2024 updated European Heart Rhythm Association core curriculum for physicians and allied professionals: a statement of the European Heart Rhythm Association of the European Society of Cardiology

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EHRA DOCUMENT

EHRA European Heart Rhythm Association

2024 updated European Heart Rhythm Association core curriculum for physicians and allied professionals: a statement of the European Heart Rhythm Association of the European Society of Cardiology

Syllabus, Objective Structured Assessment of Technical Skills, training assessment, and training centre/trainer/trainee requirements to guide the certification for cardiac implantable electronic devices and invasive cardiac electrophysiology

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Heart rhythm management is a continuously evolving sub-speciality of cardiology. Every year, many physicians and allied professionals (APs) start and complete their training in cardiac implantable electronic devices (CIEDs) or electrophysiology (EP) across the European Heart Rhythm Association (EHRA) member countries. While this training ideally ends with an EHRA certification, the description of the learning pathway (what, how, when, and where) through an EHRA core curriculum is also a prerequisite for a successful training. The first EHRA core curriculum for physicians was

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published in 2009. Due to the huge developments in the field of EP and device therapy, this document needed updating. In addition, a certification process for APs has been introduced, as well as a recertification process and accreditation of EHRA recognized training centres. Learning pathways are more individualized now, with Objective Structured Assessment of Technical Skills (OSATS) to monitor learning progression of trainees. The 2024 updated EHRA core curriculum for physicians and APs describes, for both CIED and EP, the syllabus, OSATS, training programme and certification, and recertification for physicians and APs and stresses the importance of continued medical education after certification. In addition, requirements for accreditation of training centres and trainers are given. Finally, suggested reading lists for CIED and EP are attached as online supplements.

Keywords Arrhythmias • Cardiac implantable electronic devices • Certification • Curriculum • Education • Invasive electrophysiology

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Introduction

The management of cardiac arrhythmias is one of the fastest growing subspecialties of cardiology. In 2016, 524 pacemakers (PMs) and 101 implantable cardioverter–defibrillators (ICDs) were implanted per million inhabitants in the European Society of Cardiology (ESC) member countries, with a 10-year growth of 80% and 60% for PMs in the non-European and Eastern European ESC member countries, respectively, and 228% and 95% for ICDs in the Eastern and Northern European countries. Catheter ablation was performed in 288 procedures per million inhabitants, with a growth exceeding 100% in all geographical ESC regions except for Southern Europe.[1] To achieve and maintain high-quality services for patients, adequate training and certification of physicians, allied professionals (APs), and training centres is of utmost importance.

Sub-speciality certification in cardiology is guided by the Certification Task Force Chair of the ESC Council on Education Standards, which cooperates with the Continuing Medical Education Expert Group of the Biomedical Alliance in Europe and the UEMS (Union of the European Medical Specialists), which is linked to the European Commission. The mission of the Certification Task Force is to define and promote standards, requirements, and procedures in subspecialty certification in cardiology. In light of this, the European Heart Rhythm Association (EHRA) started to provide certification for physicians in invasive electrophysiology (EP) and cardiac implantable electronic devices (CIED) in 2005. As part of this process, the first EHRA core curriculum was published in 2009, guiding candidates and training centres in their process of learning, teaching, and obtaining certification.[2] Recognizing the important and increasing role of APs, AP certification commenced in 2011 for CIED and in 2021 for invasive EP. However, the beforementioned core curriculum was mainly directed at physicians and needed to be updated after 15 years. The updated certification process was described in 2021 but without updating the core curriculum itself.[3]

Therefore, the 2022–2024 EHRA board delegated to the EHRA Certification Committee the task of updating the EHRA core curriculum. With a dedicated team of physicians and APs highly qualified in both CIED and EP, we composed this curriculum with the aim of guiding physicians and APs through appropriate education and training to become a heart rhythm (HR) specialist, which should be recognized by obtaining certification in CIED therapy and invasive cardiac EP. In alignment with the goals of the EHRA certification programme, we seek to update the standard for competency and excellence across Europe and beyond. It should have clearly defined assessment goals and evaluate the necessary knowledge, skills, and clinical competencies that are required for CIED therapy and EP practice.[4–15]

In the process of composing the syllabus, the writing committee recognized that while knowledge and independence levels for physicians are generally similar across Europe, there exist large differences in both the training of and assigned responsibilities to APs. Whilst in some countries the knowledge levels of physicians and aPs in the specific context of HR may be similar, APs do not possess a general cardiology training in terms of duration and content and are not trained to the same independence levels for skills as physicians. Moreover, in other countries, APs rather acquire knowledge on the level of an experienced and dedicated nurse specialist. Thus, the committee decided to compose a single syllabus and Objective Structured Assessment of Technical Skills (OSATS) list for physicians and APs and assign different required knowledge levels to physicians/higher education APs and to nursing-level APs for each syllabus subject, thereby recognizing the different knowledge levels among APs across the EHRA member countries. In contrast for OSATS, different independence levels are defined for physicians and for both groups of APs together. Altogether this highlights the importance of current and future roles played by APs in multidisciplinary CIED/EP teams composed of both physicians and APs with different but complementary functions and responsibilities.

Definitions and glossary

- Accreditation: the process of officially recognizing training centres as having a particular status and being qualified to perform training. Being accredited by the ESC is a guarantee for all stakeholders—trainees, fellows, staff, and patients—that the institution has undergone

an extensive quality control process which has evaluated the institution's overall performance in terms of training, equipment, staff, etc.
- AP: the official ESC definition is that this is a distinct group of professionals who work in collaboration with physicians and other health care professionals and apply their expertise to facilitate prevention, provide diagnostic services, treatment, and rehabilitation of people, and/or undertake research to reduce the burden of cardiovascular disease. In this document, we make a distinction between a higher education level AP and a nursing-level professional. These are not officially recognized levels and with additional training, a nursing AP may reach the higher education level.
- Certification: the process of earning or providing an official recognition, as proof that the candidate has demonstrated sufficient knowledge and practical experience. EHRA certification is both proof of professional excellence to patients and a way for practitioners to enhance their present practice.
- CIED: devices that are designed for implantation in the human body for the study, diagnosis, prevention, or management of HR disorders. These include implantable loop recorders, PMs, ICDs devices for cardiac resynchronization therapy (CRT), devices for conduction system pacing (CSP), and non-transvenous ICDs (subcutaneous ICDs and extravascular ICDs). Proficiency in this discipline requires also a basic knowledge of invasive and non-invasive cardiac EP.
- EP: Invasive cardiac EP is the discipline that involves the study, diagnosis, treatment, and prevention of cardiac arrhythmias through recording electrical activity, stimulation, and the controlled creation of endocardial and epicardial lesions in the heart and its principal vessels through catheters applying thermal and non-thermal energy. These catheters are generally introduced by the percutaneous vascular route. Knowledge of the management of HR implantable devices, as one of the diverse diagnostic and therapeutic approaches for HR disorder management, is also required for proficiency in this specialty.
- ERTC: EHRA recognized training centre.
- ERTC referent: a member of the EHRA Certification Committee responsible for the ERTC recognition process.
- ESC: European Society of Cardiology.
- HR specialist: a cardiologist with specific knowledge, training, skills, and attitudes for the study, management, research, and teaching of HR disorders.
- Knowledge level: In the syllabus, each chapter or subchapter is assigned a knowledge level. The knowledge levels are adapted from Bloom's taxonomy[16] and are shown in *Table 1* and *Figure 1*.
- Logbook/portfolio: is a record of the trainee's practical experience.
- Multidisciplinary teams (MDTs): teams of different specialists from different disciplines to discuss a complex patient case.
- OSATS: OSATS are used to guide the teaching/learning process of skills. At each interim evaluation during the training programme, the programme director, after having consulted the training staff, assigns a certain independence level to each OSATS. *Table 2* and *Figure 1* define the five levels of entrustment or independence, starting from 'able to observe' (level 1) to 'able to perform the activity and supervise others' (level 5).
- Syllabus: a syllabus is a listing of subject matters with all the knowledge that should be covered in a training programme. The syllabus is composed for the candidate to check whether their knowledge is proficient for all subjects.

Table 1 Knowledge levels for each subject are adapted from Bloom's taxonomy[16]

1. Trainee remembers the subject
2. Trainee understands the subject
3. Trainee can apply the subject (to new contexts)
4. Trainee can analyse and evaluate the subject
5. Trainee can create new knowledge based on the subject

Definition of the knowledge levels derived from Bloom's taxonomy for all knowledge subjects mentioned in *Tables 3–5*.

Syllabus

For the 2024 EHRA core curriculum, we decided to keep a syllabus with all knowledge subjects. We chose not to combine knowledge, skills, and attitudes in entrustable professional activities as has been done in the ESC curriculum for the cardiologist.[17] While the syllabus is for the trainee to learn and for the trainers/teachers to teach, we introduced OSATS for technical skills and restricted the trainer/trainee assessment to these technical skills

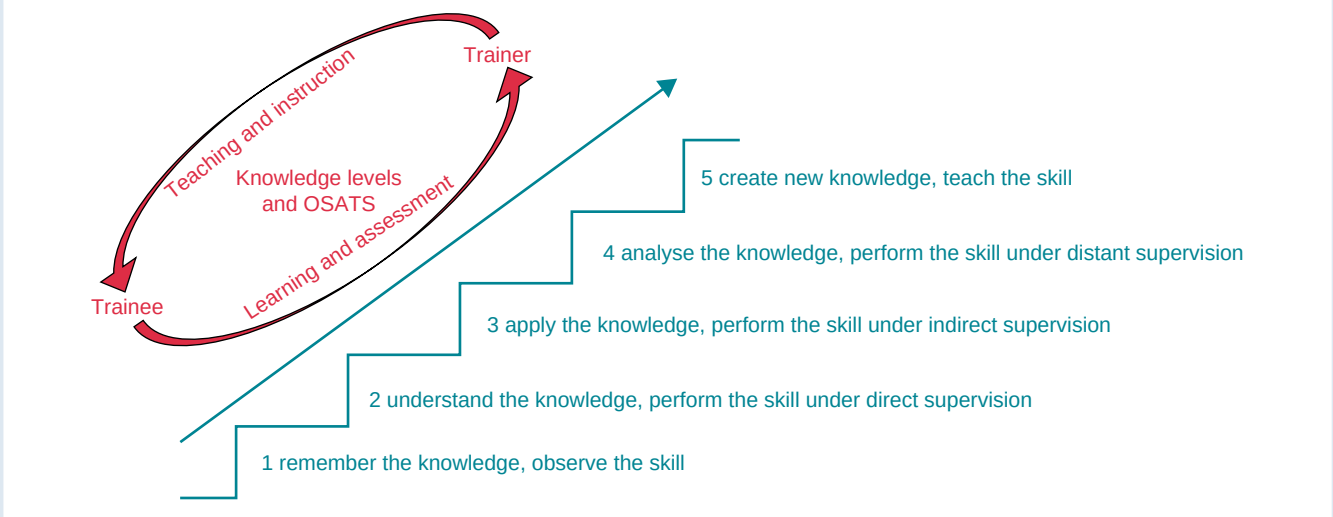

Figure 1 As trainees progress through their training, they acquire a greater level of autonomy. Simultaneously, trainers build confidence in the knowledge and skills of their trainees. This mutual process demands dedication from both parties. Trainers must commit to teaching and instructing and asses the knowledge and skills of trainees regularly to confirm that the trainees can be trusted to perform the professional activities at the expected level of independence. This figure is analogous to a similar figure in the ESC core curriculum.[17] ESC, European Society of Cardiology.

Table 2 Levels of independence

Level 1: Trainee is able to observe
Level 2: Trainee is able to perform the activity under direct supervision
proactive, close supervision, supervisor in the room
Level 3: Trainee is able to perform the activity under indirect supervision
reactive, on-demand supervision, trainee has to ask for help, supervisor readily available, within minutes
Level 4: Trainee is able to perform the activity under distant supervision
reactive supervision available remotely, e.g. within 10–20 min, on the phone or post-hoc
Level 5: Trainee is able to supervise others in performing the activity

Definition of the five levels of independence for a professional skill. These levels are used to assign independence levels for the technical skills mentioned in *Tables 6–8* and are identical to the ESC core curriculum for the cardiologist.[17]
ESC, European Society of Cardiology.

only. The justification for this is that the assessment of the knowledge subjects is performed during the EHRA exam and that trainer/trainee assessment of all knowledge subjects would make the assessment process too time consuming. The syllabus is divided into three parts: *Table 3* is for the HR specialist in general. Both trainees in CIED and in invasive EP should obtain the assigned knowledge levels for each subject. *Table 4* is specific for trainees in CIED and *Table 5* is specific for trainees in invasive EP. For each subject, a desired knowledge level is shown for the physician/higher education level AP and for the nursing-level AP. A graphical description of the growth in knowledge is shown in *Figure 1*.

Objective Structured Assessment of Technical Skills

As mentioned above, OSATS are reserved for skills and for training/trainee assessment. For each OSATS, the trainee starts at level 1 or 2 and grows to the desired independence level, as shown in *Tables 6* and *7* and *Figure 1*, now for physicians and for APs separately. At each assessment point, the trainer assigns an independence level to the trainee for each OSATS, after consulting the other training staff and the trainee. At the end of the training period, the trainee should have reached the desired independence level for all OSATS.

Table 3 Syllabus for all heart rhythm specialists

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
1. Normal and abnormal anatomy of the heart and the conduction system	4	3
2. Normal and abnormal general physiology and heart EP including ion channels, cellular EP, autonomous system influences, and the basic mechanisms of rhythm disorders, syncope, and sudden death	4	3
3. Basic EP principles (intervals, refractoriness, conduction velocity, block/gap)	4	3
4. Basic arrhythmia mechanisms (macro re-entry, micro re-entry, automatism, triggered activity)	4	3
5. Impulse formation and conduction within the heart (sinus node function, sinoatrial conduction, atrial conduction and refractoriness, AV nodal and His-Purkinje physiology, ventricular conduction and refractoriness)	4	3
6. Arrhythmic disorders (epidemiology, genetics, pathophysiology, ECG, clinical features and diagnosis, prognosis and risk evaluation, treatment, prevention):		
6.1. Sinus node and atrial impulse formation and their disorders	4	3
6.2. AV nodal and His-Purkinje conduction disorders	4	3
6.3. Atrial and thoracic vein ectopy and tachycardias	4	3
6.4. Typical atrial flutter	4	3
6.5. Atypical right and left atrial flutter/tachycardias	4	3
6.6. Atrial fibrillation	4	3
6.7. Junctional and AV node ectopy and tachycardias	4	3
6.8. Accessory pathway mediated tachycardias	4	3
6.9. Ventricular ectopy and tachycardias	4	3
6.10. Ventricular fibrillation	4	3
6.11. Autonomic disorders (carotid sinus hypersensitivity, reflex syncope)	4	3
7. Arrhythmogenic diseases and syndromes (epidemiology, genetics, pathophysiology, ECG, clinical features and diagnosis, prognosis and risk evaluation, treatment, prevention):		

Continued

Table 3 ***Continued***

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
7.1. Ischaemic or post-infarction myocardial dysfunction	4	3
7.2. Non-ischaemic cardiomyopathies:		
7.2.1. Dilated cardiomyopathy and hypokinetic non-dilated cardiomyopathy	4	3
7.2.2. Hypertrophic cardiomyopathy	4	3
7.2.3. Arrhythmogenic right ventricular cardiomyopathy	4	3
7.2.4. Left ventricular non-compaction	4	3
7.2.5. Restrictive cardiomyopathy	4	3
7.2.6. Neuromuscular cardiomyopathies	4	3
7.2.7. Valvular-related cardiomyopathies	4	3
7.2.8. Congenital diseases	4	3
7.2.9. Other	4	3
7.3. Primary electrical disease:		
7.3.1. Long QT syndrome (including acquired long QT syndrome)	4	3
7.3.2. Short QT syndrome	4	3
7.3.3. Brugada syndrome	4	3
7.3.4. Andersen–Tawil syndrome Type 1	4	3
7.3.5. Idiopathic ventricular fibrillation	4	3
7.3.6. Catecholaminergic polymorphic ventricular tachycardia	4	3
7.3.7. Early repolarization syndromes	4	3
7.3.8. Other	4	3
7.4. Inflammatory cardiac diseases	4	3
7.4.1. Acute and chronic myocarditis	4	3
7.4.2. Acute and chronic cardiac sarcoidosis	4	3
7.4.3. Chagas' cardiomyopathy	4	3
7.5. Other situations leading to rhythm disorders	4	3
8. Diagnostic procedures and techniques in heart rhythm disorders (rationale, materials and equipment, techniques and procedures, complications, result interpretation, indications and contraindications):		
8.1. Clinical evaluation (history and physical examination)	4	3
8.2. ECG:	4	3
8.2.1. Conventional 12-lead ECG	4	3
8.2.2. ECG monitoring (Holter, event monitoring, implantable event, e-health/ wearable devices, and loop monitoring)	4	3
8.2.3. Signal-averaged ECG	4	2
8.2.4. Body surface mapping	4	2
8.3. ECG-pharmacological tests:		
8.3.1. Type I drugs for His-Purkinje system challenge	4	2
8.3.2. Type I drugs for Brugada ECG unmasking	4	3
8.3.3. Atropine testing for cardioneuroablation	4	2
8.3.4. Adrenaline/atropine for sinus node dysfunction	4	2
8.3.5. Adenosine/ATP for sinus node and AV node dysfunction	4	2
8.3.6. Other	4	2
8.4. Exercise tests	4	3
8.5. General knowledge in imaging techniques: fluoroscopy, echocardiography (including transoesophageal and intracardiac), magnetic resonance imaging (MRI), computed tomography, nuclear imaging, angiograms	4	3
8.6. Autonomic nervous system evaluation:		

Continued

Table 3 *Continued*

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
8.6.1. Carotid sinus massage	4	3
8.6.2. Supine to orthostatism for orthostatic hypotension evaluation	4	3
8.6.3. Tilt testing	4	3
8.6.4. Other	4	3
8.7. Other	4	3
9. Therapies in heart rhythm disorders (rationale, material and equipment, techniques and procedures, side-effects and complications, results, indications and contraindications):		
9.1. Physical and autonomous system manoeuvres	4	3
9.2. Resuscitation and life support	4	4
9.3. Drugs with antiarrhythmic effects	4	3
9.4. Drugs for associated rhythm problems (anticoagulants, vasodilators)	4	3
9.5. Transient electrical stimulation:		
9.5.1. Transcutaneous	4	4
9.5.2. Intracardiac percutaneous	4	4
9.6. Cardioversion and defibrillation	4	4
9.7. General knowledge of cardiac and antiarrhythmic surgery	4	3
9.8. Other	4	3
10. Professional, legal, ethical, and socioeconomical aspects	4	3
11. Patient centred care		
11.1. Shared decision making and informed consent	4	4
11.2. End of patient life: discussions and advanced care planning	4	4
11.3. MRI, radiotherapy, and non-cardiac surgery in patients with CIEDs	4	4
11.4. Driving and legal considerations	4	3
11.5. Documentation, registries, audit and research, management of advisories and recalls	4	3

Syllabus with knowledge subjects for all heart rhythm specialists. These knowledge levels should be mastered by all heart rhythm specialists regardless of their specialization in CIED and/or invasive EP.
AP, allied professional; AV, atrio-ventricular; EP, electrophysiology; ECG, electrocardiography; CIED, cardiac implantable electronic devices.

Table 4 Syllabus for the CIED specialist

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
1. Historical perspectives of pacing and CIEDs and their nomenclature	4	2
2. Pathophysiology and classification of bradyarrhythmias		
2.1. Sinus node disease: sinus arrest, sinoatrial block, bradycardia-tachycardia syndrome, intrinsic and extrinsic causes, sleep apnoea	4	3
2.2. AV blocks: mechanisms, causes and risk assessment	4	3
2.3. Bundle branch and fascicular blocks	4	3
2.4. Reflex syncope and disorders of autonomic function	4	3
3. Pathophysiology and mechanisms of sudden death and ventricular arrhythmia	4	3
4. Evaluation of patients with suspected or documented bradycardia or conduction system disease		
4.1. History and physical examination	4	2

Continued

Table 4 ***Continued***

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
4.2. ECG	4	2
4.3. Non-invasive investigation (ambulatory ECG monitoring, exercise testing, head up tilt testing, imaging, laboratory and genetic tests)	4	2
4.4. Invasive evaluation: electrophysiological testing	4	2
4.5. Guidelines and indications for pacing	4	2
5. Heart failure and indications for CRT		
5.1. Pathophysiology of heart failure	4	2
5.2. Indications for CRT in heart failure	4	2
5.3. Mechanism of action of CRT, role of bundle-branck block and QRS duration	4	2
6. Evaluation of patients for ICD therapy		
6.1. History and physical examination	4	2
6.2. ECG and ambulatory monitoring	4	2
6.3. Non-invasive evaluation: imaging (echo, cardiac magnetic resonance, and advanced imaging techniques)	4	2
6.4. Invasive evaluation: electrophysiological testing	4	2
7. Evaluation of patients considered for CRT		
7.1. History and examination	4	2
7.2. ECG and imaging	4	2
7.3. Special considerations; CRT and defibrillator therapy, device upgrade	4	2
8. Indications for pacing in specific conditions		
8.1. Transcatheter aortic valve implantation and post-cardiac surgery, hypertrophic cardiomyopathy, acute myocardial infarction, rare diseases (long QT syndrome, neuromuscular, congenital heart block, mitochondrial diseases, lamin mutation), inflammatory conditions (sarcoidosis), post-CIED infection, postcongenital reparative surgeries	4	2
9. Types and modes of pacing/defibrillator therapies		
9.1. Endocardial pacing	4	2
9.2. Epicardial pacing	4	2
9.3. Conduction system pacing	4	2
9.4. Leadless pacing	4	2
9.5. Pacing mode and rate responsive pacing	4	2
10. ICDs		
10.1. Transvenous ICD systems	4	2
10.2. Subcutaneous and extravascular (non-transvenous) ICD systems	4	2
11. Pacemaker and ICD systems		
11.1. Pulse generator design and technology: batteries, capacitors, and electronic circuits	4	3
11.2. Ohms law, battery longevity	4	3
11.3. Pacemaker and ICD lead design and technology: structure and design of conductors, electrodes, and insulation	4	3
11.4. Sensing, capture threshold, impedance, timing cycles, and EGMs	4	4
11.5. Pacemaker programming: timing cycles, blanking and refractory periods, common algorithms, minimization of ventricular pacing strategies, pacemaker-mediated tacycardia (PMT) and Repetitive nonreentrant ventriculoatrial synchrony (RNRVAS)	4	4
11.6. ICD programming: detection, discriminators, anti-tachycardia pacing and defibrillation therapy, common algorithms, programming for primary and secondary prevention, special considerations (young patients, athletes)	4	4

Continued

Table 4 *Continued*

	Knowledge levels physician/ higher education level AP	Knowledge levels nursing-level AP
11.7. Troubleshooting: types and mechanisms of lead noise, impedance change, loss of capture, inappropriate modes switch, T-wave and P-wave oversensing	4	4
12. Follow-up		
12.1. Schedule, systematic pacemaker and ICD check, optimal programming, CRT optimization, medication review	4	4
12.2. Remote monitoring, benefits, limitations, alert based	4	4
13. Operating room considerations		
13.1. CIED implant team: roles, team brief, and safety checks	4	4
13.2. Sterility and minimizing risk of infection	4	4
13.3. Radiation safety	4	4
13.4. Surgical instruments, optimal OR design and essential equipment	4	4
14. CIED implant technique		
14.1. Preprocedural planning	4	3
14.2. Venous and cardiac anatomy, peripheral and central venous anatomy, CS anatomy and variations	4	3
14.3. Surgical techniques	4	2
14.4. Venous access techniques	4	2
14.5. Imaging for venous access	4	2
14.6. Lead implantation: techniques, choosing optimal implant site, fluoroscopic imaging (postero-anterior, right and left anterior oblique)	4	3
14.7. Options for dealing with difficult implants	4	2
14.8. Intraprocedural testing: sensing, capture threshold, impedance, slew rate, injury current	4	4
14.9. Defibrillation threshold and device programming	4	4
14.10. Anaesthesia, analgesia, and safe sedation	4	3
14.11. Managing acute complications	4	3
14.12. Special considerations for conduction system pacing, leadless pacemakers, subcutaneous and extravascular ICDs, and epicardial systems	4	3
15. Complications: identification and management		
15.1. Acute: bleeding/haematoma, pneumothorax, lead displacement, cardiac perforation, allergy/anaphylaxis, infection	4	3
15.2. Chronic: lead displacement, cardiac perforation, infection, exit block, lead failure	4	4
16. Special considerations to minimize complications		
16.1. Patient procedure selection to reduce lead complications	4	3
16.2. Perioperative considerations to minimize infection: antibiotic prophylaxis, draping, surgical technique, and operative environment	4	4
16.3. Perioperative management of anticoagulation	4	3
17. CIED extraction and lead management strategies		
17.1. Management of non-functioning and abandoned leads	3	2
17.2. Indications for extraction	3	2
17.3. Extraction team and operation room requirements	3	2
17.4. Risk assessment, patient selection, and pre-procedure preparation	3	2
17.5. Extraction tools: sheaths, stylets, and snares	3	3
17.6. Management of complications	4	3
17.7. Lead specific considerations: lead design implications, dual coil, coil backfilling, co-radial design	3	2

Syllabus with knowledge subjects for the CIED (cardiac implantable electronic device) specialist. These knowledge levels should be mastered by heart rhythm specialists specialized in CIED. Explanation of the knowledge levels is found in *Table 1*.
CIED, cardiac implantable electronic device; AP, allied professional; AV, atrio-ventricular; ECG, electrocardiography; EGM, electro-cardiogram; CRT, cardiac resynchronization therapy; ICD, implantable cardioverter defibrillator.

Table 5 Syllabus for the invasive cardiac electrophysiologist

	Knowledge levels for physician/ higher education level AP	Knowledge levels for nursing-level AP
1. EP laboratory equipment (fluoroscopy, catheters, sheaths, EP signal recording systems, navigation and mapping systems, programmed electrical stimulation systems)	4	4
2. Vascular access using ultrasound including vascular closing options	4	2
3. Cardiac access techniques: transoesophageal echocardiographic and intracardiac echographic and fluoroscopic guidance	4	2
4. Catheter placement techniques including guiding means (fluoroscopic or non-fluoroscopic, manual or remote navigation)	4	2
5. Angiography of cardiac chambers and vascular structures, such as the pulmonary veins	4	2
6. EP signals (bipolar/unipolar, filters and filter settings, voltage/timing/morphology)	4	3
7. Electroanatomical mapping and analysis of voltage, activation, and complex electrograms (decremental, late, fractionated, split)	4	3
8. Merging of electroanatomical maps with imaging techniques	4	3
9. Programmed electrical stimulation techniques (pulse width/amplitude, unipolar/ bipolar, continuous/extrastimulus stimulation, atrial/ventricular/other location stimulation, pacing algorithms) and pharmacological tests and modulation	4	3
10. Ablation energies and techniques including radiofrequency, cryo-energy, electroporation, laser energy with their catheters, common uses, indications and outcomes for each energy source	4	3
11. Ablation methods other than energy-based technologies (e.g. alcohol ablation of coronary arterial and venous system)	4	2
12. ECG and EP (cardiac activation, responses to electrical stimulation and to drug administration, EP diagnosis) of normal HR and electrical impulse conduction	4	3
13. ECG and EP (induction, cardiac activation, responses to electrical stimulation and to drug administration, cardiac activation, diagnosis) of the different types and variants of sinus and AV node and His-Purkinje impulse formation and conduction defects including sick sinus syndrome, AV block, intraventricular conduction blocks, and autonomous system mediated disorders (carotid sinus hypersensitivity, reflex syncope)	4	3
14. ECG and EP (induction, termination, electroanatomical mapping, responses to electrical stimulation and to drug administration, EP diagnosis and ablation) of the different types and variants of atrial arrhythmias:		
• Atrial ectopy	4	3
• Idiopathic atrial tachycardias	4	3
• Typical CTI-dependent atrial flutter	4	3
• Scar related atrial tachycardias and atrial flutters	4	3
• Atrial fibrillation: pulmonary vein isolation, linear ablation, ablation of fractionation	4	3
15. ECG and EP (induction, termination, electroanatomical mapping, responses to electrical stimulation and to drug administration, EP diagnosis and ablation) of the different types and variants of junctional arrhythmias:		
• junctional ectopy	4	3
• junctional accelerated rhythms		
• junctional tachycardias		
16. ECG and EP (induction, termination, electroanatomical mapping, responses to electrical stimulation and to drug administration, EP diagnosis and ablation) of the different types and variants of AV accessory pathways and pathway mediated arrhythmias including ectopy, escape and accelerated rhythms, and tachycardias	4	3

Continued

Table 5 *Continued*

	Knowledge levels for physician/ higher education level AP	Knowledge levels for nursing-level AP
17. ECG and EP (induction, termination, electroanatomical endocardial and epicardial mapping, responses to electrical stimulation and to drug administration, EP diagnosis and ablation) of the different types and variants of ventricular arrhythmias: • Idiopathic ventricular ectopy and tachycardias • Ischemic ventricular ectopy and tachycardias • Non-ischemic ventricular ectopy and tachycardias • Ventricular tachycardias in primary electrical diseases • Ventricular tachycardias in inflammatory cardiac diseases • Ventricular fibrillation	4	3
18. Complications and adverse effects of EP studies and ablation: pathophysiology, diagnosis, prevention, and management	4	3

Syllabus with knowledge subjects for the invasive EP (electrophysiology) specialist. These knowledge levels should be mastered by heart rhythm specialists specialized in invasive EP. Explanation of the knowledge levels is found in *Table 1*.
AP, allied professional; AV, atrio-ventricular; EP, electrophysiology; ECG, electrocardiography; HR, heart rhythm; CTI, cavo-tricuspid isthmus.

Table 6 OSATS for the CIED specialist

Core	Independence level physician	Independence level AP (excluding physical intervention)
1. Perform assessment of patient referred for CIED. Understand treatment options, indications, risks and benefits of CIED implantation and plan appropriate management	5	3
2. Safely use cardiac catheterization lab/operating room including role of team members, X-ray imaging equipment, surgical instruments, CIEDs, and associated implantation tools and safe sedation	5	5
3. Perform transvenous pacemaker implantation including indications and management of complications	4	3
4. Perform transvenous ICD implantation including indications and management of complications	4	3
5. Perform transvenous CRT implantation including indications and management of complications	4	3
6. Interrogate and programme pacemaker, ICD and CRT device in outpatient clinic and remotely	5	5
7. Safely troubleshoot CIED alerts including plan appropriate investigations and management	5	4
Optional		
8. Perform leadless pacemaker implantation including indications and management of complications	4	3
9. Perform non-transvenous ICD implantation including indications and management of complications	4	3
10. Perform CSP implantation including indications and management of complications	4	3
11. Perform CIED lead extraction including indications, risk assessment, operating room requirements, use of extraction equipment, and role of multidisciplinary team	4	3

OSATS (Objective Structured Assessment of Technical Skills) for the CIED (cardiac implantable electronic device) specialist. These independence levels should be obtained by heart rhythm specialists specialized in CIED. Physicians not performing physical interventions will only achieve independence in OSATS 1. Explanation of the independence levels is found in *Table 2*.
AP, allied professional; ICD, implantable cardioverter–defibrillators; CRT, cardiac resynchronization therapy; CSP, conduction system pacing.

Training centre and trainer requirements

Formal training in HR management should be carried out in a centre that is recognized and accredited as a sub-speciality HR training centre by an official organization such as the EHRA or a National Cardiac Society. Ideally the centre is also an ERTC. Training centres that are not ERTC recognized are encouraged to obtain this recognition. In addition, the criteria described in this paragraph are identical to the ERTC requirements.[18] The HR department should be incorporated within a cardiology department providing a full range of cardiac services and investigations including coronary intervention, cardiac imaging, heart failure, and cardiac surgery. The institution must be a training centre for general cardiologists and a recognized centre for performing a full range of arrhythmia and CIED-related procedures (according to national laws) for more than 3 years. Each centre must have access to at least one dedicated and fully equipped EP catheterization laboratory, it

Table 7 OSATS for the invasive electrophysiologist

	Independence level physician	Independence level AP
1. Manage a patient with a cardiac ion channel dysfunction	5	2
2. Use EP laboratory equipment including fluoroscopy, pacing, EP signal measurement, and mapping equipment including simple trouble shooting	5	5
3. Access the heart through venous and arterial access including echocardiographic guidance, placement of catheters, and angiography of cardiac chambers, arteries, and veins	5	2
4. Access the epicardium of the heart	3	1
5. Perform a diagnostic EP study including anatomy, indications, (differential) diagnosis and managing of complications	5	4 (excluding the physical intervention)
6. Perform an AV node ablation including anatomy, indications and managing of complications	5	4 (excluding the physical intervention)
7. Perform an AVNRT ablation including anatomy, indications and managing of complications	4	4 (excluding the physical intervention)
8. Perform an accessory pathway (concealed or manifest) ablation including anatomy, indications and managing of complications	4	4 (excluding the physical intervention)
9. Perform a cavo-tricuspid isthmus (CTI) ablation for typical atrial flutter including anatomy, indications, and managing of complications	5	4 (excluding the physical intervention)
10. Perform a non-CTI atrial tachycardia ablation—focal or re-entrant including anatomy, indications and managing of complications	3	3 (excluding the physical intervention)
11. Perform a pulmonary vein isolation including anatomy, indications and managing of complications	4	4 (excluding the physical intervention)
12. Perform an atrial fibrillation ablation beyond pulmonary vein isolation including several of the following options: lines, fragmented or high frequency electrograms, AF triggers, vein of Marshal ablation	3	3 (excluding the physical intervention)
13. Perform a VT/PVC ablation in normal hearts including anatomy, indications and managing of complications	3	3 (excluding the physical intervention)
14. Perform a VT/PVC ablation in structural heart disease including anatomy, indications and managing of complications	3	3 (excluding the physical intervention)

OSATS (Objective Structured Assessment of Technical Skills) for the invasive EP (electrophysiology) specialist. These independence levels should be obtained by heart rhythm specialists specialized in invasive EP. Explanation of the independence levels is found in *Table 2*.
AP, allied professional; AV, atrio-ventricular; AVNRT, atrio-ventricular reentry tachycardia; EP, electrophysiology; VT, ventrcular tachycardia; PVC, premature ventricular contraction.

must record EP and device procedural data, have a robust method for detecting, recording, and reviewing complications, and have an ongoing programme of clinical governance, audit, and MDT meetings for complex case discussion. The training centre must employ at least two fully trained, advisable HR specialists, who should have a minimum of five years of experience in EP and/or CIED and are EHRA members and should be actively involved in the field of HR management for at least 70% of the time (based on a fulltime employment). A centre training in CIED and/or EP should employ staff members for at least one fulltime equivalent with a valid level 2 EHRA certification for CIED and/or EP. The programme supervisor should be a fully trained HR specialist who has at least 5 years of experience in the field and is an EHRA member. In addition, the training programme staff should be active in clinical research related to the field of HR management. Nominated supervisors for trainees undertaking EHRA certification must undertake action to ensure the highest standard of training and verify that the completed logbook/portfolio is a true account of procedures undertaken and that the documented complications are accurate. It is recognized that increasing numbers of trainees will train as CIED specialists but may not train in EP. They may spend some of their time in centres that do not have full EP facilities as outlined above, however, at least 50% of their 2-year training programme should be in a fully equipped EP centre. We recommend full EP centres to associate with non-full EP centres to optimize training and patient care. Centres should foster a culture of high-quality patient centred care emphasizing patient safety, shared decision making, and providing patients with information regarding treatment options and the risk and benefits of each option sufficient to allow fully informed consent.

Clinical practice activities: procedures and numbers

The fully equipped training centre should perform PM, implantable cardioverter defibrillator (ICD), and CRT device implantation and replacement. In addition, all cardiac access routes should be available including venous, arterial, transseptal, and epicardial for invasive electrophysiological procedures, and the following catheter ablation procedures should be performed on a regular basis:

- Accessory pathway mediated tachycardias
- Atrio-Ventricular (AV) nodal re-entrant tachycardia/junctional tachycardia
- Ectopic atrial tachycardia
- Atrial flutter from the right and the left atrium
- Atrial fibrillation
- AV nodal ablation
- Ventricular tachycardia: idiopathic and in patients with structural heart disease, both endo- and epicardial.

The centre should enrol at least 2–4 training fellows in 4 years. The training centre should perform annually at least 250 invasive electrophysiological procedures of which at least 200 are catheter ablation procedures, 200 PM implantations/replacements, 60 ICDs implantations/replacements, and 40 CRT/CSP implantations. If a centre has multiple concurrent fellows, we recommend that the centre performs an adequate number of procedures to enable all fellows to fulfil the requirements to obtain level 2 EHRA certification within a 2-year period. If this is not the case, we recommend centres to associate with other centres performing these procedures and being able to perform part of the fellows' training. Ideally, the training centre should perform CSP, leadless PM implantation, non-transvenous ICD implantation, and either perform or have regular access to a CIED extraction programme.

Education, governance, and audit

The training centre should organize regular theoretical educational activities. These should aim to cover syllabus related topics, case reviews, and literature reviews in both EP and CIED. In addition, there should be a regular departmental programme of clinical governance, audit, and morbidity and mortality review. Regular clinical MDTs are recommended and close working relationships with colleagues from other subspecialties such as heart failure, inherited cardiac conditions and grown-up congenital heart disease, imaging, interventional radiology, and palliative care are encouraged. Trainees should attend at least 70% of these scheduled activities.

Research activities

A fully equipped training centre should seek to maintain an active research programme and trainees should be encouraged to submit research for presentation at HR congresses and accredited national and international meetings and peer reviewed journals.

Infrastructure and equipment

Training centres should be resourced with facilities that allow high-quality treatment using current approved technologies in line with EHRA and national guidelines.

These will include:

- EP laboratory equipment including fluoroscopy, EP signal recording systems, navigation and mapping systems, and programmed electrical stimulation systems.
- Cardiac catheterization lab or operating room with appropriate ventilation for CIED implantation and equipped with X-ray systems and protection that minimize patient and operator exposure. Operators should be trained in radiation protection according to national laws.
- Each EP or device laboratory should be equipped with full resuscitation equipment including the availability of pericardiocentesis. There should be clearly documented protocols for provision of emergency cardiac surgery.
- Facilities to provide a range of anaesthesia include conscious sedation, deep sedation, and general anaesthesia with clear protocols in place according to national guidance.
- Patient databases for EP and device procedures, complications, and outcomes.

Trainee and training programme requirements, training assessment, and certification process

Trainee requirements

In most countries, performing diagnoses on and treatment of patients is limited to physicians. As HR is a sub-speciality of cardiology, every HR specialist/physician should be medical doctor and possess a cardiology registration issued by a National Health Authority. Trainees should have completed general cardiology, in accordance with the ESC core curriculum[17] ideally including a common trunk of 2 years of internal medicine, prior to starting sub-speciality training. Although APs can obtain the theoretical knowledge to pass the higher education level AP exams, they can neither participate in the physician parts of the training programme nor obtain the EHRA level 2 certification for physicians.

Training programme requirements

Due to the extensive knowledge and manual skills that the HR specialist has to obtain to achieve certification, the training programme should last for at least 2 years, which corresponds to what has been set in the past.[2] For trainees working less than fulltime, the duration is extended pro rata. Because of the complexity of the subjects involved, we do not recommend to dedicate less than 80% of a standard working week to the training of the HR specialist. With this 80%, the training duration would be extended to 2.5 years.

The training programme should contain outpatient clinic, arrhythmia clinic, device follow-up, device implantations, and invasive EP. As a guide, we recommend 10% of the time dedicated to outpatient clinic, 10% to CIED follow-up, 40% to CIED implantations, and 40% to invasive EP. This dedication of the time should also depend on previous experience of the trainee and whether the trainee follows both the CIED and EP tracks or only one of them. If possible, also scientific research should be part of the training programme. In contrast to the previous edition of the core curriculum, we do not specify the percentages of the training period that have to be dedicated to each subject. This will depend on the local situation and on the capabilities of the trainee. Some trainees need more time to master a subject or to develop a practical skill. The programme should be flexible enough to individualize the training for each trainee.

It is important to note that there should be enough time for fellows to observe clinical cases and to learn practical skills. This is especially important for large training centres with many trainees. Ideally, there should be a 1:1 trainer–trainee ratio, such that in most of the cases a procedure is performed by a trainer with a single trainee attending.

Training assessment

The previous edition of the EHRA core curriculum contained a detailed month-to-month training plan. For the current version, we have removed these constraints. Learning pathways should be tailored to individual needs. Trainees sometimes work part-time or have other obligations in the general cardiology clinic or outpatient department. In addition, trainees have different learning styles. Therefore, we chose to concentrate the training assessment around the knowledge levels and OSATS. A graphical representation of the learning pathway is displayed in *Figure 2*.

Knowledge

Acquisition of knowledge is a prerequisite for training. In this core curriculum, required knowledge levels are mentioned in the syllabus. Trainers and trainees can use this syllabus to determine whether or not the trainee has obtained the required levels. In addition to continuous acquisition of knowledge during training, formal teaching is also important. Training centres should organize regular teaching sessions and group meetings to discuss complex cases. In addition, the new EHRA educational programme (level 1–3) is also an important part of the training. The training centre should facilitate each trainee's participation in the level 2 EHRA preparatory courses for the CIED and invasive EP exams. In addition, the

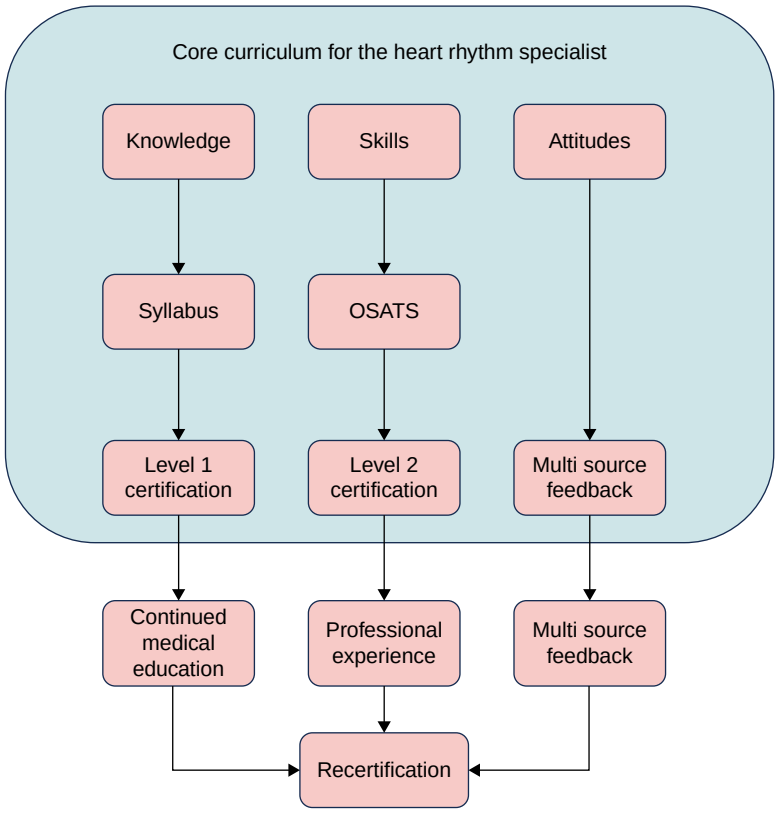

Figure 2 Learning pathway of the heart rhythm specialist acquiring knowledge skills and attitudes culmination in EHRA certification. Thereafter, the certified heart rhythm specialist maintains these skills through continued medical education, working in the field(s) of cardiac implantable electronic devices and/or EP, and receiving regular multi-source feedback from colleagues. EHRA, European Heart Rhythm Association; EP, electrophysiology.

trainee should follow as many EHRA level 2 on-site courses and online webinars as possible and take advantage of the online learning platform of EHRA.[19]

Skills

Required skills are described in the OSATS. Especially in the beginning of the training period, simulator-based training can be valuable to develop practical skills in a safe and efficient manner and is encouraged. Subsequently, when the trainee performs OSATS activities in patients, both trainees and trainers are encouraged to ask for or to perform an OSATS assessment after this activity that the trainer has observed or performed together with the trainee. An example of an OSATS assessment form is shown in *Table 8*. The primary responsibility for collecting these assessments lies with the trainee. When the trainee has collected enough assessments for a single OSATS at a certain independence level, the trainee can ask the head of the training programme to officially assign the OSATS level to the trainee. During the 2-year training period, the trainee should obtain the desired independence levels for all OSATS.

With the development of 'single-shot' devices for pulmonary vein isolation and the enormous increase in patient numbers, the idea may develop that these procedures may also be performed by general cardiologists or interventional cardiologists. We strongly advocate against this. Only a fully trained invasive electrophysiologist with sufficient knowledge and training is able to set the proper indication, change from one ablation approach to another if the situation changes, diagnose secondary arrhythmias and is able to manage recurrences, pro-arrhythmia, and complications. In line with this, the new EHRA educational pathway allows for a minimum of 2 years to obtain certification.

Table 8 OSATS assessment form

1. Name trainee:
2. Name trainer/supervisor:
3. Date:
4. OSATS name:
5. Feedback according to the Pendleton rules[20]:
   a. What went well according to the trainee:
   b. What went well according to the trainer:
   c. What could have gone better according to the trainee:
   d. What could have gone better according to the trainer:
   e. What are the learning objectives for the near future derived from the feedback:
6. Independence level attained from this assessment:

Example of an OSATS assessment form which can be used during a trainer/trainee interaction, i.e. after having performed the activity described in the OSATS. The trainee should collect several assessments for a single OSATS at a certain independence level before asking the head of the training programme to officially assign the OSATS level to the trainee.
OSATS, Objective Structured Assessment of Technical Skills.

Attitudes

Assessing the growth of trainees' attitudes and behaviours involves gathering input from various sources including multiple trainers' reports and structured feedback from MDT members. This feedback, organized by the training programme supervisor, offers valuable insights into essential skills such as communication, leadership, teamwork, and reliability, drawing from perspectives of both senior and junior medical professionals, nurses, administrative staff, and other clinical team members.[21,22] To ensure honesty and constructive criticism, supervisors must oversee the feedback process. Additionally, patient surveys conducted at the beginning and end of training may help to evaluate trainees' communication skills from the perspective of those they serve.

Finally, it has to be noted that all contemporary cardiologists have been trained in accordance with the ESC core curriculum with emphasis on all seven CanMEDS competencies or roles.[23] CanMEDS is a framework that identifies and describes the abilities physicians require to effectively meet the health care needs of the people they serve. These abilities are grouped thematically under seven roles: Medical Expert, Communicator, Collaborator, Leader, Health Advocate, Scholar, and Professional. A competent physician seamlessly integrates the competencies of all seven CanMEDS roles.[23] Therefore, we chose not to repeat these competencies in the EHRA core curriculum.

Certification process

The certification process has been extensively described in 2022.[3] In short, there is certification in CIED and EP both for physicians/higher education level APs and for nursing-level APs. Certification is a two-level process. Level 1 certification is based on a written examination. The examination consists of 130 questions, divided into 2 parts of 65 questions each. Each part is run over 3 h with a 1-h break in-between. Questions are designed to assess the candidate's knowledge:

- Based on a clinical scenario.
- Five options with only one single best answer.
- No negative marking.
- Questions are drawn from the entire spectrum of the subjects in *Tables 3–5*.

Each question is assigned a difficulty level by the members of the certification committee and the exam is composed of questions with different difficulty levels. The exam is delivered at least once a year, using an online proctoring platform. The passmark of the exam is established using the modified Angoff standard setting approach.[24] As this process is dependent on the knowledge level of the judges in the standard setting process, the standard setting subcommittees are formed from the more senior members of the EHRA certification committee and includes APs. The passing score links the score required to pass the exam to the minimum level of knowledge required for CIED practice. The statistical performance of each multiple-choice question (MCQ) is analysed and the 10 least discriminating MCQs are not taken into account. The candidate's final score is, therefore, derived from 120 MCQs.

Candidates who have successfully passed the level 1 certification exam can apply for the level 2 certification, documenting practical experience in the respective field by means of a logbook/portfolio. There is a level 2 certification for physicians and for APs. The level 2 certification for APs will be newly developed after the completion of this updated core curriculum. Level 2 certification recognizes the achievement of skills in OSATS independence levels (*Tables 6 and 7*) on top of the knowledge levels (*Tables 3–5*) tested in the certification exam. The development and certification of practical skills is important to physicians and APs alike.

Candidates for the physician certification will be asked to provide a copy of their medical diploma and cardiology registration issued by a National Health Authority. All candidates are required to submit letters of endorsement from a supervisor and their National Cardiac Society and a logbook with a prespecified set of performed cases (*Table 9*) as first operator. As the EHRA certification committee cannot judge the authenticity of the cases in the logbook, both the submitter and the endorsement letter of the supervisor should vouch for the correctness of the logbook. For the cases in the logbook for physicians, the definition of first operator is that the trainee has started the procedure with the mutual intention of trainer and trainee to perform the procedure independently. During the procedure, it may happen that the trainee needs help from the trainer. Cases included in the logbook must have been collected within a period of 36 consecutive months—these 36 months can be taken anytime from 2 years before up to 2 years after the exam date.

The documents submitted by the candidate are evaluated by a senior member of the EHRA certification committee. If all conditions are fulfilled, level 2 certification is assigned.

A note of caution is issued here: obtaining a level 2 certification means that the trainee is an independent HR specialist but their experience in complex procedures is still limited. We therefore recommend that the certified HR specialist performs complex procedures under the guidance of experienced more senior HR specialists in the years following the training period, to further broaden their knowledge and skills. In addition, not all operators will keep performing all procedures and many will choose to sub-specialize.

Table 9 Procedural requirements for CIED and EP specialists

CIED specialist—a list of 300 CIED procedures including at least	EP specialist—a list of 200 EP procedures including at least
70 transvenous device implantation procedures of which at least 25 ICDs	AVNRT—15
30 CRT/CSP implantation procedures	Accessory pathway (concealed or manifest)—15
200 device follow-up procedures of which at least 100 ICDs and 50 CRTs	Cavo-tricuspid isthmus (CTI) for typical atrial flutter—25
Optional procedures (above 300) for gaining competency in specific procedures:	Non-CTI atrial tachycardia—focal or re-entrant—10
• 10 leadless pacemaker implantations	AV node—ablation—5
• 10 non-transvenous ICD implantations	AF ablation—50, max 30 single shot
• 40 leads for CIED extractions	VT/PVC ablation in normal hearts—10
	VT/PVC ablation in structural heart disease—5

Minimum numbers of procedures required in the logbooks to obtain level 2 EHRA certification for CIED (cardiac implantable electronic devices) and invasive EP (electrophysiology). AVNRT, atrio-ventricular reentry tachycardia; ICD, implantable cardioverter–defibrillators; CRT, cardiac resynchronization therapy; CSP, conduction system pacing; EHRA, European Heart Rhythm Association; PVC, premature ventricular contractions; VT, ventricular tachycardia.

Recertification process

Recertification of physicians and allied professionals

Once the candidates have been certified, the certification is valid for 10 years after which the candidate must apply for recertification to keep the certification valid. Recertification can be obtained for both level 1 and level 2 certification. The recertification process consists of a checklist to validate continuing engagement in EHRA educational activities and attendance of the EHRA annual congresses.

Recertification criteria are listed below as:

- Letter of endorsement from the National Cardiac Society.
- Evidence of attendance of at least 2 EHRA congresses in the last 5 years.
- Proven participation in at least 5 EHRA webinars in the last 2 years.
- Evidence of Continued Medical Education in the field of arrhythmia or device therapy achieved by either:
    - participation in one of the EHRA preparatory courses for the exam in the last 2 years or
    - obtaining 13 Continuing medical education (CME) credits in the last 2 years from the EHRA educational content (level 2, ESC 365)[19] or
    - Active participation as speaker/contributor in EHRA educational activities (documents and/or courses and/or webinars).
- As an additional requirement for level 2 recertification, candidates must submit a letter of the head of the EP/cardiology department stating that the candidate has been working in CIED/EP for at least 50% of a full working week for the last 5 years and has performed at least 250 CIED/EP procedures in the last 5 years, depending on for which subject recertification is requested.

Candidates must apply for recertification from 1 year before to 1 year after the 10-year certification expiration date. Due to the late introduction of the recertification process while the first EHRA exam was already delivered in 2005, an exception to this rule is that candidates with a certification already expired for more than 6 months can apply for recertification until 2025. In exceptional circumstances, candidates may request an extension to submit their application. To ensure that the process remains fair and robust, extensions will generally only be given in the following circumstances: parental leave, less than fulltime work, or illness of the candidate. Extension requests must be accompanied by a signed letter from the candidate's supervisor briefly explaining the situation and stating the duration of the extension required. Requests cannot be considered without this letter. The request must be submitted before the deadline and the requests will be reviewed on a case-by-case basis by the certification committee. Eligible candidates will receive an automatic notification to start the recertification process. If all requirements of recertification are met, a certificate will be issued which will be valid for a further 10-year period.

Apart from the recertification requirements, we strongly advocate certified HR specialists to participate in continued medical education activities including, but not limited to, ESC/EHRA congresses, webinars, educational courses, and resources on ESC 365[19] as well as educational activities of the National Societies.

Renewal process of the EHRA recognized training centre quality label

An ERTC Quality Label is valid for 5 years from the date of acceptance. The renewal of a ERTC Quality Label is valid for an additional 5 years. Candidates must apply via the ERTC Quality Label dedicated webpage.[18] It is the responsibility of the centres to request their renewal. However, the ESC Accreditation Team sends a reminder to centres that have not requested their renewal more than 5 years after the previous recognition. A smartsheet form must be completed to start the renewal process.[25] The criteria are the same as for the initial accreditation. As experience from previous fellows is of utmost importance,[26,27] a survey is sent to a minimum of four fellows that have completed their training in the centre.[28] It is the responsibility of the centre to provide the names and contact details of the fellows and to ensure that at least four surveys are successfully completed. The ESC Accreditation Team checks the results of the surveys. When all feedback is positive or neutral, the ESC Accreditation Team validates the application with a 'PASS' decision without contacting the ERTC Referent. When one or more feedbacks are negative, the ESC Accreditation Team sends all feedbacks to the ERTC Referent in order to get her/his decision (CONDITIONAL REACCREDITATION or FAIL). In case of a 'FAIL' decision, the reason(s) must be explained to the centre. In case of a 'CONDITIONAL REACCREDITATION', the centre will be asked for a formal report on this condition(s) within 1 year form the decision date. This report must be signed by both the centre director and a current fellow on behalf of their colleague-fellows. It is mandatory to give essential information to the ESC Accreditation Team to understand that the condition(s) is/are actually met. The ERTC Referent will judge the report and make a 'PASS' or 'FAIL' decision. In case of a 'FAIL' decision, the centre can appeal against this decision with the chair of the EHRA certification committee.

After approval of the process and when the payment has been received, the ESC Accreditation Team informs the centre on the reaccreditation. Finally, the centre is updated on the ERTC webpage.

Future developments in certification and recertification

Although the writing committee took utmost care in adequately describing the certification, recertification, and ERTC recognition processes, the situation described is of 2024. In the years to come, insights may change, new procedures will be developed, and classic procedures may become obsolete. Therefore, candidates for certification, recertification, or ERTC recognition should always check the EHRA websites[4,18] for the most recent requirements.

Supplementary material

Supplementary material is available at *Europace* online.

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