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ORIGINAL ARTICLE

Intensive care medicine in Europe: perspectives from the European Society of Anaesthesiology and Intensive Care

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BACKGROUND Anaesthesiology represents a rapidly evolving medical specialty in global healthcare, currently covering advanced peri-operative, pre-hospital and in-hospital critical emergency management (CREM), intensive care medicine (ICM) and pain management. The aim of the European Society of Anaesthesiology and Intensive Care (ESAIC) is to develop and promote a coordinated interdisciplinary and multidisciplinary European network of Anaesthesiology and Intensive Care Medicine (AICM) societies for improvement of patient safety and outcome, and to enhance political and public awareness of the role of anaesthesiologists all over Europe. The ESAIC promotes coordinated interdisciplinary and multidisciplinary care for severely compromised patients, based on the European training requirements (ETR) within the European Union of Medical Specialists (UEMS).

METHODS To define the current situation of AICM in Europe, a survey was sent in April 2019 to the ESAIC Council and the ESAIC National Anaesthesiologists Societies Committee (NASC) members. The survey posed questions regarding the year of foundation, the inclusion of ICM in the society name, and if, and to what extent, various kinds (postoperative, general, specific, mixed) of national ICUs are being run by differing medical specialties. The study

data were compiled and analysed by the ESAIC Board, Council and NASC in December 2019.

RESULTS AND CONCLUSION Amongst the 42 European national societies surveyed (41 members of ESAIC-NASC plus Luxembourg), nineteen (45%) also include terms related to critical care medicine or ICM in their names, seven (17%) include terms related to reanimation and three (7%) to resuscitation. In recent years, several national societies revised their names to better reflect their gradual embrace of peri-operative medicine, ICM, CREM and pain management. Approximately 70% of ICU beds in Europe, and 100% in Scandinavia, are being run by anaesthesiologists, the remaining 30% being managed by physicians from other surgical or medical specialties. To emphasise future needs and resources of European AICM, the ESAIC drafted an ICM roadmap in terms of clinical practice, organisation of healthcare, interprofessional and interdisciplinary collaboration, patient safety, outcome and empowerment, professional working conditions, and changes in research, teaching and training required to meet future challenges and expectations.

Published online xx month 2022

Introduction

Modern anaesthesiology differs widely from what it was like half a century ago, not just because of what it covers today in the operating room, but rather as it has crossed borders to embrace activities far beyond providing general

and regional anaesthesia within and outside the hospital. Many procedures performed by anaesthesiologists are high-risk interventions testing human physiology to the extreme.

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DOI:10.1097/EJA.0000000000001706

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Maintaining well tolerated medical conditions throughout and after extensive surgical procedures under anaesthesia is a huge professional challenge. Consequently, anaesthesiology is a medical specialty based on, and inseparably linked to, patient safety from its very birth. Unexpected anaesthesia-related death has encouraged scientific development of resuscitation, creation of medical emergency teams, critical emergency medicine (CREM) and intensive care medicine (ICM),^{1,2} initially only targeting the prevention of anaesthesia-associated mortality but subsequently aiming at managing the full range of perioperative morbidity and survival.¹ In particular, modern anaesthesiology has been shaped by clinical aspects of resuscitation, CREM and ICM, where these are not only based on deeper knowledge of applied human physiology, pharmacology and pathophysiology but also together with nontechnical skills, such as holistic thinking, situational awareness, interprofessional communication and interdisciplinary teamwork, paying particular attention to patients, their relatives and other healthcare providers.

Unlike other physicians, anaesthesiologists manage patients of all age and gender groups, from healthy to terminally ill, from neonates to very elderly, in advanced perioperative procedures ranging from maternal, intra-uterine and neonatal management to organ transplantation and cardiac or brain surgery. European Anaesthesiology and Intensive Care Medicine (AICM) is based on close and open-minded interprofessional and interdisciplinary collaboration to maintain patient safety and achieve optimal clinical outcomes within the dynamic, flexible and rapidly expanding fields of perioperative medicine, ICM, CREM and pain medicine.

The rapid early expansion of ICU facilities all over Europe during the SARS-CoV2 pandemic to provide ICU care to severely compromised Covid-19 patients was enabled mainly by the broad and deep professional competence of European anaesthesiologists, and by their use of simulation-based training, enabling rapid involvement of internal and emergency medicine physicians, as well as surgeons, together with nurses, mostly recruited from anaesthesia services.²

Intensive care medicine was born in Europe by the initiative of the Danish anaesthesiologist and professor Björn Ibsen. In Copenhagen, 5722 cases of poliomyelitis were managed in 1952, out of which 2450 (42.8%) had respiratory failure. Few of them could be mechanically ventilated as only negative-pressure ventilators (considered less suitable in bulbar poliomyelitis) were available. Professor Ibsen introduced the idea of tracheotomy followed by manual positive-pressure ventilation. He observed the mysterious alkalosis in those patients suffering from respiratory muscle paralysis.³ The hospital then recruited 1500 medical students to ventilate patients by hand day and night (altogether 165 000 h). Another

brilliant idea was to treat those patients together in a large-space area, to allow nursing staff to rapidly deal with similar potential problems. In this first ICU, the mortality rate of bulbar poliomyelitis was reduced from over 90 to 25%. At the same time, Poul Astrup, Ole Siggaard-Anderesen and John Severinghaus developed the first pH, PCO_2 and PO_2 electrodes, based on established technology used by the Danish brewing industry. Suddenly, long-term mechanical ventilation was possible, and along with improved patient monitoring, ICM was born.⁴ Anaesthesiology and ICM have been strongly linked, and naturally interdependent, ever since.

Methods

To define the current situation of AICM in Europe, a survey was sent by the European Society of Anaesthesiology and Intensive Care (ESAIC) Board to the Council and to all European national societies of anaesthesiology, which were members of the National Anaesthesiologists Societies Committee (NASC) in April 2019, regarding year of foundation, inclusion of ICM in the society denotation, and if, and to what extent, various kinds of national ICUs (postoperative, general, specific, mixed) are being run by differing medical specialties. The questionnaire is available in the supplementary material. The study data were compiled and analysed by the ESAIC Board, Council and NASC in December 2019.

Ethics: ethical approval for this study was not required as no animals or patients are involved.

Results

Eighteen of 42 national societies (43%) in Europe were founded before 1960, and six of them (14%) even in the 1930s or 1940s (Table 1). All 42 national societies (41 members of ESAIC-NASC plus Luxembourg) include anaesthesiology in their society denotations, and 29 of them (69%) also include an ICM-related term. Nineteen societies (45%) include intensive, intensivists, intensive care, intensive therapy, reanimation and intensive care, reanimation and intensive medicine, critical care medicine or ICM; seven (17%) include reanimation or reanimatologists and three (7%) resuscitation (Table 1). In recent years, several national societies in Europe have revised their titles to better reflect their gradual embrace of perioperative medicine, ICM, CREM and pain medicine.

In 32 (76%) of the European countries with national societies being members of the ESAIC or NASC, the names of the medical specialty recognised by the national ministries of health (MOH) also contain terms related to ICM and anaesthesiologists in three other countries (Norway, Finland and Israel) where, even though their names of the specialty include only anaesthesiology, they are fully empowered to practice ICM (Table 1).

Table 1 Main outcomes of recent European survey on year of foundation, and current denotation, of national societies of anaesthesiology and intensive care medicine, and on current relative involvement of anaesthesiologists in national ICM

Country (Member of the European Union)	National society founded in (year)	ICM-related terms included in formal denotation of national society	Approximate proportion of intensive care beds run by anaesthesiologists (%)
Austria	1951	Yes	70
Armenia	1996*	Yes	-
Belgium	1948	Yes	30
Bulgaria	1957	Yes	100
Czech Republic	2006	Yes	20
Croatia	1992	Yes	60
Cyprus	1989	No	30
Denmark	1949	Yes	100
Estonia	1967	No	90
Finland	1950	No	100
France	1982	Yes	100
Germany	1953	Yes	70
Georgia	2005	Yes	100
Greece	1960	No	20
Hungary	1966	Yes	100
Iceland	1972*	Yes	-
Ireland	1959*	No	-
Israel	1952	No	90
Italy	1934	Yes	90
Kosovo	2006	Yes	100
Latvia	1992	Yes	95
Lithuania	2009	Yes	100
Luxembourg	2007*	Yes	75
North Macedonia	1990*	No	70
Malta	1983	No	100
Moldova	1979	Yes	100
Montenegro	2004*	Yes	-
Netherlands	1948*	No	5
Norway	1953	No	100
Poland	1959	Yes	100
Portugal	1955	No	55
Romania	1974	Yes	100
Russia	1966	Yes	0
Serbia	2006	Yes	60
Slovakia	1969	Yes	80
Slovenia	1975	Yes	70
Spain	1953	Yes	50
Sweden	1946	Yes	100
Switzerland	1952	Yes	20
Turkey	1956	Yes	80
United Kingdom	1932	No	33
Ukraine	1960	No	100

Some missing data, depicted with an asterisk, was added later

Corresponding data from the national societies of the 27 European Union (EU) member countries are even more relevant. Nineteen national societies (70%) include ICM-related terms in their names. Moreover, in 22 of those countries (81%), the name of the medical specialty recognised by the national MOH also contains terms associated with ICM (Table 1).

This is further reflected in the duration and structure of training. Fourteen national societies of AICM in the EU (52%) include a minimum of 24 months of graduate training in ICM.

Approximately 70% of ICU beds in Europe – and all ICU beds in Scandinavia – are now being run by anaesthesiologists (Table 1), and the remaining 30% of ICU

beds by physicians from other surgical and medical specialties.

Discussion

The ESAIC did not include ICM in its society name until 1 October 2020, despite the established name and content of the European Board of Anaesthesiology (EBA) within the European Union of Medical Specialists (UEMS) curriculum and syllabus (i.e. anaesthesiology, pain and intensive care), and of the ESAIC examination, the European Diploma in Anaesthesiology and Intensive Care (EDAIC). Currently, more than 60% of European and 70% of EU national societies of AICM already include ICM-related terms in their names (Table 1). Considering that the decision on name change from ESA to ESAIC by the ESA General Assembly was

supported by more than 95% of its delegates, most of the remaining European national societies might well introduce ICM in their names in the future. However, it is crucial to note that at this stage the European Society of Intensive Care Medicine (ESICM) does not consider the EDAIC to appropriately cover ICM as discussed at the European Board of ICM (EBICM) and Multiple Joint Committee (MJC) on ICM (MJCICM) meetings in Berlin in September 2019.

However, the recent European Training Requirement (ETR) in anaesthesiology, launched by the EBA-UEMS and recognised all over Europe, devotes considerable parts to ICM and CREM (<http://www.eba-uems.eu/resources/pdfs/edp/etr-anaesthesiology-2018.pdf>). Moreover, the EDAIC, based on those ETRs and covering basic scientific and clinical aspects considered relevant to and appropriate for European anaesthesiologists, is recognised by the UEMS as the European examination in AICM, and is also nowadays a valued and useful tool for professional learning and validation outside Europe.

In medical, political and economical terms, ICM now, and most probably even more so in the future, represents one of the most important and challenging fields of modern healthcare because of high and increasing demands, insufficient allocated ICU beds, use of advanced technologies, high-quality healthcare and high costs. This has become particularly obvious during the ongoing Covid-19 pandemic, where the coherence of AICM and broad and deep professional competence of European anaesthesiologists, together with systematic use of simulator-based training of nurses and other specialist physicians, have paved the road for rapid, dynamic, flexible and safe expansion and adaptation of ICU care facilities to meet higher and rapidly changing requirements for advanced and lifesaving high-quality healthcare.

Intensive care medicine is not a primary medical specialty. Ten European primary medical specialties, formally recognised as (in alphabetical order) anaesthesiology, cardiac surgery, cardiology, emergency medicine, internal medicine, neurology, neurosurgery, paediatrics, pneumology and general surgery, are currently practicing ICM to some extent, and none of them is prepared to give it up. It is worth mentioning that in Switzerland, Spain, Portugal and parts of the UK and Ireland, direct ICM specialist training of physicians is allowed without any above-mentioned underlying primary medical specialty. However, physicians specialising in ICM cannot benefit from recognition in other EU member countries as the European Directive (2005/36/CE, amended as 2013/55/EU) on the recognition of professional qualifications within the EU does not recognise ICM as a primary medical specialty. The process of including ICM as a European primary medical specialty in the Annex V (Article 25) requires recognition by a qualified (weighted

proportion independently defined by each member state) majority in at least two-fifths of the EU member states. Moreover, to create a specialist section and board for ICM within the UEMS, ICM must be recognised as an independent medical specialty by more than one-third of the EU member states and registered in the official journal of the European Commission (Directive 205/36/EC).

The UEMS, and particularly its MJCICM, has offered to work together with European authorities to incorporate ICM into recognised medical specialties as a 'particular qualification' in a future revision of the European Directives 2005/36/EU and 2013/55/EU to allow mutual recognition and free movement within European member states. Just adding ICM to the Annex V would certainly cause more problems than offer solutions or enable free movement between EU member states.

To facilitate harmonisation of ICM training across Europe, the UEMS created the European Board of ICM (EBICM) in 2006, with equal representations from the MJCICM and the ESICM (<https://ebicm.esicm.org/membership>). European Boards like the EBICM are to be considered as platforms for collaboration between MJCs and scientific societies to address scientific and training interests. The EBICM as a working group of the MJCICM was established to address such interests in ICM. Therefore, the MJCICM is providing a conduit for the EBICM to report to the UEMS Council.⁵ Within this group, the ETR for ICM was compiled and endorsed by the UEMS Council in 2014.

In 2017, the EBICM was reformed according to UEMS rules by Professor Kai Zacharowski. Since September 2017, the EBICM has unanimously agreed to follow the UEMS rules and to recruit more members from the nine (now ten, including emergency medicine) European societies representing primary medical specialties interested in, or practicing, ICM. This will enable those specialties and their scientific societies to have a higher attendance, and hence more influence, at future EBICM meetings.

The new EBICM structure is proposed to include as members: the president of the MJCICM, the EBA-UEMS (with emphasised roles in defining harmonisation of ETR, course accreditations, revalidation procedures and implementation of a European fellowship), UEMS sections from all other nine medical specialties representing ICM, members of the ESICM Board, members of the ESAIC Board, ESAIC Council and ESAIC NASC (with emphasised roles in defining potential benefits to ESAIC members), and members of the European societies of cardiac surgery, cardiology, emergency medicine, internal medicine, neurology, neurosurgery, paediatrics, pneumology and general surgery (with emphasised roles in defining potential benefits to their members). According to UEMS statutes, however, the number of delegates from academic or scientific societies shall not exceed the number of delegates from parent MJCICM.

Table 2 Current challenges to European anaesthesiology and intensive care medicine

Insufficient information on national and international Intensive Care Medicine (ICM) training programmes (e.g. the CoBaTrICE-based Scandinavian postgraduate ICM fellowship programme concluded by the European Diploma in Intensive Care parts I and II exams) in Europe.
Ageing European population.
Need for dynamic expansion and flexible adaptation of European ICU facilities to rapidly meet future threats from pandemics and potential disasters.
Rapidly evolving new surgical, interventional and pharmacological techniques for more effective management of critical medical conditions.
Wide and increasing gaps between availability of, and requirements for, ICU beds in Europe.
Legislative demands for nationally board-certified ICM specialist physicians in some European countries (Switzerland, Spain, Portugal, parts of the United Kingdom and Ireland).

Since 2018, the EUROANAESTHESIA and ESICM LIVE congresses host bi-annual joint meetings of the ESAIC and the ESICM, the MJCICM and the EBICM, and also presidential talks between the ESAIC and the ESICM.

Current challenges to, and proposed solutions for, European AICM are listed in Tables 2 and 3, respectively.

In 2018, the ESA Board founded a roadmap of ICM to deal with its future within the ESAIC and in Europe. The purpose of a roadmap is to provide an extended look into the future within a chosen field of inquiry, based on collective knowledge and visions by devoted drivers of change in that particular field. This document represents just a starting point and needs to be more extensively developed and designed, to define a chair position and steering committee responsible for all items to be approved, together with a list of contributors in the field. The ESAIC ICM roadmap aims at outlining future needs and provision of European AICM in terms of clinical practice, organisation of healthcare, interprofessional and interdisciplinary collaboration, patient safety, outcome and empowerment and professional working conditions. It also highlights major research challenges and changes in teaching and training of healthcare professionals and students required to meet future challenges and expectations of the society. It will be an ongoing project gathering, selecting and scrutinising contents from all fields of AICM in Europe. A proposed initial name of a link to this project might be www.aicm.org/roadmap.

The roadmap should align with visions, missions and strategies of the ESAIC, and with expectations of different stakeholders (patients, physicians, nurses, managers, industry, politicians, taxpayers, etc.). In this regard, surveys are needed, the needs of stakeholders should be

analysed and requirements and means for achieving set goals should be defined. To reflect this extensive professional mission, incorporating competences and experience of anaesthesiologists all over Europe and to promote and improve patient safety in-hospital and outside, the ESAIC must take further responsibilities within the total field of AICM based on multidisciplinary and continuous interprofessional collaboration. Clinical teams within perioperative medicine and ICM, including physicians from other medical specialties (cardiology, emergency medicine, radiology, surgery, etc.), should be led by anaesthesiologists to provide evidence-based perioperative and ICU care, guided by robust audit data. These interdisciplinary teams provide natural points of mutual contact for anaesthesiologists and surgeons with general practitioners and other specialist physicians to ensure that individual needs of medically complex patients are appropriately met and carefully coordinated from the decision regarding surgery and/or ICU care until several weeks, or even months, afterwards. Organisational details should be determined based on actual requirements and available resources at local, regional, national and international levels.

Conclusion

Sixty-nine percent of the European and 70% of the EU national societies of AICM already include ICM-related terms in their denotations. The name of the medical specialty, as recognised by the relevant national government authorities, contains (alongside anaesthesia or anaesthesiology) terms linked to ICM in 81% of EU member countries.

The ESAIC ICM roadmap reflects future needs and resources of European AICM in terms of clinical practice, organisation of healthcare, interprofessional and

Table 3 Solutions proposed for European anaesthesiology and intensive care medicine

Roadmap of Intensive Care Medicine (ICM) to be compiled and continuously developed by the European Society of Anaesthesiology and Intensive Care (ESAIC) as a basis for more appropriate future strategic considerations and decisions.
Concepts of ICM, critical care medicine, critical care, intermediate critical care (ICC), intermediate care (IMC) and critical emergency medicine to be defined and implemented in a European context by the ESAIC and the European Board of Anaesthesiology (EBA).
European (and global) networks of ICUs run by anaesthesiologists to be developed and maintained, preferably also within international postgraduate training programs (e.g. the Scandinavian postgraduate ICM fellowship programme).
European patient data on perioperative and intensive care to be prospectively recorded to enable structured compilation, analysis and comparison at both national and international levels.
Expanded use of telemedicine to improve patient safety, for example, by enabling and promoting perioperative and emergency remote monitoring of vital organ functions also outside postanaesthesia care, ICC/IMC and ICUs.

interdisciplinary collaboration, patient safety, outcome and empowerment, professional working conditions, and changes in research, teaching and training required to meet future challenges and expectations.

It is mainly intended to be used by and shared between European stakeholders (e.g. patients, physicians, nurses, students, managers, industry, politicians, organisations and taxpayers), the ESAIC, the EBA-UEMS, the MJCICM-UEMS and other European AICM societies.

Acknowledgements relating to this article

Assistance with the article: none.

Financial support and sponsorship: none.

Conflicts of interest: none.

Presentation: none.

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