

SYSTEMATIC REVIEW

Geriatric medicine learning objectives and entrustable professional activities in undergraduate medical curricula: a scoping review

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Abstract

Background: entrustable professional activities (EPAs) have become an important component of competency-based medical education. The aim of this study is to evaluate how geriatric medicine learning objectives are addressed by undergraduate medical curricula including EPAs.

Methods: we performed a scoping review following Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines to identify undergraduate medical curricula that include EPAs. A content analysis was conducted to examine how these curricula address the care of older individuals. In addition, we mapped the curricula to 19 geriatric medicine learning objectives identified from the European curriculum of undergraduate medical education.

Results: we found nine curricula, each containing between 4 and 16 core EPAs. In the sections describing the EPAs, three of the nine curricula specify that all core EPAs apply to all age groups including older patients, whereas the remaining six curricula either only refer to older patients in selected EPAs or not at all. Mapping revealed that some geriatric medicine learning objectives are covered by most curricula (e.g. medication use, multidisciplinary team work), whereas others are lacking in the majority (e.g. normal ageing, geriatric assessment, cognitive assessment, nutrition assessment, decision-making capacity assessment, long-term care). Three curricula cover most geriatric learning objectives by using a matrix aligning EPAs with geriatric competencies.

Conclusions: geriatric learning objectives continue to be missing from undergraduate medical curricula, also from those adopting the novel approach of EPAs. However, this review also identified some curricula that might serve as models for how geriatric learning objectives can be successfully covered within future EPA frameworks.

Keywords: Geriatrics, undergraduate medical education, geriatric assessment, long-term care, biological ageing, systematic review, older people

Key Points

- Entrustable professional activities (EPAs) are an emerging educational approach emphasising lifelong learning.
 - In undergraduate training, it defines the professional activities students can be entrusted to perform with distant supervision.
 - Geriatric learning objectives continue to be missing from most undergraduate medical curricula including entrustable professional activities (EPAs).
 - Topics commonly missing include geriatric assessment, decision-making capacity and long-term care.
 - We identified some curricula that might serve as models for how geriatric learning objectives can be successfully covered.
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Introduction

With an ever increasing older population, health care use in this age group will become an important issue in all domains of medicine [1]. Physicians of all specialties, perhaps with the exception of paediatrics, need to be prepared to deal with the unique medical challenges in the work-up and management of older patients. Therefore, training of essential geriatric competencies cannot be limited to postgraduate or specialty training alone, but should be a longitudinal theme integrated in undergraduate training for all future physicians [2]. Consequently, it is vital that undergraduate curricula address essential geriatric learning objectives.

Formerly, medical curricula were based on educational concepts such as learning outcomes; knowledge, skills, and attitudes; and competencies [3–7]. In recent years, ‘entrustable professional activities’ (EPAs) have become a new concept used for competency-based medical education [8]. EPAs are defined as units of professional activities that can be entrusted to a sufficiently trained learner. A learner must possess multiple competencies, including knowledge, skills and attitudes, to perform each professional activity. Recent guidelines therefore recommend that curricula using this approach use a matrix to outline the EPAs as well as the expected student competencies associated with each of these EPAs [9].

Originally, EPAs were mainly used for postgraduate medical education [9], including geriatric medicine postgraduate specialty training. The American Geriatrics Society published ‘End-of-Training Entrustable Professional Activities’ outlining the professional activities carried out by a geriatric specialist [10]. The European Union of Medical Specialists (UEMS) Geriatric Medicine Section also used EPAs to define postgraduate learning objectives [11].

There is a growing interest in the use of EPAs in undergraduate medical education [12–16]. In this context, EPAs are defined as units of professional activities, which medical students can be entrusted to perform with distant supervision alone [9, 17]. EPAs provide a framework for determining the professional activities each future physician—independent of their future specialty—must master in the care of old and very old patients. Research to date does not, however, address the presence of geriatric medicine learning objectives in undergraduate medical curricula including EPAs.

The purpose of this review is therefore to evaluate whether, and if so how, current undergraduate curricula including EPAs address geriatric learning objectives.

Methods

This scoping review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) framework [18–20].

Identifying the research questions

This scoping review was guided by the following review questions:

- Do undergraduate medical curricula including EPAs specifically mention that old age or specific age groups should be taken into account?
- How do geriatric learning objectives listed in the European curriculum for undergraduate medical training [2] feature within undergraduate medical curricula including EPAs?

Search strategy and selection criteria

Search strategy

A systematic literature search was carried out on 17 November 2021 using four electronic databases: PubMed, Embase, Scopus and ERIC. No time or language restrictions were set. We identified additional records by searching the cited references of relevant articles. Moreover, we contacted all delegates of the 28 member countries of the UEMS Geriatrics Section, and further educational experts worldwide, for the availability of curricula including EPAs in their respective country.

Search terms

Search terms were developed under the headings ‘Entrustable Professional Activity’ and ‘Undergraduate Medical Education’. Truncation (*) and medical subject headings were also employed. The detailed search strategy is available in Appendix 1, Supplementary Data.

Selecting the curricula

All records were imported into EndNote 20 (Clarivate Analytics, Philadelphia, PA) and duplicates were removed. Two

independent assessors (AS, TS) screened the titles and, if available, abstracts for eligibility and if screened positive, reviewed the remaining full text citations. We included all available curricula for undergraduate medical education that made reference to the EPA concept, published as journal and book references, as well as on websites. Records were excluded if they (1) did not feature a curriculum intended for the end of undergraduate medical training and/or (2) did not include 'Entrustable Professional Activities'.

Charting the data

Two independent assessors (AS, TS) systematically abstracted information from the included curricula using a predefined abstraction sheet. In case of discrepancies, the final decision was made in consensus with a third abstractor (TM). General characteristics of the identified undergraduate curricula were charted, recording location and year of publication, number of core EPAs, number of nested EPAs, sections used for describing the EPAs and entrustment level expected at graduation. Sections used for describing EPAs were classified according to the recently published recommended guidelines for EPA descriptions [20]. Levels of entrustment were coded according to the scale proposed for undergraduate medical education [9]: level 1: not allowed to practice EPA; level 2: allowed to practice EPA only under proactive, full supervision; level 3: reactive/on-demand supervision; level 4: allowed to practice EPA unsupervised.

We examined each curriculum for content related to old age, by systematically searching for the terms age, elder, geriatric, old and senior (accounting for variations of these terms including aged, ageing, elderly, elders, geriatrics, geriatrician and older). In non-English curricula, the corresponding terms were searched in the source language. All citations, which mentioned one or several of these terms were abstracted, along with the section in which they were listed. Citations were excluded if they did not refer to old age, for example a citation referring to 'childhood age'. In addition, we mapped the content of the identified curricula to 19 geriatric medicine learning objectives selected from headings and subheadings of the European undergraduate curriculum in geriatric medicine [2] (for details, see Appendix 2, Supplementary Data).

Collating, summarising and reporting the literature

We summarised the findings in four separate Tables.

Results

A total of 1,311 records were identified through searching electronic databases, reference lists and hand searching, as well as through contacting field experts (Figure 1). Overall, 833 records remained after duplicates were removed. A total of 688 records were subsequently removed after screening titles and abstracts for exclusion criteria and a further 134 were removed following full text screening. Eleven records

were identified, each consisting of curricula intended for the end of undergraduate medical training including the use of EPAs. Of these 11 records, two were removed because in both cases, newer versions of these curricula were among the remaining records. As a result, we included nine curricula in this scoping review.

Characteristics of the curricula including EPAs

The main characteristics of the nine medical undergraduate curricula including EPAs are summarised in Table 1 [21–29]. All curricula were published between 2014 and 2020. Four curricula were published by national organisations (Canada [23], Germany [24], Switzerland [28], United States [29]), four curricula originated from individual universities situated in Europe or Canada (Berlin [21], Bristol [22], Louvain [25], Newfoundland [27]) and one further curriculum was published by a cooperation of eight universities in the Netherlands [26].

The nine identified curricula each contain between 4 and 16 core EPAs (Table 1, second column). Most curricula base the EPAs on the phases of patient care (e.g. gathering a medical history, performing a physical examination, recommending and interpreting diagnostic tests or initiating a management plan). The curricula also contain professional activities related to tasks that reach beyond individual patient care, such as interprofessional collaboration or contribution to a culture of safety. The German [24] and Dutch [26] curricula each outline a small number of broad core EPAs (e.g. medical consultation) and further define these using more detailed activities, as nested EPAs (e.g. preparing a differential diagnosis).

The curricula use very different approaches and levels of detail for describing EPAs and competencies (Table 1). The United States curriculum [29] contains an introductory chapter explaining the background and use of the EPAs, and a subsequent three-page chapter for each of the 13 EPAs outlining detailed specifications of the respective EPA, including expected behaviours of the learner and clinical vignettes illustrating the required knowledge, skills and attitudes [29]. The Berlin curriculum [21] contains a similar level of detail and additionally includes limitations for each EPA and specific suggestions for assessment of the EPAs at the end of the training period. In contrast, the Bristol curriculum [22] is very brief, containing only a short description of the core EPAs, subsequently referring to two documents published by the General Medical Council [30, 31] to define the competencies expected of medical students.

The expected level of entrustment at graduation is similar across all of the included curricula. Most curricula define an entrustment level of 3 for all EPAs, signifying performance of the EPAs without direct supervision [9]. The precise level of indirect supervision varies (e.g. availability of on-demand support from immediate to distant) and is not further specified in some curricula. Although the German curriculum [24] expects an entrustment level of 3 for most

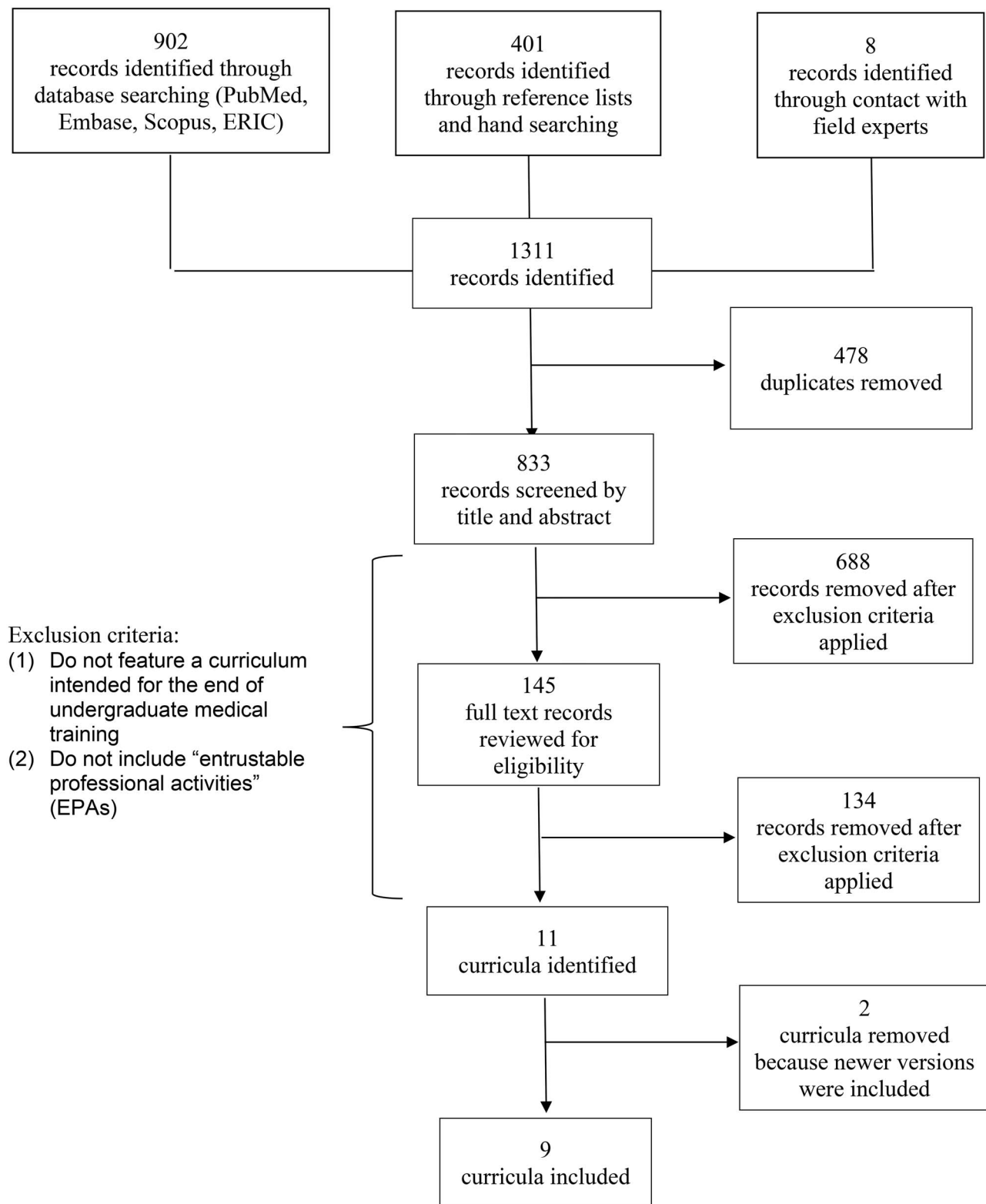


Figure 1. PRISMA-ScR flow diagram.

EPAs, a level of only 2 is required for a select few nested EPAs (e.g. performance of certain medical procedures) [24]. Although the Berlin curriculum [21] requires an entrustment

level of 3 for all EPAs, certain patient groups are excluded from this, including critically ill or patients unable to give consent.

Table 1. Characteristics of the undergraduate medical curricula included in this scoping review

Location of curriculum (language)	Number of EPAs	Contents of section describing EPAs	Contents of section describing student competencies
Berlin, Germany (English) [21]	12	<ul style="list-style-type: none"> • General comments, title, specifications, limitations • Assessment suggestions 	<ul style="list-style-type: none"> • CanMEDS roles • Required knowledge, skills and attitudes
Bristol, England (English) [22]	16	<ul style="list-style-type: none"> • General comments, title • Assessment suggestions 	<ul style="list-style-type: none"> • Required professional values and behaviours, knowledge, skills [30] • Expected standards of medical practice [31]
Canada (English) [23]	12	<ul style="list-style-type: none"> • General comments, title, specifications • Assessment suggestions 	<ul style="list-style-type: none"> • CanMEDS roles • Required behaviours of learner
Germany (German ^a) [24]	6 (each with 5–14 nested EPAs)	<ul style="list-style-type: none"> • General comments, title, specifications • List of reasons for medical consultation 	<ul style="list-style-type: none"> • Physician roles • Required learning outcomes (knowledge, skills, attitudes)
Louvain, Belgium (French ^b) [25]	15	<ul style="list-style-type: none"> • General comments, title, specifications 	<ul style="list-style-type: none"> • Physician roles
Netherlands (Dutch and English) [26]	4 (each with 2–5 nested EPAs)	<ul style="list-style-type: none"> • General comments, title, specifications, limitations • List of issues concerning health and disease 	<ul style="list-style-type: none"> • CanMEDS roles • Required knowledge domains
Newfoundland, Canada (English) [27]	13	<ul style="list-style-type: none"> • General comments, title, specifications 	<ul style="list-style-type: none"> • Required knowledge, skills, and attitudes
Switzerland (English) [28]	9	<ul style="list-style-type: none"> • General comments, title, specifications • List of situations as starting points 	<ul style="list-style-type: none"> • CanMEDS roles • Required skills
United States of America (English) [29]	13	<ul style="list-style-type: none"> • General comments, title, specifications 	<ul style="list-style-type: none"> • Expected behaviours (knowledge, skills, attitudes) illustrated with vignettes

Note: EPA = entrustable professional activity, CanMEDS roles refers to the CanMED framework [7] ^aThe term used in German for EPA is 'Anvertraubare Professionelle Tätigkeiten (APT)' ^bThe term used in French for EPA is: 'activités professionnelles pouvant être déléguées, dites "déléguables" (APD)'

Specific mention of old age in description of EPAs

The EPA titles in the included curricula are brief and generic, and do not contain specific reference to age groups or to older people. However, several curricula address old age as part of the detailed description of the EPAs (Table 2). Three of the nine curricula state that all EPAs should be mastered in situations involving older people [23, 26, 28]. The Canadian curriculum [23] includes an overarching comment stating that the EPAs are to be applied across age groups, including older individuals. The Swiss curriculum [28] similarly contains an overarching comment and adds that all clinical situations include older individuals. The Dutch curriculum [26] declares that issues related to ageing and geriatric diseases are relevant to all EPAs. In addition, it mentions that the EPA 'clinical consult' and its five related nested EPAs must be mastered in the geriatric specialist setting. Two of the nine curricula refer to old patients in the description of selected EPAs [25, 29]. The Louvain curriculum [25] outlines that the age of the patient has to be taken into account as part of three of the 15 EPAs (e.g. physical examination) but does not list an age requirement in the remaining 12 EPAs (e.g. emergency care, differential diagnosis, interpretation of diagnostic tests). The United States curriculum [29] does not explicitly specify that professional activities have to include situations with older patients but uses an implicit approach to address old age by using vignettes describing situations of older patients in four of the 13 EPAs. The remaining four curricula [21, 22, 24, 27] do not refer to the care of older patients in their description of EPAs.

Specific mention of old age in description of competencies

Table 3 depicts the curricula, which refer to the care of older people as part of the expected competencies of medical students. Three of these curricula [26, 28, 29] are also listed in Table 2, because they refer to the care of older people both as part of EPA and competency description. Three of the curricula listed in Table 3 [21, 22, 24] are not listed in Table 2 because they do not address older patients as part of the EPA description, but they only refer to the care of older people within the competencies required for mastering EPAs. The Bristol curriculum [22] refers to old age as part of the learning outcomes for graduates as described in two associated General Medical Council documents [30, 31]. The curricula from Berlin and Germany [21, 24] mention the care of older people as part of the description of selected competencies related to knowledge, skills and attitudes.

Mapping of European learning objectives to EPAs

Table 4 depicts the 19 learning objectives derived from the European undergraduate curriculum in geriatric medicine mapped to the contents of the undergraduate curricula including EPAs. The number of geriatric learning objectives included in each of the identified curricula is variable, ranging from 4 to 18 of all 19 objectives. Only four of these geriatric learning objectives feature in all curricula, including 'patient respect', 'medication use', 'multidisciplinary team work' and 'acute inpatient and emergency care'. In contrast, the following learning objectives are mentioned in only three of the nine curricula; 'normal ageing', 'geriatric assessment',

Table 2. Statements in included undergraduate medical curricula indicating that EPAs apply to older people

Curriculum	Number and content of relevant EPAs	Subsection in which statement is listed	Statement
Canada [23]	All EPAs	General comments	‘The focus of these EPAs is meant for usual common presentations expected in the course of medical school across patient age groups.’
	8 of 12 EPAs: history and physical examination, diagnostic tests, management, clinical reports, handover, urgent care, procedures, prevention	Assessment suggestions	EPA should be assessed by ‘direct observation (. . .) with patients of various age groups including children and their parents, adults and elderly individuals.’
Louvain [25]	3 of 15 EPAs: history, physical examination, prescription	Specification	For description of symptoms by patient, examination techniques, prescriptions: the learner should take into account the age of the individual patient.
Netherlands [26]	All EPAs	General comments	Paragraph on challenges of change: ‘Societal changes, changes in the patient population (such as ageing, migration and socio-cultural diversity) (. . .).’
	1 of 4 EPAs: medical consult	Specification	The EPA ‘has been mastered in a variety of settings (of GPs, geriatric specialists (. . .).’
	All EPAs	Issues	<ul style="list-style-type: none"> • ‘Issues in specific stages of life, like ageing and geriatric diseases, dying.’ • ‘Issues in relation to personal and external factors: (. . .) abuse of the elderly.’
Switzerland [28]	All EPAs	General comments	<ul style="list-style-type: none"> • ‘All the objectives and situations apply to any age group (baby, child, adolescent, young and middle-aged adults, old and very old persons).’ • Paragraph on challenges: (. . .) ‘there is an increasing incidence of chronic non-communicable diseases and multimorbidity due to an ageing population.’
	2 of 9 EPAs: history, examination	Specification	Performance of the EPA in all ages.
	2 of 9 EPAs: diagnosis, management		‘Take into account the age (. . .).’
	1 of 9 EPAs: diagnosis		‘Demonstrate awareness of multimorbidity and atypical presentation of disease, especially in elderly patients.’
	1 of 9 EPAs: diagnostic tests		‘Demonstrate awareness of differences in values and thresholds regarding sex and age in the interpretation of biological test results.’
	1 of 9 EPAs: culture of safety		‘Assess age-specific environmental risks and propose safety measures.’
5 of 9 EPAs: history, physical examination, interpret diagnostic tests, differential diagnosis, management	Situations as starting point	<ul style="list-style-type: none"> • Statement for all situations: application to all ages (children, adults, the elderly) and to various settings (ambulatory practice, hospital, nursing home for elderly people etc.). • List of seven situations ‘related to old age’: elder abuse and neglect; functional impairment (cognition, sensory and motor); malnutrition and sarcopenia; polymorbid, polymedicated patient; pressure ulcers; progressively dependent patient; urinary and faecal incontinence. 	
USA [29]	1 of 13 EPAs: emergency care		‘Recognises age appropriateness of (. . .) patients’ vital signs.’

‘decision making capacity’ and ‘patient care in long-term care’. Learning objectives related to ‘elder abuse’, ‘advance directives’, ‘rehabilitation’ and ‘palliative and end-of-life care’ are listed in only four of the nine curricula. Only one of the nine curricula listed all components of the geriatric assessment.

Discussion

This review is the first to analyse the representation of geriatric medicine learning objectives in undergraduate

medical curricula including EPAs. We found that important geriatric learning objectives are missing in a majority of undergraduate medical curricula including EPAs. This finding is of significant concern due to the ever increasing prevalence of older patients as part of all clinical encounters. However, a minority of curricula including EPAs successfully manage to cover most geriatric medicine learning objectives as outlined in the European consensus on minimal undergraduate training requirements in geriatric medicine [2]. These curricula might serve as models for those wanting to adopt EPAs as part of future curriculum development.

Table 3. Statements in included undergraduate medical curricula indicating that expected student competencies apply to the care of older people

Curriculum	Number and content of relevant EPAs	Subsection in which statement is listed	Statement
Berlin [21]	1 of 12 EPAs: emergency situation	Skill	‘Beginning basic-life support without technical resources in patients of any age showing loss of vital functions.’ Required attitude: ‘Attention to diversity (gender, age, culture).’
Bristol [22, 30, 31]	8 of 12 EPAs: e.g. history, physical examination, diagnostics All EPAs	Knowledge, skills, attitudes Knowledge, skills, attitudes	<ul style="list-style-type: none"> ● ‘Explain how normal human structure and function and physiological processes applies, including at the extremes of age (. . .)’ ● ‘Safeguarding vulnerable patients: e.g. identify signs and symptoms of abuse or neglect and be able to safeguard children, young people, adults and older people.’ ● ‘Recognise the challenges of safe prescribing for patients with (. . .) multiple morbidities and medications, in pregnancy, at extremes of age and at the end of life.’ ● Respect for patient’s rights in situations of vulnerability (birth, childhood, illness, disability, old age, death). ● Diagnostic and therapeutic measures, emergency procedures, professionalism, medical ethics, history and law: ‘Take into account age-specific aspects (. . .).’ ● Pathogenetic mechanisms of ageing, age-specific cut-off of vital signs. ● ‘Performance of specialised geriatric examination and geriatric test procedures.’ ● Pharmacotherapy in ageing: principles, age-dependent dosage. ● Prevention and health promotion for older people: modifiable risk factors in old age, health counselling; specific measures of prevention in old age. ● Elder abuse and neglect: risk factors and counselling. ● ‘Structure and physiology: (. . .) ageing mechanisms.’ ● ‘The (. . .) ageing and dying of an organism: molecular/cellular/physiologic/organ ageing, ageing theory, atypical presentation, epidemiology of ageing.’ ● ‘(. . .) mental problems: development as child and ageing of adult.’ ● ‘Society in a globalising world: influence of diversity (e.g. age, (. . .)).’
Germany [24]	All EPAs	Knowledge, skills, attitudes	<ul style="list-style-type: none"> ● Role of medical expert: ‘Establish a patient-centred, shared management plan and deliver high quality cost-effective preventive and curative care, especially when dealing with a patient who is vulnerable and/or multimorbid (elderly) (. . .).’ ● Role of medical expert: ‘Develop a critical awareness of common stereotypes that might bias clinical activities, related to factors such as age, gender, (. . .).’
Netherlands [26]	All EPAs	Knowledge domains	<ul style="list-style-type: none"> ● Four vignettes describe older patients: 65-year-old ambulatory healthy person, 67-year-old patient with cancer and acute problem, 76-year-old multimorbid patient and 88-year-old multimorbid patient with acute problem.
Switzerland [28]	All EPAs	Competency domains	
USA [29]	4 of 13 EPAs: documentation of clinical encounter, presentation of clinical encounter, patient handover, informed consent	Knowledge, skills, attitudes	

Geriatric learning objectives continue to be underrepresented in undergraduate medical curricula, as demonstrated by previous research [32–39], also in those including EPAs. It is possible that the approach of EPAs may lend itself to better representing professional work situations, however there continues to be a lack of awareness and importance placed on the special considerations required when dealing with older patients in these clinical encounters. One theme

missing in a majority of identified curricula is the care of patients in long-term, rehabilitation or palliative and end-of-life settings. This deficit cannot be attributable to the nature or structure of EPAs themselves, since the provision of patient care in an acute or emergency setting features as an EPA in all identified curricula. This finding highlights the continued lack of importance placed on the care of patients in settings most relevant to older people but also

Table 4. Learning outcomes listed in the European undergraduate curriculum in geriatric medicine [2] mapped to the content of undergraduate medical curricula including EPAs

Learning outcome	Berlin [21]	Bristol [22]	Canada [23]	Germany [24]	Louvain [25]	Netherlands [26]	Newfoundland [27]	Switzerland [28]	USA [29]	Total number listed
Patient respect	+	+	+	+	+	+	+	+	+	9
Normal ageing	-	+	-	+	-	+	-	-	-	3
Multimorbidity	-	+	-	+	-	+	-	+	+	5
Elder abuse	-	+	-	+	-	+	-	+	-	4
Geriatric assessment:										
• Activities of daily living	-	-	-	+	-	+	-	+	-	3
• Cognition	-	+	-	+	-	-	-	+	-	3
• Gait and balance	-	-	-	+	-	+	-	+	-	3
• Hearing and vision	-	+	-	-	-	+	-	+	-	3
• Nutrition	-	+	-	-	-	+	-	+	-	3
Medication use	+	+	+	+	+	+	+	+	+	9
Ethical and legal issues										
• Advance directives	-	-	-	+	-	+	-	+	+	4
• Decision-making capacity	+	+	-	-	-	-	-	+	-	3
• Informed consent	+	+	+	+	+	+	-	+	+	8
Multidisciplinary team work	+	+	+	+	+	+	+	+	+	9
Patient care in different settings:										
• Primary and community	-	+	+	+	-	+	-	+	+	6
• Acute inpatient and emergency	+	+	+	+	+	+	+	+	+	9
• Rehabilitation	-	+	-	+	-	+	-	+	-	4
• Long-term	-	+	-	-	-	+	-	+	-	3
• Palliative and end of life	-	+	-	+	-	+	-	+	-	4
Total number listed	6	16	6	15	5	17	4	18	8	n.a.

Note: The ‘+’ sign indicates that the learning outcome is mentioned in the curriculum, the ‘-’ sign conversely indicates that the learning objective is not mentioned in the curriculum, n.a. not applicable.

demonstrates that different care settings could easily be incorporated as part of EPAs within undergraduate medical curricula. Similarly, it is worrying that ‘geriatric assessment’ and ‘decision making capacity’ are not covered in curricula including EPAs, given that these geriatric learning objectives relate to key competencies required for the care of older individuals.

The fact that the basics of ageing and gerontology do not consistently feature within the examined curricula has been shown in previous surveys of undergraduate training [36, 37], but may also be related to the very nature of EPAs. The Swiss curriculum [28] states that it intentionally omitted the scientific foundations of medicine because it focuses on roles, tasks and situations. However, the Dutch curriculum [26] demonstrates that this learning objective can be covered within an EPA framework. As part of the definition of competencies required for all EPAs, it lists relevant scientific foundations of medicine, including topics such as biological ageing or the challenges of ageing populations.

This scoping review has some limitations. Firstly, the search for existing curricula was challenging, because curricula are often not part of published references and could only be identified through expert survey, searching listed references or through an internet search. We cannot discount that we may have missed some existing curricula. However, through our approach of contacting experts in all European countries, it is unlikely that we missed any relevant curricula including EPAs within Europe. Secondly, comparisons between the undergraduate medical curricula as listed in the tables have to be interpreted with caution, given the wide variability in purpose, structure and level of detail across the reports. Thirdly, coverage of geriatric medicine learning objectives was performed with a selected list of topics from the European curriculum, and we therefore may have missed deficits in unlisted topics.

Remediating the deficits in representation of geriatric medicine in undergraduate curricula would be an important first step to better prepare future doctors for the care of older people, but additional efforts are needed for actual improvement of undergraduate training. Medical schools have to adapt the contents of courses and teaching methods, as well as transform the culture within clinical learning environments. New procedures are required to optimally assess EPAs, for example by instituting clinical competence committees for high-stakes entrustment decisions [9]. Medical schools need large numbers of teachers from all fields of medicine as well as other disciplines who are motivated and competent in addressing geriatric medicine learning objectives. They may also consider establishing faculty development programs. Finally, medical education research should critically appraise the emerging EPA approach ideally by connecting educational methods with patient outcomes [40]. Although this review specifically examined undergraduate medical curricula, the findings are likely to also apply to graduate entry medical curricula.

In conclusion, geriatric learning objectives continue to be missing from undergraduate medical curricula, including those adopting the novel approach of EPAs. Organisations developing new curricula for undergraduate medical training including EPAs may seek to adopt recent guidelines for curriculum development and use a matrix-based approach covering both EPAs and corresponding student competencies [9]. The European undergraduate curriculum in geriatric medicine [2] could be further developed itself to include elaborated model EPAs (including specifications, clinical situations, assessment formats) which could be used by educators for their local curriculum development. The existing undergraduate curricula including EPAs, which feature nearly all geriatric learning objectives or feature those, which are commonly missing from previous curricula might serve as models for how geriatric learning objectives can be covered within future EPA frameworks.

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