,hw.) OR ((house ADJ2 officer*) OR interns OR internship OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*).ti,ab.)

4. Cochrane Library Wiley
Limit to year = “2005-Current” and “2020-Current”
–
(((entrust* NEAR/5 activit*) OR entrustability OR entrustment OR EPAs) OR (EPA AND education)):ab,ti,kw AND ((house NEAR/2 officer*) OR interns OR internship OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*):ab,ti,kw

5 .Web of Science – Core Collection
Limit to year = “2005-Current” and “2020-Current”

TS=(((entrust* NEAR/5 activit*) OR entrustability OR entrustment OR "EPAs") AND ((house NEAR/2 officer*) OR "interns" OR "internship" OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*)

6. ProQuest Dissertation & Thesis A&I

AB,TI((entrust* NEAR/5 activit*) OR entrustability OR entrustment) AND AB,TI(("medical education" AND graduate) OR (("general practi*" OR "internal medicine") AND education) OR ((house NEAR/2 officer*) OR interns OR internship OR junior* OR post-graduate* OR postgraduate* OR registrar* OR residenc* OR resident* OR trainee*))

7. Google Scholar
Limit to year = “2005-current”

"Entrustable Professional Activities"|Entrustability Internship|"post-graduate training"|"postgraduate training"|registrars|residency|residents|trainees "internal medicine"|"general medicine"|"family medicine"

"Anvertraubare professionelle Tätigkeiten"

"activites professionnelles confiables"

References found: 242 on the 13th February 2020. Only the first English 200 were screened. All results in German (30) and French (12) screened

The order of import in Endnote follows the order below:

Initial Search			
Databases and web portals	**Date**	**Number of references**	
		found	after deduplication
Medline Ovid SP	13-Feb-20	567	566
Embase.com	13-Feb-20	713	360
ERIC Ovid SP	13-Feb-20	13	7
CENTRAL Cochrane Library Wiley	13-Feb-20	10	3
Web of Science Core collection	13-Feb-20	355	59
ProQuest Dissertations & Theses A&I	13-Feb-20	6	6
Total		1664	1001
Supplementary search results			
Google Scholar	13-Feb-20	242	126
Total		1906	1127

Complementary Search			
Databases and web portals	**Date**	**Number of references**	
		found	after deduplication
Medline Ovid SP	1-Apr-22	361	361
Embase.com	1-Apr-22	430	132
ERIC Ovid SP	1-Apr-22	3	0
CENTRAL Cochrane Library Wiley	1-Apr-22	9	0
Web of Science Core collection	1-Apr-22	244	31
ProQuest Dissertations & Theses A&I	1-Apr-22	332	23
Total		1379	547

Grey literature:

We also performed complementary searches introducing the same keywords on Google Scholar. For practicality and relevance, we limited the search to the first 200 results yielded by Google Scholar. We hand-searched literature in two leading medical education journals ("*Medical Education*" and "*Medical Teacher*"). We also hand-searched the abstract books of the following

conferences of medical education: *Association for Medical Education in Europe* (AMEE), *Association for the Study of Medical Education* (ASME), *Ottawa Conference*, *Asia Pacific Medical Education Conference* (APMEC), *International Conference on Residency Education* (ICRE), and the following medical societies' recommendations: the Royal College of Physicians and Surgeons of Canada, the American Association of Family Practitioners (AAFP), the Alliance for Academic Internal Medicine (AAIM), the French-speaking *Société Internationale Francophone d'Éducation Médicale* (SIFEM), and the German-speaking society of medical education *Gesellschat für Medizinische Ausbildung* (GMA).

The search considered papers written in English, French or German. For this purpose, we identified the French term relating to EPA (*"Activités Professionelles Confiables"* or "APC") and the German term ("*Anvertraubare professionnelle Tätigkeiten*"). These terms were hand-searched in the grey literature we screened (see above).

Appendix 3 - Quality assessment of the literature

		QATSDD - Mean score										
Item/Article	Item mean score	1	2	3	4	5	6	7	8	9	10	16
Item 1	2.77	3	3	2.5	3	3	3	3	1	3	3	3
Item 2	2.86	2.5	2.5	3	3	3	3	3	2.5	3	3	3
Item 3	2.86	3	2.5	3	3	2.5	3	3	2.5	3	3	3
Item 4	0.77	0	0.5	0.5	0	1.5	0.5	3	0	0.5	0.5	1.5
Item 5	2.23	2	2	2	2.5	2	2.5	2.5	2	3	2.5	1.5
Item 6	2.41	2	2	2.5	2.5	2	2.5	2.5	1.5	3	3	3
Item 7	1.45	1	0.5	1	2	1.5	2	1	1	3	2	1
Item 8	1.73	2	1	1.5	1.5	1	2.5	1.5	1.5	3	1.5	2
Item 9	1.64	-	-	1.5	1	-	1	1	2	2	3	-
Item 10	2.79	-	-	2.5	2	-	3	3	3	3	3	-
Item 11	2.30	2	2.5	2	2.5	2.5	2.5	2.5	2	2.5	-	2
Item 12	2.73	3	2	3	2	3	3	2.5	3	3	3	2.5
Item 13	1.86	1	1	2	1.5	1.5	1	1.5	2	3	3	3
Item 14	1.20	1.5	1	0	0	1.5	2	0.5	1	3	-	1.5
Item 15	0.91	0	0	1.5	2	2	0	3	0	0	1.5	0
Item 16	2.00	1.5	2	2	1.5	1	3	2	1.5	2.5	2.5	2.5
Total score	32.38	24.5	22.5	30.5	30	28	34.5	35.5	26.5	40.5	34.5	29.5
MEAN TEST	30.59090909											
SD TEST	5.295366757											
ICC (2,2)	0.89400207											

		AACODS - Mean score per article				
Article	Item mean score	11	12	13	14	15
A1	0.75	0.75	0.75	0.75	0.75	0.75
A2	0.40	0.375	0.325	0.325	0.5	0.45
C	0.00	0	0	0	0	0
O	1.00	1	1	1	1	1
D	0.93	0.625	1	1	1	1
S	0.88	1	1	1	0.375	1
TOTAL	3.95	3.75	4.075	4.075	3.625	4.2
MEAN TEST	3.945					
SD TEST	0.244565942					
ICC (2,2)	0.69075192					

Appendix 4 – Differences between internal medicine and family medicine

When we looked at the thematic representation across internal medicine (IM) and family medicine (FM) separately (Fig. 2), there are few differences between the themes present in IM and FM residency programs using EPAs. Only one theme was exclusive (i.e. uncertain diagnosis in IM). In addition, IM residency programs showed a more frequent focus on quality and safety, as well as on education and research. FM residency programs showed a more frequent focus on procedural skills, on care to specific populations and in specific contexts, as well as on leadership.

Figure 2: Proportion of articles with references to each theme in family medicine and internal medicine