MEDICAL EDUCATION ONLINE
2025, VOL. 30, 2463483
https://doi.org/10.1080/10872981.2025.2463483

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RESEARCH ARTICLE

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CARAvELA – Competency in Anaesthesiology – self-Reported Assessment on European Learning Aims: a national survey

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ABSTRACT

Introduction: Competency-based teaching is the preferred approach for anaesthesia training, however, limited data exists on Portuguese residents' exposure to essential competencies. This study aimed to evaluate their daily exposure to seven selected competencies from the 2022 European Training Requirements (ETR).

Methods: A cross-sectional survey was conducted amongst 350 Portuguese anaesthesia residents, throughout a 10 working day period, using a questionnaire with 170 questions. Participants were on either anaesthesia or intensive care unit rotation. Demographic data and scores of exposures to selected competencies were gathered. Statistical analyses included descriptive statistics, comparison of means and a Linear Mixed Model using the restricted maximum likelihood estimation method. The significance threshold was set at $p < 0.05$.

Results: Regarding ETR competency exposure, no statistical differences were found based on gender. Residents reported statistically significant higher levels of exposure to competencies while in anaesthesia rotations, except for lung, cardiac and Point-of Care ultrasound. Apart from ultrasound and academic research activities, the maximum exposure level was attained only during anaesthesia rotations. There was no reported exposure to airway ultrasound in any rotation. Exposure to academic research activities, in a scale from 0 to 5, was on average below one. The average reported values for direct patient communication were the highest. As expected, the fifth-year residents reported overall higher scores. Residents from the North reported lower scores for general anaesthesia maintenance, peripheral regional anaesthesia, airway intubation and ventilation management, but higher scores of exposures to academic research activities.

Discussion: Adopting a national logbook, formative regular assessment, supporting the trainers as well as strategies to improve competencies in academic research activities and ultrasound training are recommendations to improve the Portuguese training curricula.

Conclusion: Addressing the gaps between expected and monitored competencies contributes to the advancement of anaesthesiology training. The survey drew attention to the ETR among the residents.

Trial registration: Not applicable – registered on OSF Registries.

ARTICLE HISTORY
Received 29 April 2024
Revised 19 January 2025
Accepted 31 January 2025

KEYWORDS
Medical education; competency based education; anesthesia

Introduction

Background

Competency-based medical education (CBME), as described by Frank et al. [1], has become the dominant framework in postgraduate medical training worldwide and gained widespread recognition as the dominant approach to anaesthesia training [2]. This approach aims to ensure that trainees achieve specific competencies necessary for safe and effective clinical practice. However, the implementation of this educational framework at a European level, seeking to provide a shared foundation for all European anaesthesia training, is not without challenges, demanding substantial resources, time, effort and the engagement of all stakeholders [3–6]. In Europe, the Union Européenne des Médecins Spécialistes (UEMS) has outlined standardized training in anaesthesia, essential competencies, measurable endpoints and evaluation tools [7]. In 2011, additional revisions provided more information about the domains, competencies, objectives and assessment tools [8]. The

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/10872981.2025.2463483

most recent update in 2022 [9], aimed to improve teaching and assessment standards and promote their widespread use in Europe. Despite these efforts, the adoption of a competency-based curriculum varies among European countries; data shows that in 29% of the 41 European countries recognized by the World Health Organization (WHO), the training duration is less than the recommended 5 years [10].

In Portugal, Anaesthesiology is officially considered a medical specialty since 1950, with the first training program duration of 2 years already reflecting the importance of the pre- and postoperative period. The residency training is governed by national legislation, which defines the structure and length of the program. Since 2011, according to UEMS guidelines, the residency program has increased from 4 to 5 years, proposing competency-based teaching rather than time-based.

Although the Portuguese curriculum aligns broadly with the 2022 European Training Requirements (ETR), there are significant gaps between the theoretical recommendations and actual clinical practice. The time gap between the 2022 ETR recommendations and the last update of the Portuguese training program, that took place in 2016 must be considered. For example, there is no mention of exposure to point-of-care ultrasound (POCUS), education and self-directed learning nor training requirements for trainers. The variability in hospital training environments, resources and the differing levels of emphasis on certain competencies also contributes to the existent gaps. There is no standard national logbook/portfolio that allows the recording of the residents' progression, the level of skills and cases carried out. Consequently, when a resident undergoes a rotation in a different training site, necessary for training in, for example, pediatrics, neurosurgery or cardiovascular or thoracic anaesthesia, the competencies level is unknown, and thus the allowed autonomy level might be lower than the residents' real capability. Formative assessment is not mandatory, specialists lack formal training in the workplace-based assessment and feedback tools and thus frequently residents' progression is time-based. The rapid evolution of anaesthesia practice, particularly in critical care and advanced perioperative medicine, creates new demands that are not fully addressed by the current training framework. Residents can individualize their training, with an optional six-month rotation. Apart from this, they follow a fixed time-based rotation that does not always fit their individual learning needs, nor accommodate the standardized training expectations. Thus, residents are not actively shaping their own training.

The available literature has highlighted that learners' active participation in shaping their own growth and progress is essential for successful CBME implementation; both learners and educators are accountable for ensuring the programs' success [11]. Programs must be flexible to adapt to the learner's progress, and learners take responsibility for their own learning and development [3]. For learners to effectively partner and take responsibility, they must have adequate exposure to CBME principles and practices.

To evaluate the level of ETR competencies, a survey was conducted, to monitor the self-reported exposure to core competencies by Portuguese anaesthesia residents. Self-reported assessments are frequently used in educational research and higher education, to evaluate attitudes, opinions, knowledge and competence [12].

Purpose/aim

The main objective of our study was to obtain self-reported data and monitor the Portuguese anaesthesia residents' daily exposure to specific and selected competences from the 2022 ETR, in all Portuguese training hospitals. The secondary objective was to identify differences between the 2022 ETR recommendations and the actual practice in Portugal.

Methods

Ethical considerations

Participation was voluntary. The objectives and information regarding data use were clearly explained. Consent was obtained prior to participant enrolment. The survey was conducted anonymously and confidentially. Only the investigators had access to the database, and the information was not shared with anyone outside the project. Unidade Local de Saúde Gaia e Espinho Health Ethics Commission approved the study, approval document n.143/2024.

Study design

As part of CARAvELA (Competency in Anaesthesiology self-Reported Assessment on European Learning Aims) pilot project, promoted by the *Sociedade Portuguesa de Anestesiologia* (SPA) and the National Anaesthesiologists Societies (NASC), a cross-sectional web-based survey was conducted in Portugal. The reporting of this survey followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [13].

Sample characteristics

All Portuguese anaesthesia residents (350), from the 27 board certified training hospitals, were enrolled.

The Portuguese Anaesthesiology training program is regulated by law [14]. The Portuguese hospitals are

Table 1. Respondents' characteristics.

	n	%
Gender		
Female	69	66.3%
Male	35	33.7%
Year of attendance		
1st	29	27.9%
2nd	26	25.0%
3rd	17	16.3%
4th	17	16.3%
5th	15	14.4%
Training hospital		
North	47	45.2%
Center	22	21.2%
South	30	28.8%
Islands	5	4.8%
Rotation		
Anaesthesia	91	87.5%
ICU	13	12.5%

ICU – Intensive Care Unit.

categorized as either private or public, and public hospitals further divided into five groups. Anaesthesia training can take place in all types of hospitals. Only in university or type III hospitals can residents spend their entire anaesthesia residency training program in a single institution. When placed in another type of hospital, residents must complement their training in a different certified institution. Only 40.2% of residents (39 out of 97) were placed in university or type III hospitals in 2023. The time spent on other hospitals, to complement the training, is variable ranging from 1 to 36 months. The certified hospitals differ in terms of daily cases amount and complexity, professional and educational resources, as well as educational opportunities. Therefore, training is not homogeneous across hospitals (see Supplemental Digital Content Table 1).

Data collection methods

To collect information on specific skills and expertise of residents in the anaesthesiology training program, a quantitative research approach was employed using Google Forms for continuous assessment (CA).

The survey (see Supplemental Digital Content, survey link) consisted of 170 questions in English, predominantly multiple-choice, but also included dropdown options, linear scales and text fields for certain questions. It contained one section for general data collection (demographic information, year of residency, affiliated hospital, current rotation in Intensive Care Unit (ICU) or Anaesthesia) and sections dedicated to the selected ETR competencies. The seven evaluated ETR competencies were: airway intubation, general anaesthesia (induction, maintenance and emergence), regional anaesthesia (neuraxial and peripheral), ultrasound (lung, cardiac, airway, regional and point-of-care), direct patient communication, ventilation management and academic research activities. The questionnaire was designed and reviewed by experts in medical education. Responses to the competency-related questions were collected on a predetermined scale ranged from 0 to 5, to represent the different levels of exposure and expertise. The lowest score of 0 would mean the resident had no exposure to the skill being assessed and the highest score of 5 representing the resident reaching the maximum level of expertise (being able to mentor and guide more junior colleagues in performing the skill). The in-between scores meant that the resident had the occasion to discuss the skill with a specialist without the opportunity to observe or engage directly in its implementation; or observed an experienced practitioner performing the skill; or was able to perform the skill under direct supervision of an experienced practitioner; or independently performed the skill without direct supervision.

The survey was completed daily for 10 working days. The residents had one week to review and rectify their answers before final submission.

Study preparation and survey administration

The survey was created and pre-tested by the investigators. Anaesthesia training coordinators received emails outlining the study's objectives, duration and asking for residents' active participation. Additionally, social media initiatives were launched addressing questions regarding the survey's purpose, relevance and importance, and to provide information on the ETR.

Participants received both a QR code and a direct link via email, multiple reminders through social media channels such as WhatsApp, Facebook and Instagram, as well as through bi-weekly email reminders.

Registration with an email address was required to access the survey and complete the daily evaluation, thus preventing duplicate responses. The survey took place on 10 working days between 12 and 23 June 2023.

Statistical analysis

A primary qualitative analysis of the residents' responses was conducted using Microsoft Power BI.

The original dataset was structured in a panel format with multiple responses for each resident. Statistical analyses were performed with SPSS (Statistical Package for the Social Sciences), version 29.0 (IBM Corp, 2023 (International Business Machines Corporation)).

Normal distribution of variables was assessed using the Shapiro–Wilk test, Kolmogorov–Smirnov tests and histograms, confirming this assumption. The significance threshold was set at $p < 0.05$. The original dataset underwent a two-step process for

analysis. In the initial step, we determined the minimum and maximum scores for each skill, considering all responses from complete questionnaires. Subsequently, we calculated the mean score for each skill per resident and derived an overall mean from these individual results. Continuous variables were described using means (M) and standard deviations (SD). Categorical variables were presented as frequencies (*n*) and proportions (%). To compare means between participants according to gender, year of residency, place of work and current rotation, t-tests were performed, considering comparisons between two groups and ANOVAs with Sidak pairwise tests for more than two groups. A linear mixed models (LMM) using the restricted maximum likelihood (REML) estimation method analysis was performed. Degrees of freedom were calculated with the Kenward-Roger approximation. This analysis considered all responses in the dataset. Fixed effects were estimated from the included variables of gender, year of residency, place of work and current rotation.

Results

Respondent characteristics

A total of 491 responses from 104 residents were included (response rate 32.5%). Averaging 4.7 responses for each participant out of 10 maximum responses (this analysis exclusively considered responses from working days). Respondents' characteristics are represented in Table 1.

Most of the participants were female (66.3%), akin with the percentage (64.2%) of total Portuguese female residents, and the most widely represented year of residency was the first. Nearly half of the participants were affiliated with training hospitals located in the North region (45.2%), followed by the South (28.8%) and Centre region (21.2%). Most of the participants (87.5%) were on an anaesthesia rotation. Responses were obtained from nearly all training hospitals (26 out of 27), both public and private.

Academic research activities and ultrasound were the competencies with the lowest exposure level, while the highest, level of competencies exposure was observed on direct patient communication during anaesthesia rotation.

Only direct communication with patients reached the expected target mean value of three (indicating the resident was able to perform the skill under direct supervision of an experienced practitioner) across all years of training. In all other analysed competencies, the mean values were below this expected value. For airway intubation, general anaesthesia (induction, maintenance, and emergence) and ventilation management, the mean value approached the expected. For regional anaesthesia (neuraxial and peripheral), ultrasound (lung, cardiac, airway, regional, and point-of-care), and academic research activities recorded mean values of less than one, in most years of training (Tables 2 and 3).

There was no statistically significant difference in means regarding gender and affiliated training hospital area, for any of the analysed ETR competencies. (see Supplemental Digital Content Tables 2 and 3). Except for direct communication with patients, all the skills had a significantly higher mean score in anaesthesia compared to ICU rotation (Table 2). There was no reported exposure to airway ultrasound in any rotation. Apart from ultrasound and academic research activities, the maximum exposure level was attained only during anaesthesia rotation. There was a difference regarding regional ultrasound exposure (average in ICU 0.23 versus 0.58 in anaesthesia) and a higher mean score in academic research activities during anaesthesia rotation. The average reported values for direct communication were the highest, compared

Table 2. Current rotation – minimum, maximum and mean scores of the competencies, highlighting a significant higher exposure to all competencies during anaesthesia rotation, except for lung, regional, POCUS and direct communication with patients.

	Anaesthesia	ICU	T-test (*p* value)
Airway intubation procedures	2.2 ± 0.9 [0.0–5.0]	0.7 ± 1.1 [0.0–4.0]	<0.001*
General anaesthesia induction	2.3 ± 0.9 [0.0–5.0]	0.7 ± 1.2 [0.0–4.0]	<0.001*
General anaesthesia maintenance	2.5 ± 1.0 [0.0–5.0]	1.1 ± 1.3 [0.0–4.0]	<0.001*
General anaesthesia emergence	2.2 ± 1.0 [0.0–5.0]	0.5 ± 1.0 [0.0–4.0]	<0.001*
Neuraxial regional anaesthesia	1.3 ± 1.2 [0.0–5.0]	0.5 ± 0.9 [0.0–4.0]	0.020*
Peripheral regional anaesthesia	0.9 ± 1.0 [0.0–5.0]	0.2 ± 0.5 [0.0–4.0]	<0.001*
Use of lung ultrasound	0.1 ± 0.4 [0.0–4.0]	0.7 ± 1.1 [0.0–4.0]	0.097
Use of cardiac ultrasound	0.1 ± 0.3 [0.0–3.0]	1.0 ± 1.1 [0.0–4.0]	0.011*
Use of airway ultrasound	0.0 ± 0.0 [0.0–0.0]	0.0 ± 0.0 [0.0–0.0]	0.003*
Use of regional ultrasound	0.8 ± 0.9 [0.0–5.0]	0.3 ± 0.5 [0.0–4.0]	0.222
Use of POCUS ultrasound	0.1 ± 0.3 [0.0–3.0]	0.6 ± 1.5 [0.0–4.0]	0.146
Direct communication with patients	3.7 ± 0.5 [0.0–5.0]	3.4 ± 0.9 [0.0–4.0]	0.848
Ventilation management	2.5 ± 1.1 [0.0–5.0]	2.5 ± 1.4 [0.0–4.0]	<0.001*
Exposure to academic research activities	0.6 ± 1.0 [0.0–5.0]	0.1 ± 0.2 [0.0–5.0]	<0.001*

ICU – Intensive Care Unit, POCUS – Point of Care Ultrasound. Results presented as Mean ± SD [min – max]; *$p < 0.05$.

Table 3. Year of residency – minimum, maximum and mean scores of the competencies between the years of training. Statistical differences are only found between first- and third-year residents regarding peripheral regional anesthesia.

	1st	2nd	3rd	4th	5th	ANOVA (p-value)	Sidak test
Airway intubation procedures	2.3 ± 0.8 [0.0–4.0]	2.0 ± 1.0 [0.0–5.0]	1.9 ± 1.2 [0.0–5.0]	1.8 ± 1.3 [0.0–5.0]	1.8 ± 1.3 [0.0–5.0]	0.487	
General anaesthesia induction	2.4 ± 0.7 [0.0–4.0]	2.1 ± 1.0 [0.0–5.0]	1.8 ± 1.3 [0.0–4.0]	2.0 ± 1.3 [0.0–5.0]	2.0 ± 1.2 [0.0–5.0]	0.374	
General anaesthesia maintenance	2.5 ± 0.6 [0.0–4.0]	2.3 ± 1.1 [0.0–5.0]	2.1 ± 1.3 [0.0–4.0]	2.4 ± 1.4 [0.0–5.0]	2.2 ± 1.3 [0.0–5.0]	0.787	
General anaesthesia emergence	2.2 ± 0.9 [0.0–4.0]	2.1 ± 1.0 [0.0–5.0]	1.6 ± 1.3 [0.0–4.0]	1.8 ± 1.4 [0.0–5.0]	2.0 ± 1.2 [0.0–5.0]	0.548	
Neuraxial regional anaesthesia	1.5 ± 1.1 [0.0–3.0]	1.3 ± 1.4 [0.0–4.0]	0.5 ± 0.8 [0.0–4.0]	0.9 ± 1.1 [0.0–4.0]	1.4 ± 1.0 [0.0–5.0]	0.087	
Peripheral regional anaesthesia	1.2 ± 0.9 [0.0–4.0]	0.6 ± 0.8 [0.0–4.0]	0.3 ± 0.7 [0.0–5.0]	0.8 ± 0.9 [0.0–4.0]	0.9 ± 1.1 [0.0–5.0]	0.017*	(a)
Use of lung ultrasound	0.2 ± 0.6 [0.0–3.0]	0.1 ± 0.2 [0.0–3.0]	0.2 ± 0.3 [0.0–4.0]	0.3 ± 1.0 [0.0–4.0]	0.3 ± 0.5 [0.0–4.0]	0.743	
Use of cardiac ultrasound	0.1 ± 0.2 [0.0–2.0]	0.0 ± 0.2 [0.0–3.0]	0.2 ± 0.5 [0.0–3.0]	0.5 ± 1.0 [0.0–4.0]	0.4 ± 0.7 [0.0–4.0]	0.034*	(b)
Use of airway ultrasound	0.0 ± 0.0 [0.0–0.0]	0.0 ± 0.0 [0.0–0.0]	0.0 ± 0.0 [0.0–0.0]	0.0 ± 0.0 [0.0–0.0]	0.0 ± 0.0 [0.0–0.0]	0.119	
Use of regional ultrasound	1.0 ± 1.0 [0.0–3.0]	0.6 ± 0.8 [0.0–4.0]	0.4 ± 0.6 [0.0–5.0]	0.7 ± 0.8 [0.0–4.0]	0.9 ± 1.1 [0.0–5.0]	0.191	
Use of POCUS ultrasound	0.1 ± 0.4 [0.0–3.0]	0.1 ± 0.2 [0.0–3.0]	0.0 ± 0.0 [0.0–0.0]	0.5 ± 1.3 [0.0–4.0]	0.1 ± 0.4 [0.0–3.0]	0.041*	(b)
Direct communication with patients	3.7 ± 0.5 [0.0–4.0]	3.8 ± 0.4 [0.0–5.0]	3.4 ± 0.8 [0.0–4.0]	3.9 ± 0.4 [1.0–5.0]	3.8 ± 0.6 [0.0–5.0]	0.742	
Ventilation management	2.7 ± 0.8 [0.0–4.0]	2.4 ± 1.2 [0.0–5.0]	2.5 ± 1.2 [0.0–5.0]	2.7 ± 1.4 [0.0–5.0]	2.3 ± 1.3 [0.0–5.0]	0.277	
Exposure to academic research activities	0.3 ± 0.7 [0.0–3.0]	0.8 ± 1.2 [0.0–5.0]	0.5 ± 0.9 [0.0–3.0]	0.7 ± 1.1 [0.0–3.0]	0.3 ± 0.5 [0.0–5.0]	0.487	

Results presented as Mean ± SD [min – max]; *$p < 0.05$; (a) first vs. third year ($p = 0.013$); (b) no differences after Bonferroni correction.

to other competencies. As expected, fifth-year residents had overall higher levels of exposure than more junior ones. (see Supplemental Digital Content Table S4).

Ultrasound

Pocus, lung and cardiac ultrasounds' maximum value was 4 not reaching the maximum level in any year of training. For cardiac ultrasound, a significantly higher mean score of exposure was observed during ICU rotation. Anaesthesia residents are less exposed to regional ultrasound during ICU rotation. Rotation in anaesthesia was associated with significantly lower scores of lung, cardiac and POCUS ultrasound than ICU rotation ($\beta = -0.64$, $\beta = -0.86$, $\beta = -0.33$, $p < 0.001$; respectively). When compared to the fifth year of residency, the first and third year presented a lower score for the use of regional ultrasound ($\beta = -0.80$ and $\beta = -0.89$, $p < 0.001$).

Airway intubation and ventilation management

For airway intubation procedures and ventilation management, first-year residents and residents in ICU rotation did not achieve the maximum level of exposure. The fourth year had significantly higher scores for airway intubation procedures ($\beta = 0.21$, $p = 0.047$) than the fifth. No other differences were found regarding ventilation management exposure.

General Anaesthesia

Across all three stages of general anaesthesia, both first and third-year residents fell short of achieving the maximum level of exposure, only reaching a maximum level of 4.

Within each year group, some residents were not exposed to general anaesthesia. The first year presented a significantly lower score for general anaesthesia emergence ($\beta = -0.48$, $p = 0.044$), when compared to the fifth year. No statistically significant differences were found in induction and maintenance of general anaesthesia according to the year of residency.

Regional anaesthesia

Concerning neuraxial regional anaesthesia, only fifth-year residents achieved the maximum value. For peripheral regional anaesthesia, the maximum values were reached for third and fifth years, with a significant difference between third and first year. When compared to the fifth year of residency the fourth year had significantly lower scores for neuraxial anaesthesia ($\beta = -0.56$, $p = 0.044$), while for the second and third years the difference was for both neuraxial and peripheral anaesthesia ($\beta = -0.59$; $\beta = -1.06$, and $\beta = -0.85$; $\beta = -1.00$, respectively).

Direct communication

All year groups were exposed to direct communication with patients and only third- and first-year residents did not reach the maximum value. When compared to the fifth year of residency, the third year exhibited significantly lower scores ($\beta = -0.32$, $p = 0.019$) and the fourth-year higher scores ($\beta = 0.67$, $p = 0.023$).

Academic work/Investigation

The mean values for academic research were inferior to one across all year groups, with the lowest average mean value. The maximum level of exposure was only reached for the fifth and second years (Table 3), with the second year presenting a higher average value (0.44).

Affiliated hospital area

After LMM analysis, there were some differences in competencies when comparing geographical areas. Residents from the North reported lower scores for general anaesthesia maintenance, peripheral regional anaesthesia, airway intubation procedures and ventilation management, and higher scores of exposures to academic research activities.

Discussion

We observed the Portuguese anaesthesia residents' daily exposure to specific and selected ETR competencies in 26 Portuguese training hospitals. Differences between the 2022 ETR recommendations and the actual practice regarding the selected competencies were observed, namely in the lower exposure levels to ultrasound and academic research activities. We also identified different levels of autonomy throughout the years of training, with higher scores in the fifth year.

Each task in anaesthesia is related to a specific learning progression [15], needing different amounts of training to achieve the level of proficiency. Self-reporting is a regular part of continuous quality improvement programs [16], and could also be used as a form of assessment or feedback [17,18] when combined with other forms of data collection. In our study, self-reporting aimed at gathering data about the training program effectiveness.

In the context of the COVID-19 pandemic, which led to institutional rescaling and closures and disrupted education worldwide, the use of online tools became even more essential [19,20]. Google Forms was selected for this study as a free online tool that allows for the creation of surveys and quizzes [19,20]. The top-down (specific questions on skills entered by experts) and bottom-up (answers given directly by students) combined approach allowed for an overview of considerable importance [21]. Aiming to identify important skills, competencies or areas of improvement, medical education experts elaborated questions which residents answered providing first-hand experiences and perspectives on their training. The adequacy of instructional design and the protection of students' privacy was also considered [22]. Detailed information about the residents' practical experience and progression in acquiring the necessary competencies was gathered. It provided insights into their level of exposure, hands-on training and the development of their skill set.

The findings indicate that while residents experience substantial exposure during anaesthesia rotations, significant variability exists in exposure across training years and rotations, especially in the essential skills of academic research and ultrasound.

During ICU rotation, apart from lung, cardiac and POCUS ultrasound, anaesthesia residents reported lower levels of exposure to competencies. Critical care ultrasound is considered an essential component of intensive care practice [23]. The reported levels of exposure were below our expectations, since ultrasound usage in ICU context should be a common procedure. This could be explained as residents in the ICU rotation are on average more junior, when these competencies are not assessed and therefore cannot be delegated. Intensive care medicine is an independent speciality in Portugal and hence specialists and residents from Intensive Medicine share the need to train and gain these competencies. Another explanation could be the difficulty in operationalizing these recommendations into effective training.

One of the reasons for the lower levels of exposure in ICU rotation to other competencies, could be explained by the ICU workload, with fewer, perhaps more unstable patients, and thus the anaesthesia residents developed other competencies not assessed in our survey. Regardless, a reflection on these results should prompt changes, ICU rotation is essential for the foundational training of an anaesthesiologist. The higher levels of exposure to the selected competencies observed during anaesthesia rotations suggests that, during their intensive care rotation, anaesthesia residents are either less autonomous or focus on skills not considered core to their training as anaesthesiologists.

The null exposure to airway ultrasound was surprising. This is a strategy that has gained popularity in recent years [24]; however, it is still being implemented, unfamiliar or deemed irrelevant by many specialists.

The observed mean values for airway intubation, ventilation management, general anaesthesia (induction, maintenance, and emergence), and regional anaesthesia (neuraxial and peripheral) were below the expected levels. Anaesthesiologists are expected to be proficient in all these areas to ensure safe and high-quality care. To address this, simulation exercises, on-site observational learning, manikin training, and courses on airway, ventilation management, general or regional anaesthesia should be encouraged or made mandatory. Training progression with clear, objective, and achievable learning goals should be closely monitored with prospective assessment using validated tools. Providing prompt feedback and tailored training can enhance autonomy in a safe environment, allowing residents to achieve higher levels of autonomy and competency.

Competencies such as academic research and ultrasound demonstrated significant variability across different training years, with scores being inconsistent. The reported values to Academic Work/investigation were highest in the second and fifth year of

training. To become a specialist, Portuguese residents undertake a final national exam. One of the parameters valued in the curricular part of the exam is related to research/academic work/investigation. The highest level of exposure found in these 2 years can be related to the incentive to fulfil the curricula criteria, at the end or early stage of the residency program, and not due to a genuine interest in developing this skill. It can be related to the organization within departments, the lack of supportive structure to perform research (time, resources, funding) or lack of knowledge or guidance from more senior anaesthesiologists. The second-year residents notably higher-than-expected exposure to academic research activities can also be attributed to their remaining within their primary training hospital during the early years and participating in research projects early in their residency. This initial engagement with research contrasts with the expectations typically associated with this stage of training. These planned research activities may be interrupted once residents engage in rotations outside their primary training hospital, probably justifying the lower scores in third- and fourth-year residents. This is in line with Pierre, M et al. [25] report that only 19.6% of medical students considered that research was sufficiently addressed during pre-graduate education. Residency programs should seek to promote a more continuum exposure to academic work, with structured programs encouraging residents' participation in research projects and a regular engagement with these competencies throughout residency. Recommendations already exist and should be incorporated into training programs. These range from emphasizing the importance of research activities, embracing diversity, equity and inclusion, examining other systems and learning from each other to improve access to and actively advertise research collaborations [26].

Regarding ultrasound, we recommend including dedicated workshops, focusing on both technical and clinical aspects, ensuring residents develop proficiency and confidence in their skills during the training program. These competencies should be frequently assessed, and their acquisition encouraged throughout all the stages of anaesthesia training. It is estimated that performance of 150 ultrasound exams might be required to demonstrate competency [27]. The development of mentorship programs could further support residents in achieving competencies, fostering an environment where academic curiosity is a core part of their training. Supporting the trainers is a mandatory aspect in competency-based medical education. These models of education require many resources. Trainers should be given time, proper training and recognition to help residents achieve their full potential. The Portuguese training program should be revised to include a section with recommendations, in line with the 2022 ETR requirements, to provide structured support to those involved in training residents.

Regarding the differences found in levels of exposure and the years of training, it is unsurprising that fifth-year residents report the highest level of exposure. This reflects the natural progression of skill acquisition and increased autonomy throughout the training program. This trend aligns with the anticipated increase in exposure to more complex procedures as residents advance in their training. However, several unexpected findings emerged. Interestingly, in our study, second-year residents also reported high levels of exposure to some competencies. Residents spend most of the first 2 years of training in their training centres, thus allowing a continuous assessment and development. As mentioned, after the initial 2 years, most need to complete their training in different hospitals, usually universities or larger hospitals. In the fifth and fourth year of the anaesthesia rotations residents usually need to complete training in areas such as neurosurgery, paediatrics, cardiac or advanced training in specific areas, for example. Even though fifth- and fourth-year residents could be considered more competent than first- or second-year residents, they are often not allowed to perform tasks independently – due to more complex cases, unfamiliar training site or the supervision of specialists uninformed of the background of the trainee. These could even explain lower levels of exposure of some competencies than those found in the third and fourth years. E-portfolio/logbook and formative assessment in the form of feedback and workplace-based assessment tools, could contribute towards the clarification of the level of competency and allow exposure of more experienced residents to higher levels of competencies. These should be incorporated into the revised training program with guidance on how and when to apply them.

These improvements will better align training with European standards, ultimately enhancing the quality of patient care provided by future anaesthesiologists.

It is difficult to compare our results with other European countries: despite the ETR recommendations, there are differences in European training programs regarding assessment and certification. Only six out of 35 countries have a competency-based curriculum [28]. Most of the self-reporting studies refer to overall medical competencies, not anaesthesia specifically. Though self-reporting studies can address assessment and qualitative feedback, many focus on the latter and not on having quantitative or comparable scores. A study conducted in Argentina explored the adoption of a new evaluation system in medical specializations, highlighting how collaboration and feedback enhance learning outcomes

[29]. Advanced medical students regard social-interactive competencies, mental skills and personality traits as essential for basic clinical tasks, noting different competency demands across specialties [30].

In a recent article [31], Portuguese residents expressed their wish to cooperate in the programs' revision. They also reflected on the importance of including feedback, reflection, e-portfolios and formative assessment of the different competencies. They also urge for autonomy, discussion of clear objectives and case-based discussion or simulation highlighting the importance of competency-based curriculum programs.

This study did not collect open-ended feedback from residents on the training program, future surveys could be expanded to include questions on what additional support residents feel they need. Similarly, future surveys could explore the residents' perceived level of competency, instead of only the exposure score. Gathering this information would enable the trainers to tailor educational interventions more accurately to each resident's needs, enhancing both competency acquisition and confidence in performing critical tasks. Incorporating resident feedback into the curriculum development process ensures that training aligns with both national and European standards while addressing any gaps perceived by the trainees themselves.

Limitations

Our study presents some limitations. There are different training rotations that can take place at the same time (Pain management, ICU, Obstetrics, Paediatrics, for example). Most of these can also take place in different training years and hospitals. These different possibilities can lead to bias. Despite this, we consider that analysing the reported exposure per year of training is relevant and allows a measure of the residents' evolution, that should always be a continuum. The response rate was probably related to the timeline of the survey. The possibility of response at the end of each day and a reduced timeline could have improved the response rate. Considering similar studies, the response rate was high. Another possibility for the low response rate could be related to the expectations and previous information regarding competency exposure. Many residents reached out to the authors inquiring about the aim of the collected data, the practical implications for their training program and to question about the European Training Requirements. Nevertheless, the low response rate poses questions regarding representativeness. Fifth year and some geographical areas residents were less represented. The results might be biased towards residents who are keen to provide feedback.

For example, non-respondents could have scored higher for some of the competencies evaluated, meaning that the above suggestions would not be as urgent or needed. Nonetheless, we consider the proposed actions relevant, since all the residents would benefit from changes highlighted by the one-third who participated in this survey.

Lastly, this study provides a descriptive analysis of the data and does not explore potential correlations between competencies and how they influence one another. For instance, we did not examine the impact of improving direct communication skills on academic research or other related competencies. This limitation highlights the need of future studies to employ advanced statistical analyses or qualitative methods to examine interactions among different competencies.

Conclusions

Our survey reports the daily exposure of Portuguese residents to seven specific competencies, as required in the European Training Requirements: airway intubation, general anaesthesia (induction, maintenance and emergence), regional anaesthesia (neuraxial and peripheral), ultrasound (lung, cardiac, airway, regional and point-of-care), direct patient communication, ventilation management and academic research activities. For the first time in Portugal, valuable data has been collected on residents' level of involvement in skill and competency development. A clear understanding of the competencies acquisition can lead to better personal and professional growth. By identifying gaps between what is expected and monitored, we can design training programs that guide residents learning and development, enabling them to acquire the necessary competencies to succeed in their roles.

The collected information offers insights into the individual training needs and the necessary curriculum development, tailoring educational interventions and contributing to the advancement of anaesthesiology training at both national and European levels. National education programs should prioritize the development of competencies such as academic research activities and ultrasound, whose reported values were lower in our findings. The mere application of the survey brought awareness regarding the European Training Requirements, unknown to some residents at the time of the study.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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References

[1] Frank JR, Snell LS, Cate OT, et al. Competency-based medical education: theory to practice. Med Teach. 2010;32(8):638–645. doi: 10.3109/0142159x.2010.501190

[2] Ten Cate O. Competency-based postgraduate medical education: past, present and future. GMS J Med Educ. 2017;34(5):Doc69. doi: 10.3205/zma001146

[3] Weller JM, Naik VN, San Diego RJ. Systematic review and narrative synthesis of competency-based medical education in anaesthesia. Br J Anaesth. 2020 Jun;124(6):748–760. doi: 10.1016/j.bja.2019.10.025

[4] Caverzagie KJ, Nousiainen MT, Ferguson PC, et al. Overarching challenges to the implementation of competency-based medical education. Med Teach. 2017 Jun;39(6):588–593. doi: 10.1080/0142159x.2017.1315075

[5] Hanley M, Shearer C, Livingston P. Faculty perspectives on the transition to competency-based medical education in anesthesia. Can J Anaesth. 2019 Nov;66(11):1320–1327. Perspectives du corps professoral sur la transition vers une formation médicale fondée sur les compétences en anesthésie. doi:10.1007/s12630-019-01412-w

[6] Ebert TJ, Fox CA. Competency-based education in anesthesiology: history and challenges. Anesthesiology. 2014 Jan;120(1):24–31. doi: 10.1097/aln.0000000000000039

[7] Carlsson C, Keld D, van Gessel E, et al. Education and training in anaesthesia–revised guidelines by the European board of anaesthesiology, reanimation and intensive care. Eur J Anaesthesiol. 2008 Jul;25(7):528–530. doi: 10.1017/s0265021508004237

[8] Van Gessel EM-O, Østergaard HT, Niemi-Murola L. Education and training standing committee EBoA, reanimation and intensive care. Postgraduate training in anaesthesiology, pain and intensive care: the new European competence-based guidelines. European Journal Anaesthesiology. 2012;29(4):165–168. doi: 10.1097/EJA.0b013e32834da759

[9] UEMS. Training requirements for the specialty of anaesthesia, pain and intensive care medicine. [cited 2024 Oct 13]. Available from: https://drive.google.com/file/d/1r2dlzJiPvM0SVM2hBrK6m4ZeNV1i68ue/view

[10] Scudellari AB, Goldik Z, Bilotta F. A plea for standardisation in the duration of training in anaesthesiology and intensive care medicine across Europe: a survey of representatives of the European national anaesthesia societies committee. Eur J Anaesthesiol. 2022 [2022 Dec 14];40(2):138–140. Published online ahead of print. doi: 10.1097/EJA.0000000000001789

[11] Richardson D, Kinnear B, Hauer KE, et al. Growth mindset in competency-based medical education. Med Teach. 2021 Jul;43(7):751–757. doi: 10.1080/0142159x.2021.1928036

[12] Davis KA, Grote D, Mahmoudi H, et al. Comparing self-report assessments and scenario-based assessments of systems thinking competence. J Sci Educ Technol. 2023 [2023 Dec 1];32(6):793–813. doi: 10.1007/s10956-023-10027-2

[13] Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-Surveys (CHERRIES). J Med Internet Res. 2004;3(4):e34. doi: 10.2196/jmir.3.4.e34

[14] Health Mo. Portaria n.º 92-A/2016, de 15 de abril. [cited 2024 Mar 17]. Available from: https://diariodarepublica.pt/dr/detalhe/portaria/92-a-2016-74163206

[15] Bilotta F, Titi L, Lanni F, et al. Training anesthesiology residents in providing anesthesia for awake craniotomy: learning curves and estimate of needed case load. J Clin Anesth. 2013 Aug 01;25(5):359–366. doi: 10.1016/j.jclinane.2013.01.012

[16] Tetzlaff John E, Warltier David C. Assessment of competency in anesthesiology. Anesthesiology. 2007;106(4):812–825. doi: 10.1097/01.anes.0000264778.02286.4d

[17] Bhardwaj N, Porterfield L, Kuo YF, et al. Resident self-assessment and clinical competency committee evaluations in family medicine: a single-institution study. Fam Med. 2023 May;55(5):333–338. doi: 10.22454/FamMed.2023.170761

[18] Sargeant J. Toward a common understanding of self-assessment. J Contin Educ Health Prof. 2008 Winter;28(1):1–4. doi: 10.1002/chp.148

[19] Mulatsih B. Application of google classroom, google form and quizizz in chemical learning during the COVID-19 pandemic. Ideguru: Jurnal Karya Ilmiah Guru. 2020 Jun 21;5(1):16–26. doi: 10.51169/ideguru.v5i1.129

[20] Iqbal M, Simarmata J, Feriyansyah F, et al. Using Google form for student worksheet as learning media. Int J Eng Technol (UAE). 2018 Jan 01;7:321–324.

[21] Garito MA, Caforio A, Falegnami A, et al. Shape the EU future citizen. Environmental education on the European green deal. Energy Rep. 2023 Jun 14;9:340–354. doi: 10.1016/j.egyr.2023.06.001

[22] Djenno M, Insua G, Pho A. From paper to pixels: using google forms for collaboration and assessment. Lib Hi Tech News. 2015 Jun 01;32(4):9–13. doi: 10.1108/LHTN-12-2014-0105

[23] Wong A, Galarza L, Forni L, et al. Recommendations for core critical care ultrasound competencies as a part of specialist training in multidisciplinary intensive care: a framework proposed by the European society of intensive care medicine (ESICM). Crit Care. 2020 Jul 3;24(1):393. doi: 10.1186/s13054-020-03099-8

[24] Lin J, Bellinger R, Shedd A, et al. Point-of-care ultrasound in airway evaluation and management: a comprehensive review. Diagnostics (Basel). 2023 Apr 25;13(9):1541. doi: 10.3390/diagnostics13091541

[25] Pierre M, Miklavcic M, Margulan M, et al. Research education in medical curricula: a global analysis. Med Sci Educ. 2022 Apr;32(2):495–502. doi: 10.1007/s40670-022-01542-9

[26] Stundner O, Adams MCB, Fronczek J, et al. Academic anaesthesiology: a global perspective on training, support, and future development of early career researchers. Br J Anaesth. 2023 Nov;131(5):871–881. doi: 10.1016/j.bja.2023.07.030 Epub 2023 Sep 7. PMID: 37684165; PMCID: PMC10636519.

[27] Boniface KS, Ogle K, Aalam A, et al. Direct observation assessment of ultrasound competency using a mobile standardized direct observation tool application with comparison to asynchronous quality assurance evaluation. AEM Educ Train. 2019 Feb 19;3(2):172–178. doi:

10.1002/aet2.10324 PMID: 31008429; PMCID: PMC6457355.

[28] Jonker G, Manders LA, Marty AP, et al. Variations in assessment and certification in postgraduate anaesthesia training: a European survey. Br J Anaesth. 2017 Nov 1;119 (5):1009–1014. doi: 10.1093/bja/aex196 PMID: 28981584.

[29] Lucchese M, Lizzio S, Calneggia MI, et al. Evaluación en especializaciones médicas: un estudio en una universidad argentina. Educación Médica. 2023;24 (2):100796. ISSN 1575–1813. doi: 10.1016/j.edumed.2023.100796

[30] Zelesniack E, Oubaid V, Harendza S. Advanced undergraduate medical students' perceptions of basic medical competences and specific competences for different medical specialties – a qualitative study. BMC Med Educ. 2022;22(1):590. doi: 10.1186/s12909-022-03606-1

[31] Gouveia H, Dias M, Gonçalves L. Perspectives and challenges in specific training in anesthesiology: a contemporary analysis and a vision for the future. RSPA. 33:- Nº 2–2024. (article in Portuguesn Portuguese). doi: 10.25751/spa.36330