UNION EUROPÉENNE DES MÉDECINS SPÉCIALISTES
EUROPEAN UNION OF MEDICAL SPECIALISTS
Association internationale sans but lucratif *International non-profit organisation*

RUE DE L'INDUSTRIE, 24
BE- 1040 BRUSSELS
www.uems.eu

T +32 2 649 51 64
F +32 2 640 37 30
info@uems.eu

UEMS 2020/12

Training Requirements for the Competency of Rare and Undiagnosed Diseases

European Standards of Postgraduate Medical Training

Preamble

The UEMS is a non-governmental organization representing national associations of medical specialists at the European level. With a current membership of 39 national associations and operating through 43 Specialist Sections and European Boards, the UEMS is committed to promote the free movement of medical specialists across Europe while ensuring the highest level of training that will pave the way to the improvement of quality of care for the benefit of all European citizens. The UEMS areas of expertise notably encompass Continuing Medical Education, Post Graduate Training and Quality Assurance. It is the UEMS' conviction that the quality of medical care and expertise is directly linked to the quality of training provided to the medical professionals. Therefore, the UEMS committed itself to contribute to the improvement of medical training at the European level through the development of European Standards in the different medical disciplines. No matter where doctors are trained, they should have at least the same core competencies.

In 1994, the UEMS adopted its Charter on Post Graduate Training aiming to provide the recommendations at the European level for good medical training. Made up of six chapters, this Charter set the basis for the European approach in the field of Post Graduate Training. With five chapters being common to all specialties, this Charter provided a sixth chapter, known as "Chapter 6", that each Specialist Section was to complete according to the specific needs of their discipline. More than a decade after the introduction of this Chapter, the UEMS Specialist Sections and European Boards have continued working on developing these European Standards in Medical training that reflect modern medical practice and current scientific findings. In doing so, the UEMS Specialist Sections and European Boards did not aim to supersede the National Authorities' competence in defining the content of postgraduate training in their own State, but rather to complement these and ensure that high quality training is provided across Europe.

At the European level, the legal mechanism ensuring the free movement of doctors through the recognition of their qualifications was established back in the 1970s by the European Union. Sectorial Directives were adopted and one Directive addressed specifically the issue of medical training at the European level. However, in 2005, the European Commission proposed to the European Parliament and Council to have a unique legal framework for the recognition of the Professional Qualifications to facilitate and improve the mobility of all workers throughout Europe. This Directive 2005/36/EC established the mechanism of automatic mutual recognition of qualifications for medical

doctors according to training requirements within all Member States; this is based on the length of training in the Competency and the title of qualification. Given the longstanding experience of UEMS Specialist Sections and European Boards on the one hand and the European legal framework enabling Medical Specialists and Trainees to move from one country to another on the other hand, the UEMS is uniquely positioned to provide competency-based recommendations. The UEMS values professional competence as "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served". While professional activity is regulated by national law in EU Member States, it is the UEMS understanding that it has to comply with international treaties and UN declarations on Human Rights as well as the WMA International Code of Medical Ethics.

This document derives from the previous Chapter 6 of the Training Chapter and provides definitions of specialist competencies and procedures as well as how to document and assess them. For the sake of transparency and coherence, it has been renamed as "Training Requirements for the Competency of Rare and Undiagnosed Diseases". This document aims to provide the basic Training Requirements for each competency and should be regularly updated by UEMS Specialist Sections, Multidisciplinary Joint Committees, or European Boards to reflect scientific and medical progress. The three-part structure of this document reflects the UEMS approach to have a coherent pragmatic document not only for medical specialists but also for decision-makers at the National and European levels interested in knowing more about medical specialist training. It is important to note that at the moment there is no such medical speciality recognized in the Annexe V. Therefore we use the term of "competency" instead of medical speciality, even if, hopefully, it will become an independent medical professional soon.

A "Rare Disorder" (rare disease, orphan disease) is defined according to the European standards as one having a prevalence of not more than five affected persons per 10.000. In different parts of the world, where consanguinity is accepted, different rare diseases can become frequent. Rare diseases can be of genetic origin, multifactorially determined or caused by environmental factors. Rare diseases can be part of different specialities ranging from genetics, through infections to different type of cancers. To date, 5.000-8.000 rare diseases are known, affecting 6-8% of the world population; 80% are of genetic origin while 20% are multifactorial. More than 50% affect children and 30% of them die before the age of 5. The number of rare diseases is increasing partly because of the intense development of genetic testing modalities and the new therapeutic modalities achievable. Rare diseases affect around 30 million EU citizens; they are recognised as a global public helath priority and an exemplar domain for precision public health. A special challenge is the undiagnosed group of rare diseases.

With the formation of the 24 thematic European Reference Networks (ERN) in March 2017, the need for Rare Disease Specialists became evident. ERN's are virtual networks involving healthcare providers across Europe. The aim of ERN's is to harmonize diagnostic strategies and perhaps in the future therapeutic approaches regarding rare diseases across the European Union. The need for rare disease specialists involves all speciality groups and Rare Disease Centers from all countries should have a minimum of 10 rare disease specialists. Whereas not all rare diseases are genetic conditions, the genetic departments are expected to feature prominently.

Aims and goals of Rare and Undiagnosed Disease Speciality training and assesment
(Further essential parts of the ETR are described in the supplementary "Description of the comptenecy" and "Syllabus"):

1. To construct a tool for training and qualification/certification system for service specialists whose goal is to assess, investigate, and diagnose diseases and medical conditions that are rare, having a prevalence of less than 1 in 2.000.
2. To create a system that provides specialist knowledge-based training information about rare and undiagnosed diseases, including recommendations for screening where appropriate.
3. To provide a service that offers education/knowledge base of counselling in relation to reproductive options and prenatal genetics in rare diseases.
4. The primary prevention of rare diseases of multifactorial or nongenetic origin, based on the knowledge and mitigation of risk factors related to medical treatments, maternal health, infections, diet, lifestyles, living environment and workplace
5. The primary and secondary prevention of rare hereditary diseases, according to: i) the choice made by those at risk of having affected offspring, based on full information and expert counselling; ii) effective programmes of newborn screening allowing early measures to prevent the onset of diseases
6. To contribute to the management of patients and families affected by rare diseases, in collaboration with other medical specialists, including treatment.
7. Knowledge on European Reference Networks (ERN), CPMS system essentials.
8. To be advocates, where necessary, for those affected by rare diseases. EURORDIS knowledge base.
9. To conduct and contribute to clinical and genomic research to enhance knowledge of the causation and natural history of rare diseases and conditions.
10. To teach and instruct medical undergraduates and postgraduates in rare and undiagnosed diseases, in order to raise the knowledge base across all medical specialties.
11. To provide a knowledge and skills resource to all medical specialties, including through multidisciplinary meetings.
12. Orphanet and orphacode knowledge base.
13. To provide a service in collaboration with clinical specialists, researchers and geneticists for diagnosis and description of a novel disorder.
14. The European Certificate in Rare and Undiagnosed Diseases is intended to be the main knowledge-based assessment tool for training and assessment across Europe, with the ultimate aim of establishing world class-leading standards in that competency throughout all countries.
15. The rare cancers are recognised under different specialties (Rare adult solid cancers, pediatric oncology, etc), some basics are still included in this competency field as well.
16. Special attention and care should be taken for expertise in the undiagnosed fields and disease management. Management of undiagnosed cases, recontacting, data sharing, participation in the existing and emerging networks.
17. Basics of communcable diseases, and selected parts of the rare diseases (including tropical), basics in bacteriology, virology, parasitology. Migration and its communicable diseases consequences.
18. Toxicology, applied pharmacotoxicology, teratology basics.
19. To facilitate connections between individuals affected with the same rare disorder or those with as yet undiagnosed diseases.
20. To contribute to the public awareness for rare diseases.

I. TRAINING REQUIREMENTS FOR TRAINEES

1. Content of training and learning outcome

The Rare and Undiagnosed Disease Competency is a field of medicine concerned with the investigation, diagnosis, treatment, prevention, and research into rare and undiagnosed diseases. The scope of patient care activities includes the recognition of these diseases, the early identification of individuals and families at risk, the identification of the possible underlying (genetic) defect and the preventive care of affected family members and identification of environmental, infectious, toxicological and/or diet/lifestyle-related risk factors to prevent diseases in population.

This competency training is aimed at giving doctors qualifications in the field of "Rare and Undiagnosed Diseases" to enable them to manage the treatment of patients with rare diseases and their families in light of current and expanding knowledge on the subject, with particular emphasis on understanding the molecular and cellular pathogenic mechanisms of such diseases, and their diagnosis and treatment. Rare disease specialists must also be able to coordinate the follow-up of patients affected by rare diseases.

Elements of knowledge base (see details in Description of Competency file and in Syllabus)

- *Basic theoretical genetics / Basic science*
- *Clinical/Medical knowledge and specialist-level skills*
- *Genetic counselling and communication skills*
- *Laboratory skills*
- *Maintaining Good Medical Practice*
- *IT skills*
- *Ethics and law*
- *Biobanking and registries*
- *Management training*
- *Teaching*
- *Quality assurance*
- *Research*

Competencies required to gain by the trainee

- sufficient knowledge and experience to manage a complex rare disease.
- shared knowledge of experts by having several specialists under one roof.
- able to undertake research in the particular rare disease and improve not only the care of one individual, but of other patients with the same condition.
- holistic vision of the patients.
- good communication skills.
- developing patient registries.
- coordinating patient routes and follow-up.

Knowledge, Technical and Non-technical skills are discussed under different headings in a formalized and more elabore Syllabus and again in the Curriculum.

2. Organization of training

a. Schedule of training

The optimal Rare Disease Competency (speciality) training is 5 years consisting of 1 year of common trunk and 3 years training in a Rare Disease Center in an accredited program and/or center and an optional extra year spent in another competency before, after, or as a part of the specialist training. The training of 3 years is also accepted, if the candidate has additional year(s) in research related to rare diseases. However, those countries that have a 3 year-course must arrange a preliminary general training, covering medicine and pediatrics if possible, before, and separate from, the 4 year specialist training. The specialist training is definied here as training in institutions involved in rare disease care. This includes training in the units with profiles of following medical specialties with rare disease outpatient clinic and/or ward: Allergology, Anaesthesiology, Cardiology, Cardiothoracic Surgery, Dermatology and Venereology, Emergency Medicine, Endocrinology, Gastroenterology, Geriatrics, Gynaecology and Obstetrics, Infectious Diseases, Internal Medicine, Laboratory Medicine / Medical Biopathology, Medical Genetics, Medical Microbiology, Medical Oncology, Nephrology, Neurology, Neurosurgery, Occupational Medicine, Ophthalmology, Oro-Maxillo-Facial Surgery, Orthopaedics, Traumatology, Otorhinolaryngology, Paediatrics, Pneumology, Psychiatry, Public Health Medicine, Radiology, Radiation Oncology and Radiotherapy, Rheumatology, Surgery, Urology. The key purpose of this is the acquisition of core clinical skills. Depending on national regulations, the training may start immediately after completion of medical school or as a sub-speciality qualification of 2 years built on Clinical/Medical/Human Genetics speciality. Trainees must maintain an accurate logbook of their training and rotations.

Optimal training would be:
- 1 years common medical trunk training including some of the following: general practice, pediatrics (including pediatrics neurology ward), internal medicine, emergency unit, and genetics.
- 3 years different competency oriented practice including the previously mentioned specialities.
- An option of one additional year spent in another competency before, after, or as a part of the specialist training. Since this is an option (not compulsory), it is technically not a requirement. Perhaps the 5th year could be rendered as an integral and required part of the Training programme. This is optional for those who have some other type of medical board qualification.

b. Curriculum of training

The general aim of the training program is to enable the Rare Disease Specialist to work effectively as a consultant. The trainee must demonstrate the ability to record and convey patient details of history, examination and investigation to senior staff. The trainee must communicate effectively with patients and relatives, and be able to pass on both technical information in a way that it can be received with understanding, and distressing information in a sensitive and caring manner. During the course of the training program classical methodologies will be applied. These include but are not limited to: lectures, seminars, bed side teaching, case reports, case scenario discussions, journal clubs, e-learning, webinars, computer assisted, self-instruction modules, problem-based learning, team-based learning, simulation etc.

c. Assessment and evaluation

The European Certificate in Rare and Undiagnosed Diseases (ECRUD) is intended to be the main knowledge-based assessment tool for training and assessment across Europe and ultimately for the entire continent's experts, with the aim of establishing world class-leading standards in that competency throughout all countries.

Countries will use assessment strategies appropriate to their needs, provided that they introduce their own training and assessment systems. In due course there will be a move to a common approach to determining whether an individual is suitable to be recognized as a 'European medical specialist with additional rare and undiagnosed diseases competence'. Thus, there will need to be an assessment of knowledge, through a form of written examination. This examination would use scenarios from an agreed list of core clinical conditions and test knowledge in the areas of relevant science and clinical practice (diagnosis, investigation, interpretation, prevention and treatment). This assessment may take the form a 'best of five' (multiple choice) format, but has yet to be decided. Oral exam can be part of the process as well. At the beginning it will be likely 100-150 MCQ but later on with the strict control of the CESMA further testing options will be considered.

Assessments will be formalized and will become obligatory over time. They will consist of Formative Assessments and a Summative Assessment, specifically, a competence-based logbook and an Exit Examination, respectively. For Formative Assessments an option would be formal documentation of trainee's development and progress after review of evidence collected. Summative assessments takes place after a specified training period with the purpose of deciding whether the trainee has reached a standard to proceed to the next level of training or to be awarded a certificate of Completion of Training.

Assessment of progress of education and training must include continuous assessment which tests whether the trainee has acquired the appropriate knowledge, skills, attitudes and professional qualities. This must include formal annual evaluations and final evaluations. The annual evaluation must formalize the assessment of a trainee's competence to promote the trainee's improvement. Final completion of a training program should be dependent upon review of the trainee's portfolio as well as success in the final examination. The Training program director must provide an overall judgment

about the trainee's competence and fitness to practice as an independent specialist in Rare and Undiagnosed Diseases. We propose the following Assessment Protocol:

First Part (Theoretical)
- 100-150 Questions Multiple Choice
- 10 Gross description & Reducing Tech and modalities

Second Part (Practical) based on virtual Pathology report
- 5 whole exome and 5 whole genome report
- 5 array interpretation
- 6 imaging (3 CT, 3 MRI result interpretation)

Pass rate will employ the Angoff method, which calculates a cut-off mark based on the performance of candidates in relation to a defined standard (absolute) as opposed to how they perform in relation to their peers (relative). It involves a judgement being made on exam items (test-centered) as opposed to exam candidates (examinee-centered).

d. Grades of Competence:

1. Knowledge
1.1. knows of
1.2. knows basic concepts
1.3. knows generally
1.4. knows specifically and broadly
2. Clinical Skills
2.1. Has observed – the trainee acts as an 'Assistant'. From complete novice through to being a competent assistant. At end of level 1 the trainee:
2.2. Has adequate knowledge of the steps through direct observation.
2.3. Demonstrates that he/she can handle the apparatus relevant to the procedure appropriately and safely.
2.4. Can perform some parts of the procedure with reasonable fluency
2.5. Can do with assistance - a trainee is able to carry out the procedure 'Directly Supervised'. From being able to carry out parts of the procedure under direct supervision, through to being able to complete the whole procedure under lesser degrees of direct supervision (e.g. trainer immediately available). At the end of level 2 the trainee
2.6. Knows all the steps - and the reasons that lie behind the methodology.
2.7. Can carry out a straightforward procedure fluently from start to finish
2.8. Knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).
2.9. Can do the whole procedure but may need assistance – a trainee is able to do the procedure 'indirectly supervised'. From being able to carry out the whole procedure under direct supervision (trainer immediately available) through to being able to carry out the whole procedure without direct supervision i.e. trainer available but not in direct contact with the trainee. At the end of level 3 the trainee
2.10. Can adapt to well-known variations in the procedure encountered, without direct input from

the trainer.

2.11. Recognizes and makes a correct assessment of common problems that are encountered.
2.12. Is able to deal with most of the common problems.
2.13. Knows and demonstrates when he/she needs help.
2.14. Requires advice rather than help that requires the trainer to intervene
2.15. Competent to do without assistance, including complications. The trainee can deal with the majority of procedures, problems and complications, but may need occasional help or advice.
2.16. Can be ***trusted*** to carry out the procedure, independently, without assistance or need for advice. This concept would constitute one Entrustable Professional Activity (EPA). An EPA is 'a critical part of professional work that can be identified as a unit to be entrusted to a trainee once sufficient competence has been reached'. This would indicate whether one could *trust* the individual to perform the job and not whether he is just competent to do it. At the end of level 5 the trainee:
2.17. Can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input to the level at which one would expect a consultant to function.
2.18. Is capable of instructing and supervising trainees.

3. Technical Skills

3.1. Has observed.
3.2. Can do with assistance.
3.3. Can do whole but may need assistance.
3.4. Competent to do without assistance, including complications, but may need advice or help.
3.5. **Can be *trusted* to carry out the procedure, independently, without assistance or need for advice (EPA).** EPAs have been explained previously.

The above detailed classification of Competence Levels could be useful during the process of formative training, when it comes to deciding when an applicant is eligible to sit an eventual Specialist Exit examination, it is the evaluation of the EPAs which is essential. In this sense, the Eligibility Assessment Process is really the first part of the Examination and that explains the suggestion that the '5th level of Technical Skills competence' should be included in a standardized Logbook Template for all trainees

e. List[1] of comprehensive Entrustable Professional Activities (EPAs)[2]

- Evaluate and manage a new medical condition in an ambulatory patient and coordinate care between healthcare providers across multiple care settings
- Manage the care of patients with rare cancers across multiple care settings
- Manage the care of patients with complex medical conditions, and/or comorbidities, across multiple

[1] Adopted with revisions from Karen. E. Hauer, Jeffrey Kohlwes, Patricia Cornett, Harry Hollander, Olle ten Cate, Sumant R. Ranji, Krishan Soni, William Iobst, and Patricia O'Sullivan (2013) Identifying Entrustable Professional Activities in Internal Medicine Training. Journal of Graduate Medical Education: March 2013, Vol. 5, No. 1, pp. 54-59 and the Alliance for Academic Internal Medicine. Internal Medicine End of training EPAs, 2012

[2] Definition: An EPA is 'a critical part of professional work that can be identified as a **unit** to be ***entrusted*** to a trainee once sufficient competence has been reached'. An EPA goes a level higher than the traditional 4th level of competence which is the 'independence competency'. The key factor is ***Entrustment.*** The trainee is not only capable of tackling the particular procedures or units independently, but he can be ***trusted*** to do this by his tutors.

care settings
- Manage transition of care for adult patients transferring to another care setting
- Manage transition of care for young patients transferring from pediatric to adult services
- Provide medical consultation to nonmedical specialties
- Lead a family meeting to discuss serious news (bad news, end of life care) with a patient and/or family and other health providers
- Obtain initial history, perform physical examination, and formulate a management plan for a new ambulatory patient in continuing care
- Manage the care of patients with chronic conditions across multiple care settings
- Access medical information to provide evidence-based care
- Facilitate the understanding of patients, their families, and members of the multidisciplinary team
- Recognize and diagnose common nonmedical conditions (i.e., surgical, neurological, dermatologic, psychiatric etc.) and refer appropriately to other specialty care
- Diagnose and comanage patients with complex conditions needing other specialty care (inpatient or outpatient)
- Organize and maintain information and knowledge through medical practice to improve personal development when delivering care and educating others (journal club, etc.)
- Recognize when palliative care is needed and liaise with palliative care specialists
- Counsel patients appropriately
- Advocate for individual patients by representing them, supporting them and working for them
- Improve patient safety
- Provide age appropriate screening and preventative care
- Identify and address any need for quality improvement in a clinical setting
- Improve the quality and safety of healthcare at both individual and systems levels
- Provide telephone management for an ambulatory rare disease patient
- Provide care to nonnative speakers in an inpatient or outpatient setting through the use of appropriate translation services
- Develop and implement a management plan based on review of outcome data for ambulatory patient population
- Provide inpatient and outpatient care for patients with difficulty in accessing appropriate healthcare; advocate for individual patients where needed
- Participate in an in-hospital cardiopulmonary resuscitation
- Perform common procedures in internal medicine (lumbar puncture, thoracocentesis, central line insertion, joint aspiration)
- Undertake a research project (e.g., a degree or diploma, quality improvement, educational opportunity, other)
- Develop the practice of lifelong learning
- Demonstrate professional behavior at all time

f. Logbook Recommendation:

Purpose: The purpose of the logbook is to document that the applicant has had direct and meaningful involvement in the rare disease evaluation, counseling and management of patients and/or families, and has received appropriate clinical supervision.
The EPA is a Unit and units can be counted. The certified Logbook with a category for EPA included is the key. Because the emphasis and attitudes regarding the spectrum of competences and education within any Medical Specialty vary significantly in the individual states, one cannot expect applicants to have attained EPA competency in each and every item listed in the Syllabus/Curriculum. In other words, one cannot expect Eligible Candidates to have attained must have attained 100% of the possible EPA Units in the Syllabus / Curriculum. The Eligibility Committee applies the correct degree of flexibility allowing for equivalence of some procedures. To give an example, the percentage of items in the

Syllabus to be expected of an applicant attaining the EPA grade of competence, for the EBSQ General Surgery, is presently set at 65%. This is an arbitrary figure which was reached by evaluating the previous year's candidates' data but will obviously vary with each particular Assessment and possibly from year to year. Another important legal point is that each Examination Board has to establish this threshold when the Exam Webpage goes online.

Requirements: Logbook of the 55 cases must be completed in accordance with the instructions provided in this summary, and anticipates ongoing review of cases between the trainee and their program director, the applicant should assure that all requirements have been fulfilled before submitting the final logbook for review.

Case Selection:
All cases must be obtained through accredited residency and/or training program.
Supervision for case encounters in genetics clinics must be provided by faculty who are certified
All 55 cases must be obtained during the inclusive dates of the applicant's training. No more than 2 cases may be obtained in any one day.
Each logbook entry must document a face-to-face interaction between the applicant and an individual patient and/or family.
A given patient or family may appear only once in an applicant's logbook, regardless of the number of encounters with that patient or family.

Description of Logbook Headings/Columns:
Entry Number: The logbook spreadsheet allows a trainee to enter an unlimited number of cases while in training. For the final logbook that may be requested for audit, you must select 100 cases to submit that fulfill all of the defined requirements. The applicant must be able to identify each case by its entry number if questions arise about a logbook entry
Date: The date in month/day/year [MM/DD/YYYY] format identifies when the patient was seen
Patient Age Category: For each case, the patient's age must be defined as Infant (5 cases), Child and Adolescent (20 cases), or Adult (25 cases) or Undiagnosed of any age (5 cases). Age refers to age of the patient on the date of the clinic visit.

Diagnosis:
No more than 5 cases may have the same specific diagnosis. Variations in genotype or phenotype of a specific diagnosis, such as age of onset or particular mutation, are not considered sufficient to count as separate diagnoses. It is the age at onset and not the age of diagnosis or the age at which the trainee saw the patient that should be taken into account in satisfying this requirement.
For each case, enter the diagnosis using the guidelines below:
Enter the diagnosis using the OMIM name or an ORPHACODE alternative title. All cases representing the same condition should be entered using the same diagnosis name.
Do not use abbreviations unless an OMIM/ORPHACODE alternative title.
Primary diagnosis must be listed first.
Use the most specific diagnosis for each case when known.
Log only those cases for which the diagnostic evaluation is complete. For example, "5p deletion syndrome" not "Rule out chromosome anomaly." If making a specific diagnosis was the reason for the referral, for example, is this Marfan syndrome?, use "Marfan syndrome" if the diagnostic evaluation is complete and this is the diagnosis or "Marfan syndrome, excluded" if the diagnostic evaluation is

complete and this diagnosis was excluded but a more specific diagnosis could not be made. If a more specific diagnosis could be made, such as Shprintzen-Goldberg syndrome, use the more specific diagnosis.
If more than one patient or family with the same genetic category, age category, diagnosis, visit date, trainee role(s), and supervisor are recorded, clearly indicate that entries are not duplicated records or members of the same family, as follows: Neurofibromatosis, patient or family 1; Neurofibromatosis, patient or family 2.

Continuous medical education (CME) and continuous professional development (CPD) to keep updated with developments in diagnosis and management of rare conditions as well as of global professional skills is an obligation of the accredited expert. Type, duration, content and monitoring of CME/CPD activity need to be established and will fall under the authority of boards that should consider the general recommendations of the UEMS. The UEMS provides European Accreditation of CME (EACCME) for international events according to defined quality standards. It is recommended that trainees in the rare disease field are introduced to CME/CPD during their postgraduate training period.

The ECRUD examination will be a joint development of the UEMS Multidisciplinary Joint Committee (UEMS-MJC RUD) and the sections, MJC-s, National Medical Associations, and of the European scientific societies, world networks, like the Undiagnosed Disease Network International (UDNI) intended to join in this effort. The examination is overseen and supervised by the Examination Steering Committee. It will be open to candidates who are trainees or fully trained experts from any nation. The ECRUD will definitely bean excellence exam, and will be valid for practice only in countries where it is ratified as an official certificate for this purpose by national regulatory bodies or organisations.

The combination of the formative and the summative assessment modalities will be used for assessing the status of the competences acquired. Formative in-training assessment will be incorporated throughout the training period and should include evaluation tools based on mini-clinical evaluation exercise, direct observation of clinical encounters, skills and procedures, classic SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) of procedures performed. Knowledge should be assessed with multiple choice questions (MCQ) during the training period. The final summative assessment is performed at predefined time points of the training period. – Like early during training e.g. after the first year, compulsory appraisal of the trainee is recommended in order to identify residents unfit for training, the CESMA will provide their help. After 3 years of training, ”part I” of the exam for the European Certification in Rare and Undiagoinsed Diseases (ECRUD) may be completed. - Towards the end of the training, national diploma or part II of ECRUD may be completed. Those colleagues, who do have their training completed, can proceed with the ECRUD directly. The details will be determined by the Examination Streering Committee, uder strong supervision of the CESMA. The UEMS CESMA endorses the ECRUD exams as a label of excellence for specialist practice, however., not as a working licence. ECRUD examination covers relevant basic sciences and clinical topics appropriate for a specialist. An increasing number of European countries will hopefully officially adopt the ECRUD as their national examination. The existence of a supra-national examination in the rare and undiagnosed diseases provides an incentive for the development and improvement of departmental, university, national and European training programs. ECRUD examination achieve a uniformly high standard of knowledge throughout Europe as judged by an independent Board of Examiners. The UEMS Council of European Specialist Medical Assessments (CESMA) have defined

recommendations on the development and organisation of assessment, selection and training of assessors.

Due to the current covid-19 virus outbreak pandemic, our lives and activities have been changed and are changing right now. We are facing a new situation on a global scale and we are reorganizing our work, many events have been canceled, postponed or re-organized in online format in order to keep everybody safe and collaborate all together to overcome this crisis. This also effects examinations worldwide. Taking this into consideration it is important for the future that we develop a system for doing the exam online and possible parts of the training as well, all according to UEMS CESMA guidelines.

Detailed description of: examination structure, manpower involved in construction and delivery, logistics, information provided to candidates and to examiners, conflicts of interest, procedure available for candidates to appeal, demographics of examiners and of candidates, language(s) in which the examination is conducted, proof of compliance with European legislation (e.g. GDPR).

g. Governance
Governance of each training program will be the responsibility of the Program or Course Director and the institution(s) in which the training program is being delivered. A trainer (who will have satisfied the requirements laid out below, Section II) will be responsible to the Program Director for delivering the required training in their area of practice. Naturally everything will be conducted under supervision of CESMA, EACCME and NASCE.

II. TRAINING REQUIREMENTS FOR TRAINERS

1. Process for recognition as trainer

a. Requested qualification and experience

Trainers/examiners should be certified rare disease specialists and must be recognized by a European or national authority. Trainers should provide evidence of academic activities (clinical and/or basic research, publications in peer reviewed journals and participations in clinical genetic scientific meetings) and professional experience. They should possess the necessary administrative, communicative, teaching and clinical skills and commitment to conduct the program. Trainers and Training Program Directors must be in active clinical practice and engaged in training in the training center. Training Program Director must be a certified specialist for a minimum of 5 years. They organize the activities of the educational program in all institutions that participate in the program.

b. Core competencies for trainers

1. Familiar with major and influential aspects of rare diseases.
2. Experienced in teaching and in supporting learners.
3. Trained in the principles and practice of medical education.
4. Act as a lecturer to a peer-audience on a regular basis, attend national meetings and be able to demonstrate appropriate participation in continuing professional development.

5. Able to recognize trainers whose professional behavior is unsatisfactory and initiate corrective and supportive measures as needed.

2. Quality management for trainers

Trainers and Program Directors will have their job description agreed with their employer, which will allow them sufficient time for support of trainees. Feedback from trainees is necessary for optimal training. The educational work of trainers and Program Directors will be appraised no less than an annual basis within their Institution as local circumstances determine.

III. TRAINING REQUIREMENTS FOR TRAINING INSTITUTIONS

1. Process for recognition as training center

a. Requirements for staff and clinical activities

A training center is a place, or number of places, where trainees are able to develop/acquire their competencies in rare diseases. Thus, training may take place in a single institution, or in a network of institutions working together, to provide training in the full spectrum of clinical conditions and skills detailed in the curriculum. A training institution must have national accreditation, in agreement with UEMS standards, and should possess an adequate infrastructure and offer qualitative and quantitative clinical exposure.

Each participating institution in a network must be individually recognized as a provider of a defined section of the curriculum. Training centers must have a sufficient throughput of patients, an appropriate case-mix to meet training objectives, and be adequately resourced with teaching staff. The training must expose the trainee to a broad range of clinical experience.

The training of a trainee will be led and managed by a specialist. This specialist will be active in the practice, with personal responsibility for the management of patients with a wide range of rare diseases. Within a training center there should be a team of specialists, each with subspecialty expertise and able to supervise and train a trainee. Allied specialties must be present to a sufficient extent to provide the trainee with the opportunity to develop his/her skills in a multidisciplinary approach to patient care. There is no specific trainee/trainer ratio required, but there should be a minimum of two teachers in a training center, and it is likely that non-medical healthcare professionals will also be engaged.

The trainee should be involved in the diagnosis and management process of new patients (out-patients and in-patients), as well as their follow up. A trainee must demonstrate increasing personal responsibility for the global care of patients with rare disorders. There should be written general guidelines within the training institution concerning patient care and patient information (including informed consent), referrals, medical records, documentation, on-call and back-up schedules, attendance at conferences and educational/training courses.

The staff of a training center should engage collaboratively in regular reviews and audit of the center's clinical activity and performance. There should be regular multi-disciplinary meetings to determine optimal care for patients, involving both medical and other healthcare professionals. There will be clinical engagement beyond the Center with other clinical groups such as Rehabilitation

Medicine, Orthopedics, Pediatrics, Surgery, Obstetrics and Gynecology, Dermatology, Ophthalmology, Psychiatry etc.

Specialist staff appointed to a training center will have completed all training requirements themselves and will have been trained also in teaching and mentoring trainee staff, and working in a multidisciplinary team with lab and genetic counsellors.

b. Requirements for equipment, accommodation

A training center should have sufficient equipment and support to enable the clinical practice that would be expected of a training center and thus provide the necessary educational opportunities for trainees.

The trainee must have adequate time and opportunities for practical and theoretical study and have access to adequate professional literature.

Computing and Information Technology and library resources must be available. All trainees must engage in clinical audits and have the opportunity to engage in research.

2. Quality Management within Training Institutions

Participation of the training institution in a certified quality management program with an external auditing process on a regular basis is consistent with good governance. Naturally everything will be conducted in accordance to CESMA, EACCME and NASCE guidelines. Criteria of quality management at competency training institutions include the following:

Accreditation

Training institutions need to be accredited with competent National Medical Boards. Additional accreditation on a supra-national level, such as that provided by an European body, is strongly recommended.

A training institution must have an internal system of medical audit or quality assurance. Quality assurance must be an integral part of the training program of all training institutions/networks. A national registry of approved institutions/networks should be available.

Internal regulations: There should be written general guidelines within the training institution concerning patient care and patient information (including informed consent), referrals, medical records, documentation, leave (annual, study), maternity/paternity, residents' working schedules, attendance at conferences and educational activities. These should be available to staff and trainees.

Clinical governance

Employee structure at training institutions needs to be designed in a way to accommodate for competency training. Workload has to be managed with a priority on training. The governance of the training program is primarily the responsibility of the Program Director and the institution(s) in which the training program taks are being delivered. A trainer will be responsible to the Program Director for delivering the required training in their area of practice and competency. Training requirements for trainers, and a Process for recognition as a trainer are expected. Trainers are expected to have achieved the appropriate nationally recognized and certified qualification to allow them to practice as a specialist/consultant.

Manpower planning

Training institutions should appoint a coordinator responsible for the composition, implementation and supervision of a competency training program. Roles of trainer and trainee need to be clearly defined. Allotted time of at least one day per workweek should be implemented for competency training interaction.

Manpower planning is under the jurisdiction of each member state according to their needs for rare disease specialists.

Regular report

Annual reports on various aspects of an institution's competency training program should be made publicly available.

External audit

Training institutions should appoint a coordinator who is also responsible for compliance of the training program with current guidelines, directives or regulations of competent medical boards, as well as the local medical school.

Transparency of training programs

Based on national and regional guidelines, UEMS strongly encourages training institutions to formulate defined training programs and make them publicly available (e.g., on their website). It is expected that a training center would publish details of the training provision available with details of the clinical service it provides and the trainers. Such information would include the training programs, the nature of the clinical or laboratory experiences in which a trainee would be engaged, and the support and interaction with the trainer and Program Director. There would be a named individual whom a prospective trainee might contact to discuss the program.

Feedback from trainers and trainees

Feedback about program quality from both trainers and trainees must be systematically sought, analyzed and acted upon. Trainers and trainees should be actively involved in using its results for program improvement and development.

UNION EUROPÉENNE DES MÉDECINS SPÉCIALISTES
EUROPEAN UNION OF MEDICAL SPECIALISTS

Association internationale sans but lucratif *International non-profit organisation*

RUE DE L'INDUSTRIE, 24
BE- 1040 BRUSSELS
www.uems.eu

T +32 2 649 51 64
F +32 2 640 37 30
info@uems.eu

UEMS 2020/12

Syllabus for residents and trainees in Rare and Undiagnosed Diseases

This a usual syllabus, an outlined summary of major and specific topics to be covered in a training course of a trainee. The goal of the syllabus is to ensure a fair and impartial working material as a connection between the instructor and the trainee. The syllabus is not a road map of the course, nor an organization/direction relaying the instructors' teaching policy to the trainees, so the syllabus is not a learning guide. Instead, the syllabus is a supporting reference material with priorities of training. However, it should be taken as a flexible material. It can differ between training institutions. Since the major pillars of the rare disease ETR rely primarily on internal medicine, neurology, pediatrics and medical genetics, it is strongly recommended to use the UEMS approved ETRs for these specialties as additional training material.

Domain 1: Basics

1.1 Rare disease terms, items, definitions

1.1.1 Rare disease definitions and rare disease basics in medical specialties
1.1.2 Causes of rare diseases
1.1.3 Rare disease clinical research networks
1.1.4 ORPHANET/ORPHACODE
1.1.5 EURODIS (Voice of rare disease patients)
1.1.6 National rare disease policies
1.1.7 International rare disease policies
1.1.8 Living with rare diseases
1.1.9 Rare disease helplines
1.1.10 Specialized social servers
1.1.11 Therapeutic recreational programs
1.1.12 Adapted housing and research centres

Domain 2: Clinical knowledge

2.1 Medical Records in Rare Diseases

2.1.1 Review medical records and identify information sources including databases and literature searches

2.2 Taking a detailed medical and family history and pedigree construction and interpretation

2.2.1 To analyse a clinical history in a relevant, succinct and logical manner
2.2.2 Use interpreters and advocates appropriately
2.2.3 Manages alternative and conflicting views from family, carers, friends and members of the multi-professional team
2.2.4 Assimilates history from the available information from patient and other sources including members of the multi-professional team
2.2.5 Recognises and interprets appropriately the use of nonverbal communication from patients and carers

2.3 Diagnosis, investigation and management of individuals with rare inherited diseases and their families

2.3.1 Examination
- 2.3.1.1 Perform a reliable and appropriate examination to elicit relevant signs of genetic disease
- 2.3.1.2 Perform examination appropriately in situations involving cultural sensitivity
- 2.3.1.3 Understand when additional specialist examination is required
- 2.3.1.4 Recognises the possibility of deliberate harm (both self-harm and harm by others) in vulnerable patients and report to appropriate agencies

2.3.2 Involvement of non-family members in process
- 2.3.2.1 Role of patient advocacy groups
- 2.3.2.2 Role of networks (scientific, patient oriented)

2.3.3 Diagnosis and Management
- 2.3.3.1 Present disease information to a patient in a sensitive and understanding manner
- 2.3.3.2 Use computerized genetic databases and registers for information retrieval
- 2.3.3.3 Present undiagnosed cases to colleagues, including dysmorphology club meetings
- 2.3.3.4 Clearly and openly explain management options
- 2.3.3.5 Record concisely, accurately, confidentially and legibly the appropriate elements of the history, examination, results of investigations, differential diagnosis and management plan

2.3.4 European Reference Networks (ERNs)
- 2.3.4.1 ERNs, structure, function, mission
- 2.3.4.2 CPMS as a diagnostic tool

2.3.5 Decision Making
- 2.3.5.1 Interpret clinical features, their reliability and relevance to clinical scenarios including recognition of the breadth of presentation of common disorders
- 2.3.5.2 Incorporates an understanding of the psychological and social elements of clinical scenarios into decision making
- 2.3.5.3 Construct a concise and applicable problem list using available information
- 2.3.5.4 Construct an appropriate management plan in conjunction with the patient, carers and other members of the clinical team and communicate this effectively to the patient, parents and carers securing their agreement to the course of action
- 2.3.5.5 Define the relevance of an estimated risk of a future event to an individual patient
- 2.3.5.6 Use risk calculators appropriately
- 2.3.5.7 Apply quantitative data of risks and benefits of screening and therapeutic intervention to an individual patient
- 2.3.5.8 Search and comprehend medical literature to guide reasoning
- 2.3.5.9 Generate hypothesis within context of clinical likelihood
- 2.3.5.10 Test, refine and verify hypotheses
- 2.3.5.11 Develop problem list and action plan

2.3.6 Ability to take samples for genetic analysis
- 2.3.6.1 Phlebotomy from adults and children, including those with special needs
- 2.3.6.2 Hair Root Extraction
- 2.3.6.3 Skin biopsy
- 2.3.6.4 Collection of other samples, such as buccal smears, urine samples, etc.

2.3.7 Clinical Photography
- 2.3.7.1 Demonstrate ability to take photographs of sufficient quality for clinical use
- 2.3.7.2 Use of digital photography and storage of data

2.4 Therapeutic aspects and emerging therapies of genetic diseases

2.4.1 Prescribe and oversee enzyme replacement therapies for applicable disorders, including lysosomal storage disorders within a multidisciplinary clinical team consensus

2.4.2 Prescribe other repurposed dugs to specific genetic condition (e.g., losartan) within a multidisciplinary clinical team consensus

2.4.3 Develop a management strategy, including preventative surgery, for men and women with hereditary cancer

2.5 Risk assessment and role in genetic testing

2.5.1 Calculate genetic risk in single gene disorders by hand

2.5.2 Calculate genetic risk by use of a computer programme

2.6 Paediatric genetics including training in Dysmorphology (knowledge of common dysmorphic syndromes, their aetiology and the use of dysmorphology databases) and investigation of learning and intellectual disability in children

2.6.1 Be able to take a relevant history, and perform an appropriate examination, obtain illustrative photographs

2.6.2 Have a rational approach to investigation of children with delayed development and/or dysmorphic syndromes

2.6.3 Formulate differential diagnoses of unknown syndromes. Utilise journals and databases used in syndrome identification

2.6.4 Cultivate critical assessment of database information and case reports to identify uncertainty and subjectivity in syndrome diagnosis

2.6.5 Be able to provide a diagnostic service within a multidisciplinary clinical team

2.6.6 Present and discuss cases with colleagues

2.7 Adult genetics to include knowledge of late onset disorders and disorders with a significant genetic component presenting in adult life (including predictive testing)

2.7.1 Be able to take a relevant history, perform an appropriate examination and formulate clinical diagnoses

2.7.2 Be able to assess patients and families affected by genetic conditions

2.7.3 Judge when it is necessary to sustain supportive relationships with patients with chronic disease

2.7.4 Be able to discuss reproductive options (AID, ICSI, IVF, pre- implantation diagnosis) with the patient and their partner in a sensitive manner

2.7.5 Be able to discuss and formulate integrated care pathways and management plans with individuals/families

2.7.6 Verify diagnoses from old hospital records

2.8 Prenatal Genetics and knowledge about effects of teratogens in foetal development

2.8.1 Interpret family history data

2.8.2 Provide genetic advice and organize testing for women who may undergo preimplantation or prenatal diagnosis

2.8.3 Formulate differential diagnoses and assess prognosis in collaboration with the foetal medicine team

2.8.4 Assess risk to foetus when pregnancies are exposed to hazards such as congenital infections, alcohol, ionising irradiation or drugs

2.8.5 Assess clinical significance of chromosome, DNA and foetal imaging in the context of foetal abnormality

2.8.6 Evaluate foetal post-mortem findings

2.8.7 Interpret the reports of non-invasive prenatal testing (NIPT)

2.9 Genetic screening programmes

2.9.1 Team-working with database managers, genetic associates and nurse specialists in:

2.9.1.1 'Cascade screening' and provision of genetic services for extended families with common single gene disorders (cystic fibrosis, Xp21 muscular dystrophy, fragile X syndrome, Huntington's disease)

2.9.1.2 Family based screening for individuals at high risk of developing cancer

2.9.1.3 Contribute to the maintenance of departmental genetic registry systems

2.9.1.4 Be able to explain the benefits and consequences of screening programmes

2.10 Examination of paediatric and adult patients, knowledge of dysmorphic signs, and main neurologic signs

2.10.1 Physical examination, body measurements and review of medical information

2.11 Gene therapy and its current and future applications

2.11.1 Be able to discuss the pros and cons of gene therapy in relation to a specific disorder and suggest clinical trials, if appropriate

2.12 Common diseases with a genetic component and oligo-/polygenic disorders

2.12.1 Distinguish between classical Mendelian and oligogenic inheritance and be able to calculate the appropriate recurrence risk

2.12.2 Be able to recognize and counsel patients with a strong genetic component

2.13 General knowledge base from UEMS specialities

Allergology
Anaesthesiology
Cardiology
Cardiothoracic Surgery
Connective Tissue Genetics
Dermatology and Venereology
Emergency Medicine
Endocrinology
Gastroenterology
Genetics of Craniofacial Anomalies and Ear Nose and Throat disorders
Genetics of Immunological and Auto-inflammatory Diseases
Geriatrics
Gynaecology and Obstetrics
Haematology
Hepatology
Hereditary metabolic disorders
Infectious Diseases
Internal Medicine
Laboratory Medicine / Medical Biopathology
Malformation, developmental anomalies and rare intellectual disabilities
Medical Genetics
Medical Microbiology
Medical Oncology
Multi-systemic vascular diseases
Nephrology
Neurogenetics
Neurology
Neurosurgery
Occupational Medicine
Oncology
Ophthalmology
Oro-Maxillo-Facial Surgery
Orthopaedics
Traumatology
Otorhinolaryngology
Paediatrics
Pneumology
Prenatal and Reproductive
Pulmonology
Psychiatry
Public Health Medicine
Radiology

Radiation Oncology and Radiotherapy
Rheumatology
Skeletal Disorders
Surgery
Urology/ Urogenital

2.14 List[1] of comprehensive Entrustable Professional Activities (EPAs)[2]

2.14.1 Evaluate and manage a new medical condition in an ambulatory patient and coordinate care between healthcare providers across multiple care settings
2.14.2 Manage the care of patients with rare medical conditions across multiple care settings
2.14.3 Manage the care of patients with complex medical conditions, and/or comorbidities, across multiple care settings
2.14.4 Manage transition of care for adult patients transferring to another care setting
2.14.5 Manage transition of care for young patients transferring from pediatric to adult services
2.14.6 Provide medical consultation to nonmedical specialties
2.14.7 Lead a family meeting to discuss serious news (bad news, end of life care) with a patient and/or family and other health providers
2.14.8 Obtain initial history, perform physical examination, and formulate a management plan for a new ambulatory patient in continuing care
2.14.9 Manage the care of patients with chronic conditions across multiple care settings
2.14.10 Access medical information to provide evidence-based care
2.14.11 Facilitate the understanding of patients, their families, and members of the multidisciplinary team
2.14.12 Recognize and diagnose common nonmedical conditions (i.e., surgical, neurological, dermatologic, psychiatric etc.) and refer appropriately to other specialty care
2.14.13 Diagnose and comanage patients with complex conditions needing other specialty care (inpatient or outpatient)
2.14.14 Organize and maintain information and knowledge through medical practice to improve personal development when delivering care and educating others (journal club, etc.)
2.14.15 Recognize when palliative care is needed and liaise with palliative care specialists
2.14.16 Counsel patients appropriately
2.14.17 Advocate for individual patients by representing them, supporting them and working for them
2.14.18 Improve patient safety
2.14.19 Provide age appropriate screening and preventative care
2.14.20 Identify and address any need for quality improvement in a clinical setting
2.14.21 Improve the quality and safety of healthcare at both individual and systems levels
2.14.22 Provide telephone management for an ambulatory rare disease patient
2.14.23 Provide care to nonnative speakers in an inpatient or outpatient setting through the use of appropriate translation services
2.14.24 Develop and implement a management plan based on review of outcome data for ambulatory patient population
2.14.25 Provide inpatient and outpatient care for patients with difficulty in accessing appropriate healthcare; advocate for individual patients where needed
2.14.26 Participate in an in-hospital cardiopulmonary resuscitation
2.14.27 Perform common procedures in internal medicine (lumbar puncture, thoracocentesis, central line insertion, joint aspiration)

[1] Adopted with revisions from Karen. E. Hauer, Jeffrey Kohlwes, Patricia Cornett, Harry Hollander, Olle ten Cate, Sumant R. Ranji, Krishan Soni, William Iobst, and Patricia O'Sullivan (2013) Identifying Entrustable Professional Activities in Internal Medicine Training. Journal of Graduate Medical Education: March 2013, Vol. 5, No. 1, pp. 54-59 and the Alliance for Academic Internal Medicine. Internal Medicine End of training EPAs, 2012

[2] Definition: An EPA is 'a critical part of professional work that can be identified as a **unit** to be ***entrusted*** to a trainee once sufficient competence has been reached'. An EPA goes a level higher than the traditional 4th level of competence which is the 'independence competency'. The key factor is ***Entrustment.*** The trainee is not only capable of tackling the particular procedures or units independently, but he can be ***trusted*** to do this by his tutors.

2.14.28 Undertake a research project (e.g., a degree or diploma, quality improvement, educational opportunity, other)
2.14.29 Develop the practice of lifelong learning
2.14.30 Demonstrate professional behavior at all time

Domain 3: Detailed and specific Topics

3.1 Detailed Topics

3.1.1 Applied pharmacology
- 3.1.1.1 Drug side effects
- 3.1.1.2 Pharmacovigilance activity
- 3.1.1.3 Pharmacogenomics in drug action
- 3.1.1.4 Pharmacotoxicology
- 3.1.1.5 Side effects, adverse effects

3.1.2 Cancer
- 3.1.2.1 Take a relevant history, perform an appropriate examination and undertake risk estimation using a variety of methods
- 3.1.2.2 Use of cancer registers and other sources to verify diagnoses
- 3.1.2.3 Use disease registers to support follow-up of affected and at-risk patients
- 3.1.2.4 Assessment of screening protocols for at-risk relatives
- 3.1.2.5 Identify at-risk patients and relatives who are eligible to participate in trials of cancer prevention strategies
- 3.1.2.6 Rare cancers; differences and similarities with rare diseases. Types (classification: Pediatric cancers, Hematologic rare neoplasms; Sarcomas; Rare thoracic cancers; Neuroendocrine tumors; Head & neck cancers; Central nervous system tumors; Rare female genital cancers; Rare urological and male genital tumors; Endocrine gland tumors; Digestive rare cancers; Rare skin cancers & non-cutaneous melanoma)

3.1.3 Cardiovascular diseases
- 3.1.3.1 Relevant history, perform an appropriate examination
- 3.1.3.2 Work with bereaved families following sudden adult death
- 3.1.3.3 Rare variants in common polygenic diseases
- 3.1.3.4 Assessment of screening protocols for at-risk relatives
- 3.1.3.5 Coordinate diagnostic and predictive genetic testing in ICC families
- 3.1.3.6 Identify at-risk patients/trios eligible to participate in prevention strategies (e.g., therapeutic trials)

3.1.4 Communicable diseases
- 3.1.4.1 Basics in microbiology
- 3.1.4.2 Rare infectious diseases
- 3.1.4.3 Travellers, migrants and their significance in the spread of communicable diseases
- 3.1.4.4 Diagnostic features

3.1.5 Connective tissue diseases
- 3.1.5.1 Conduct a physical examination appropriate for evaluation of an individual with a suspected connective tissue disorder, including appropriate body measurements (arm span, upper/lower segment ratios, Beighton score, arachnodactyly, hindfoot valgus, pes planus, pectoral abnormalities, etc.)
- 3.1.5.2 Formulate a differential diagnosis for a patient with joint laxity
- 3.1.5.3 Formulate a differential diagnosis for a patient with Marfanoid habitus
- 3.1.5.4 Formulate a differential diagnosis for a patient with aortic dilatation using family history, medical history, and physical examination
- 3.1.5.5 Apply diagnostic criteria to establish a diagnosis of Loeys-Dietz syndrome, including use of imaging (such as evidence of vascular tortuosity)
- 3.1.5.6 Establish the specific type of EDS based on diagnostic criteria
- 3.1.5.7 Apply clinical and laboratory criteria to establish a diagnosis of Stickler syndrome

3.1.6 Craniofacial Anomalies and Ear, Nose and Throat disorders
- 3.1.6.1 Differential diagnosis for craniofacial Anomalies and ear nose and throat disorders
- 3.1.6.2 Differential diagnosis in new-borns identified with congenital deafness either through new-borns screening or clinically
- 3.1.6.3 Interpret audiologic tests and distinguish different patterns of hearing impairment, including sensorineural and conductive
- 3.1.6.4 Management plan for a child or an adult with congenital or progressive hearing impairment

3.1.7 Dermatological Diseases
- 3.1.7.1 Formulate a differential diagnosis for a patient with an ichthyosiform disorder
- 3.1.7.2 Recognize the features of skin fragility and blistering associated with epidermolysis bullosa
- 3.1.7.3 Differential diagnosis for a patient with abnormal ectodermal structures (hair, teeth, nails, sweat glands)
- 3.1.7.4 Differential diagnosis for a patient with premature aging, photosensitivity, vascular lesions or multiple cutaneous neoplasms or hamartomas
- 3.1.7.5 Order appropriate genetic testing for suspected genodermatoses
- 3.1.7.6 Cutaneous features that are associated with multisystem disorders
- 3.1.7.7 Formulate a differential diagnosis for a patient with porphyria
- 3.1.7.8 Formulate a differential diagnosis for a patient with Morphoea
- 3.1.7.9 Formulate a differential diagnosis for a patient with Incontinentia pigmenti
- 3.1.7.10 Formulate a differential diagnosis for a patient with Ehlers-Danlos syndrome
- 3.1.7.11 Formulate a differential diagnosis for a patient with Cutis laxa
- 3.1.7.12 Formulate a differential diagnosis for a patient with Neurofibromatosis
- 3.1.7.13 Formulate a differential diagnosis for a patient with Tuberous sclerosis
- 3.1.7.14 Formulate a differential diagnosis for a patient with Autoinflammatory syndromes
- 3.1.7.15 Formulate a differential diagnosis for a patient with Dariers disease
- 3.1.7.16 Formulate a differential diagnosis for a patient with Hailey-Hailey disease
- 3.1.7.17 Formulate a differential diagnosis for a patient with Xeroderma pigments
- 3.1.7.18 Formulate a differential diagnosis for a patient with Pseudoxanthoma elastic
- 3.1.7.19 Formulate a differential diagnosis for a patient with Cutaneous paraneoplastic disorders
- 3.1.7.20 Formulate a differential diagnosis for a patient with Neurocutaneous melanosis and giant mealanocytic naevi

3.1.8 Diseases of malformation, developmental anomalies and rare intellectual disabilities
- 3.1.8.1 Determine if a congenital anomaly represents a malformation, deformation, disruption, or dysplasia
- 3.1.8.2 Difference between a syndrome, sequence, and association
- 3.1.8.3 Congenital anomalies in terms of dysfunction of normal development, both at the level of the embryo and at the level of cellular mechanisms of morphogenesis
- 3.1.8.4 Explain how foetal exposures/environment can adversely affect foetal growth and/or development
- 3.1.8.5 Explain how prenatal studies can facilitate diagnostic evaluation
- 3.1.8.6 Developmental milestones and growth parameters and recognize patterns of abnormal development
- 3.1.8.7 Differential diagnosis and testing strategy for a patient with one or more major anomalies
- 3.1.8.8 Specific patterns of dysmorphic features that allow for clinical diagnosis of recognizable genetic conditions
- 3.1.8.9 Differential diagnosis for a patient with hypotonia and dysmorphic features
- 3.1.8.10 Differential diagnosis for a patient with disordered growth
- 3.1.8.11 Differential diagnosis for a patient with autism and dysmorphic features
- 3.1.8.12 Apply diagnostic criteria to establish diagnosis of congenital anomaly syndromes

3.1.9 Endocrine diseases
- 3.1.9.1 Formulate a differential for a child with short stature
- 3.1.9.2 Evaluate a child with ambiguous genitalia, and formulate differential diagnosis
- 3.1.9.3 Recognize Albright's hereditary osteodystrophy
- 3.1.9.4 Counsel families with a child with 21-hydroxylase deficiency and adults with infertility, including Klinefelter syndrome, mosaic Turner syndrome, and androgen insensitivity syndrome.
- 3.1.9.5 Formulate a differential diagnosis for sex reversal
- 3.1.9.6 Counsel families with multiple endocrine neoplasia (MEN) I or II
- 3.1.9.7 Evaluate the child with thyroid abnormalities and hearing loss

3.1.10 Gastrointestinal diseases
- 3.1.10.1 A differential diagnosis for congenital anomalies such as intestinal aganglionosis, pyloric stenosis, intestinal malrotation, etc.
- 3.1.10.2 A differential diagnosis for patients with hereditary pancreatitis
- 3.1.10.3 Recognize the need for a cancer control plan for extra intestinal cancers in polyposis syndromes (e.g., breast cancer in Peutz-Jeghers syndrome)

3.1.11 Gynaecological and Obstetric Diseases
- 3.1.11.1 Stages of embryonic development and their relationship to teratogenic windows in the context of maternal teratogens such as alcohol, medications, or viral exposures
- 3.1.11.2 Range of normal variation in foetal ultrasound images, the associations of normal variants with and the limitations of ultrasound as a screening modality
- 3.1.11.3 Counsel and initiate the appropriate prenatal genetic tests when a structural malformation and/or growth abnormality is identified by foetal ultrasound

3.1.12 Hematological diseases
- 3.1.12.1 Fanconi anemia
- 3.1.12.2 Genetic causes of familial neutropenia syndromes (e.g., cyclic or severe congenital neutropenia, and Shwachman-Diamond syndrome), and disorders of neutrophil function (e.g., chronic granulomatous disease)
- 3.1.12.3 Differential diagnosis for genetic red cell membrane disorders such as hereditary spherocytosis
- 3.1.12.4 Diagnose and counsel patients with sickle cell trait, beta thalassemia trait, and the various forms of alpha thalassemia trait
- 3.1.12.5 Plan laboratory assessments for pregnant women with microcytic anemia
- 3.1.12.6 Counsel families with hemoglobinopathy

3.1.13 Hepatic diseases
- 3.1.13.1 Differential diagnosis for patients with biliary atresia or arteriohepatic dysplasia
- 3.1.13.2 Families with hepatic disorders

3.1.14 Immunological and auto-inflammatory diseases
- 3.1.14.1 A differential diagnosis for a child with severe combined immune deficiency
- 3.1.14.2 A differential diagnosis for a patient with hypogammaglobulinemia
- 3.1.14.3 A differential diagnosis for a patient with chronic granulomatous disease
- 3.1.14.4 Signs of hereditary angioedema
- 3.1.14.5 Diagnosis for an adult with auto-inflammatory disease

3.1.15 Inherited metabolic diseases
- 3.1.15.1 Family history data that suggest familial metabolic disease
- 3.1.15.2 Clinical signs in affected individuals
- 3.1.15.3 Be able to draw up a differential diagnosis and institute appropriate genetic testing
- 3.1.15.4 Assessment of symptoms and signs in patients at risk of metabolic disorders
- 3.1.15.5 Make timely, appropriate referrals to other specialists
- 3.1.15.6 Identify at-risk patients and relatives who are eligible to therapeutic and preventional strategies

3.1.16 Multi-systemic vascular diseases
- 3.1.16.1 Formulate a differential diagnosis for multi-systemic vascular diseases

3.1.17 Nephrological diseases
- 3.1.17.1 Provide genetic counselling for an individual who has or is at risk for infantile or adult polycystic kidney disease
- 3.1.17.2 Genetic aetiologies that contribute to nephrotic and renal tubular disorders
- 3.1.17.3 Differential diagnosis between Alport syndrome and other renal disorders
- 3.1.17.4 Apply diagnostic criteria to establish diagnosis of disorders including Bardet-Biedl syndrome, tuberous sclerosis complex, von Hippel-Lindau syndrome, Meckel syndrome, Zellweger syndrome

3.1.18 Neurodiseases and neuromuscular diseases
- 3.1.18.1 Recognise family history data that suggest familial neurological disease

3.1.18.2 Clinical signs in affected individuals
3.1.18.3 Differential diagnosis and institute appropriate genetic testing
3.1.18.4 Assessment of symptoms and signs in patients at risk of adult-onset neurogenetic disease
3.1.18.5 Application of protocols for pre-symptomatic diagnosis of Huntington's disease and other neurodegenerative disorders
3.1.18.6 Make timely, appropriate referrals to other specialists such as neurologists, psychologists, psychiatrists, speech therapists

3.1.19 Opthalmological disease
3.1.19.1 Differential diagnosis for a child with microphthalmia/ anophthalmia/ coloboma with or without a congenital anomaly of the central nervous system
3.1.19.2 Ocular from oculocutaneous albinism
3.1.19.3 Diagnostic criteria to establish the diagnosis of various genetic syndromes with supporting ophthalmologic features
3.1.19.4 Clinical trials in gene-replacement treatment strategies for childhood heritable retinal dystrophies

3.1.20 Psychiatric diseases
3.1.20.1 Genetic differential diagnosis based on DSM criteria
3.1.20.2 Disorders, including Huntington disease, metachromatic leukodystrophy, some forms of porphyria, and Wilson disease may present with psychiatric symptomatology before other symptoms.
3.1.20.3 Be able to diagnose, manage and counsel individuals with these disorders
3.1.20.4 Inborn errors of metabolism, particularly syndromes elevating ammonia levels, may be associated with altered behaviours that are symptomatic of acute decompensation
3.1.20.5 Knowledge of the features, consequences, and guidelines for management of foetal alcohol syndrome and foetal alcohol spectrum disorder (FASD)
3.1.20.6 Syndromic aetiologies based on presentation, including sex and age of onset of symptomatology
3.1.20.7 Cardinal features and implement management recommendations for microdeletion syndromes associated with behavioural psychopathology as a primary or major component
3.1.20.8 Poorly controlled metabolic disorders often have prominent psychiatric consequences

3.1.21 Pulmonary diseases
3.1.21.1 Differential diagnosis, for hereditary pulmonary emphysema
3.1.21.2 Differential diagnosis, for idiopathic pulmonary hypertension
3.1.21.3 Counsel patients with idiopathic pulmonary fibrosis
3.1.21.4 Counsel families with or at risk for cystic fibrosis
3.1.21.5 Counsel patients with alpha-1-antitrypsin deficiency

3.1.22 Reproductive system
3.1.22.1 Preconceptional genetic counselling to couples with sub-/infertility and organize genetic testing
3.1.22.2 Preconceptional genetic counselling to couples with genetic and inherited disorders for their reproductive choices including invasive diagnosis, non-invasive testing, and assisted reproductive technologies (ART)
3.1.22.3 Different ART options according to the national legislation and European guidelines including preimplantation genetic testing

3.1.23 Skeletal diseases
3.1.23.1 Differential diagnosis of a fetus suspected of having a skeletal dysplasia or dysostosis and assess whether the condition is compatible with postnatal survival
3.1.23.2 Differential diagnosis for a child with a congenital limb, axial, and/or craniofacial malformation, including teratogenic causes, syndromic causes, and skeletal dysostoses/dysplasias
3.1.23.3 Be able to evaluate radiographs and other imaging studies and know when to order further biochemical or molecular genetic tests, as well as which tests are appropriate for a given situation

3.1.24 Teratology
3.1.24.1 Historical perspective on teratology

3.1.24.2 Mechanisms of teratology
3.1.24.3 Epidemiology of congenital malformations
3.1.24.4 Types and classes of teratogens
3.1.24.5 Effects of teratogens (death, abortion, miscarriage, malformation, etc.)
3.1.24.6 Counselling for teratogen exposure
3.1.24.7 Genetic inbreeding

3.1.25 Toxicology
3.1.25.1 Reproductive toxicology
3.1.25.2 Basic toxicological principals
3.1.25.3 Organs in detoxification
3.1.25.4 Developmental toxicology
3.1.25.5 Toxic substances
3.1.25.6 Ionising radiation
3.1.25.7 Toxicology in society, environmental toxicology, food toxicology, clinical toxicology, risk assessment

3.1.26 Urogenital diseases
3.1.26.1 Differential diagnosis for a child with a congenital anomaly of the urogenital tract

Domain 4: Bioinformatics

4.1 Bioinformatics
4.1.1 Basic methods of medical statistics
4.1.2 Knowledge of the principles of Human Phenotype Ontology
4.1.3 Knowledge in the use of large data sets and "big data"
4.1.4 Array data analysis and interpretation
4.1.5 Next generation sequencing raw data, massive parallel sequencing file types
4.1.6 Next generation sequencing data analysis
4.1.7 Analysis of WCF files
4.1.8 Public sequence domains used for next generation sequence analysis

Domain 5: Rare disease and society

5.1 Rare disease and society
5.1.1 Families living with rare diseases
5.1.2 Patient advocacy groups
5.1.3 Patient advocacy networks (patient perspectives)
5.1.4 Medical education in patient families and advocacy groups
5.1.5 Awareness on healthcare policy and decision making
5.1.6 Specific legislation related to access and coverage for essential medical therapies, role in clinical trials
5.1.7 Genetic laws
5.1.8 ELSI in rare diseases
5.1.9 Rare Disease Day

Domain 6: Logbook Recommendations[3]

6.1 Logbook Recommendation:
6.1.1 Purpose: The purpose of the logbook is to document that the applicant has had direct and meaningful involvement in the rare disease evaluation, counseling and management of patients and/or families, and has received appropriate clinical supervision.
6.1.1.1 The EPA is a Unit and units can be counted. The certified Logbook with a category for EPA included is the key. Because the emphasis and attitudes regarding the spectrum of competences and education within any Medical Specialty, including Cardiology, vary significantly in the

[3] Based on the American Board of Medical Genetics "Certification in Clinical Genetics and Genomics Logbook Guidelines" http://www.abmgg.org/2019/2019%20Logbook%20Documents/2019%20Clinial%20genetics%20logbook%20FINAL.pdf

individual states, one cannot expect applicants to have attained EPA competency in each and every item listed in the Syllabus/Curriculum. In other words, one cannot expect Eligible Candidates to have attained must have attained 100% of the possible EPA Units in the Syllabus / Curriculum. The Eligibility Committee applies the correct degree of flexibility allowing for equivalence of some procedures. To give an example, the percentage of items in the Syllabus to be expected of an applicant attaining the EPA grade of competence, for the EBSQ General Surgery, is presently set at 65%. This is an arbitrary figure which was reached by evaluating the previous year's candidates' data, but will obviously vary with each particular Competency Assessment and possibly from year to year. Another important legal point, is that each Examination Board has to establish this threshold when the Exam Webpage goes online.

6.1.2 Requirements: Logbook of the 55 cases must be completed in accordance with the instructions provided in this summary, and anticipates ongoing review of cases between the trainee and their program director, the applicant should assure that all requirements have been fulfilled before submitting the final logbook for review.

6.1.3 Case Selection:

6.1.3.1 All cases must be obtained through accredited residency and/or training program.

6.1.3.2 Supervision for case encounters in genetics clinics must be provided by faculty who are certified.

6.1.3.3 All 55 cases must be obtained during the inclusive dates of the applicant's training. No more than 2 cases may be obtained in any one day.

6.1.3.4 Each logbook entry must document a face-to-face interaction between the applicant and an individual patient and/or family. Evaluation, management, or counseling performed via telephone or in group counseling sessions will not be accepted.

6.1.3.5 A given patient or family may appear only once in an applicant's logbook, regardless of the number of encounters with that patient or family.

6.1.4 Description of Logbook Headings/Columns:

6.1.4.1 Entry Number: The logbook spreadsheet allows a trainee to enter an unlimited number of cases while in training. For the final logbook that may be requested for audit, you must select 55 cases to submit that fulfill all of the defined requirements. The applicant must be able to identify each case by its entry number if questions arise about a logbook entry

6.1.4.2 Date: The date in month/day/year [MM/DD/YYYY] format identifies when the patient was seen

6.1.4.3 Patient Age Category: For each case, the patient's age must be defined as Infant (5 cases), Child and Adolescent (20 cases), or Adult (25 cases) or Undiagnosed of any age (5 cases). Age refers to age of the patient on the date of the clinic visit.

6.1.4.4 Diagnosis: **N**o more than 5 cases may have the same specific diagnosis. Variations in genotype or phenotype of a specific diagnosis, such as age of onset or particular mutation, are not considered sufficient to count as separate diagnoses. It is the age at onset and not the age of diagnosis or the age at which the trainee saw the patient that should be taken into account in satisfying this requirement.

For each case, enter the diagnosis using the guidelines below:

6.1.4.4.1 Enter the diagnosis using the OMIM name or an ORPHACODE alternative title. All cases representing the same condition should be entered using the same diagnosis name.

6.1.4.4.2 Do not use abbreviations unless an OMIM/ORPHACODE alternative title.

6.1.4.4.3 Primary diagnosis must be listed first.

6.1.4.4.4 Use the most specific diagnosis for each case when known.

6.1.4.4.5 Log only those cases for which the diagnostic evaluation is complete. For example, "5p deletion syndrome" not "Rule out chromosome anomaly." If making a specific diagnosis was the reason for the referral, for example, is this Marfan syndrome?, use "Marfan syndrome" if the diagnostic evaluation is complete and this is the diagnosis or "Marfan syndrome, excluded" if the diagnostic evaluation is complete and this diagnosis was excluded but a more specific diagnosis could not be made. If a more specific diagnosis could be made, such as Shprintzen-Goldberg syndrome, use the more specific diagnosis.

6.1.4.4.6 If more than one patient or family with the same genetic category, age category, diagnosis, visit date, trainee role(s), and supervisor are recorded, clearly indicate that entries are not duplicated records or members of the same family, as follows:

Neurofibromatosis, patient or family 1; Neurofibromatosis, patient or family 2.

6.2 Trainee's Role:

6.2.1 Medical history: involves obtaining pertinent medical information, such as pregnancy history, developmental milestones, and environmental exposures, by patient interview and review of medical records.

6.2.2 Pedigree: includes eliciting information for the construction of a pedigree that includes at a minimum all first and second-degree relatives using standard symbols.

6.2.3 Physical examinations: entails performing a complete physical examination or, if more appropriate, a targeted examination, to assess the system(s) of concern or to look for manifestations of a Mendelian condition in individuals who present for evaluation of a common complex disorder.

6.2.4 Management/Evaluation plan: involves determining recommendations for appropriate tests and/or assessments of medical or psychosocial care for a patient/family.

6.2.5 Testing options/results: includes explaining the technical and medical aspects of diagnostic and screening methods and reproductive options, including associated risks, benefits, and limitations, as well as interpreting and communicating testing results.

6.2.6 Risk assessment: entails performing pedigree analysis and evaluation of medical and laboratory data to determine recurrence/occurrence risks.

6.2.7 Inheritance/risk counseling: involves educating the patient or family about recurrence/occurrence risks and modes of inheritance of the disorder.

6.2.8 Discussion of diagnosis/natural history: includes conveying genetic medical information about the diagnosis, etiology, natural history, prognosis, and treatment/management of the disorder(s) in question.

6.2.9 Psychosocial support/counseling: involves providing short-term, patient or family- centered counseling, psychosocial support, and anticipatory guidance to the family, as well as addressing patient concerns.

6.2.10 Information access: includes literature review and database searches, as well as identification of resources for the patient or family and referring healthcare provider.

6.2.11 Documentation and follow-up: involves writing a consultation report or letter to the family or healthcare provider and recording adequate follow-up notes.

6.2.12 Undiagosed Case: Full description of what happened with the sequence analysis record of deposition of a network (ERN, UDNI, PhenomeCentral, CPMS.

6.3 **Supervisor:** Include the full name, degree(s), and type of certification of the supervisor who was present and was directly responsible for your activities regarding that case

Domain 7. Competencies

7.1 Knowledge
7.1.1 knows of
7.1.2 knows basic concepts
7.1.3 knows generally
7.1.4 knows specifically and broadly
7.2 Clinical Skills
7.2.1 Has observed – the trainee acts as an 'Assistant'. From complete novice through to being a competent assistant. At end of level 1 the trainee:
7.2.1.1 Has adequate knowledge of the steps through direct observation.
7.2.1.2 Demonstrates that he/she can handle the apparatus relevant to the procedure appropriately and safely.
7.2.1.3 Can perform some parts of the procedure with reasonable fluency
7.2.2 Can do with assistance - a trainee is able to carry out the procedure 'Directly Supervised'. From being able to carry out parts of the procedure under direct supervision, through to being able to complete the whole procedure under lesser degrees of direct supervision (e.g. trainer immediately available). At the end of level 2 the trainee
7.2.2.1 Knows all the steps - and the reasons that lie behind the methodology.
7.2.2.2 Can carry out a straightforward procedure fluently from start to finish
7.2.2.3 Knows and demonstrates when to call for assistance/advice from the supervisor (knows personal limitations).
7.2.3 Can do the whole procedure but may need assistance – a trainee is able to do the procedure 'indirectly supervised'. From being able to carry out the whole procedure under direct supervision (trainer immediately available) through to being able to carry out the whole procedure without direct supervision i.e. trainer available but not in direct contact with the trainee. At the end of level 3 the trainee

7.2.3.1 Can adapt to well-known variations in the procedure encountered, without direct input from the trainer.
7.2.3.2 Recognizes and makes a correct assessment of common problems that are encountered.
7.2.3.3 Is able to deal with most of the common problems.
7.2.3.4 Knows and demonstrates when he/she needs help.
7.2.3.5 Requires advice rather than help that requires the trainer to intervene
7.2.4 Competent to do without assistance, including complications. The trainee can deal with the majority of procedures, problems and complications, but may need occasional help or advice.
7.2.5 Can be ***trusted*** to carry out the procedure, independently, without assistance or need for advice. This concept would constitute one Entrustable Professional Activity (EPA). An EPA is 'a critical part of professional work that can be identified as a unit to be entrusted to a trainee once sufficient competence has been reached'. This would indicate whether one could *trust* the individual to perform the job and not whether he is just competent to do it. At the end of level 5 the trainee:
7.2.5.1 Can deal with straightforward and difficult cases to a satisfactory level and without the requirement for external input to the level at which one would expect a consultant to function.
7.2.5.2 Is capable of instructing and supervising trainees.
7.3 Technical Skills
7.3.1 Has observed.
7.3.2 Can do with assistance.
7.3.3 Can do whole but may need assistance.
7.3.4 Competent to do without assistance, including complications, but may need advice or help.
7.3.5 **Can be *trusted* to carry out the procedure, independently, without assistance or need for advice (EPA).** EPAs have been explained previously.

The above detailed classification of Competence Levels could be useful during the process of formative training, when it comes to deciding when an applicant is eligible to sit an eventual Specialist Exit examination, it is the evaluation of the EPAs which is essential. In this sense, the Eligibility Assessment Process is really the first part of the Examination and that explains the suggestion that the '5th level of Technical Skills competence' should be included in a standardized Logbook Template for all trainees

UNION EUROPÉENNE DES MÉDECINS SPÉCIALISTES
EUROPEAN UNION OF MEDICAL SPECIALISTS
Association internationale sans but lucratif *International non-profit organisation*
RUE DE L'INDUSTRIE, 24
BE- 1040 BRUSSELS
www.uems.eu
T +32 2 649 51 64
F +32 2 640 37 30
info@uems.eu

UEMS 2020/12

Description of "Rare and Undiagnosed Diseases" as a Medical Competency in EU: Aims and objectives in competency training

Competency Profile

Care of rare and undiagnosed disease patients is a multidisciplinary medical competency concerned with the provision of medical services to individuals, families and groups of affected individuals who have, or are at risk of having, conditions that are differentiated from common diseases primarily by their low incidence or prevalence. Such care includes diagnostic and counselling services that provide information about each condition and its implications, including management, prognosis, screening, prevention and reproductive options, as well as therapeutic possibilities. Information provided is based on clinical assessment, individual or family medical information, conventional laboratory investigations, imaging, and specialized genetic tests that can require complex interpretation. Besides conventional laboratory genetics (cytogenetics, molecular genetics, biochemical genetics), novel components of the services include specialized genetic and genomic approaches such as next generation sequencing and array technologies. The genetic studies include integrated clinical and laboratory services in rare disease management involving any disorder with a significant genetic component, whether inherited or sporadic.

Dedicated institutions already exist in several EU recognized medical specialties, with full medical career training systems. However, while there may be institutions or units that specialize in one or a few types of rare disease, institutions devoted exclusively to rare and undiagnosed diseases are scarce or lacking. As internal medicine, neurology, medical genetics and paediatric units often receive rare disease cases, these units could be re-organized into spokes of hub-and-spoke networks for rare diseases, which could improve care and provide career training specifically focused on rare diseases. Such full-range training is lacking at the moment. The existing educational pathways should be modified to provide education on rare diseases with a multidisciplinary perspective. They should be flexible enough to accommodate

educational needs that cover a spectrum of knowledge bases, including those that address all rare diseases and those that target only a limited number of rare conditions. These educational pathways could be provided in collaboration with the ERNs, and by the European university system. They should include courses on rare diseases, based on a broadly agreed-upon syllabus, and clinical fellowships on selected rare diseases. There should be an examination, with a certification of competence. All this could give rise to an integrated system that will produce experts on rare and undiagnosed diseases, who will ultimately become professionals with dedicated careers at the centres of hub-and-spoke networks. Due to the differences in European health care systems across member states, there may be different national emphases on the various elements of this training programme. We propose below a set of minimum criteria that will be recognized in programmes throughout the EU but

This document relates to training programs which is for qualified individuals intending to acquire UEMS CESMA certification and training in the competency of rare diseases. The individual obtains his/her certification (European Board Qualification – EBQ) through an Assessment run by the respective Board. Any such Assessment by the Board, itself needs a formal Visitation and Appraisal by UEMS-CESMA, every 5 years. A positive result from the Appraisal leads to Certification of the particular Competency Assessment. It recognizes that there may be areas of overlap with training programmes for other genetic professionals, especially in internal medicine, paediatrics, medical genetics, and neurology and that there may be opportunities for joint training for periods of the course.

One challenge for medical education in rare diseases, which differentiates it from common diseases (including genetic diseases), is that the rare disease discipline lacks reinforcement of recently acquired information due to the small patient numbers. When a physician attends an educational event on a common disease, there will likely be encounters with patients having that disease soon and often. The same does not apply when a disease is rare. The framework of any educational initiative in rare diseases must take into account this challenge.

Entry criteria

These may vary from country to country but would generally include a specified period of general medical training that includes an adult +/- paediatric +/- prenatal medicine "internship", prior to entering competency training in rare disease units. Some countries may have a minimum period of training to be undertaken before specialisation. Essentially, the duration of the training is 4 years, with a year of common trunk.

Educational goals

A concise description is provided below, with more details available in the Syllabus. This knowledge base lists the hallmarks of a trained medical doctor ready for qualification for the umbrella exam (certification) in rare diseases.

Knowledge and Skills

Fundamentals of rare disease genetics

- Cellular and molecular mechanisms that underpin human inheritance
- Chromosome structure and function, mitosis and meiosis, and the origin of aneuploidy and other imbalances
- The structure of DNA and RNA, replication, transcription and translation.
- Genetic epidemiology and biostatistics
- Risk assessment
- Population genetics, the principles of screening, and basic mathematical genetics
- Bioinformatics and basics of sequencing technology/testing
- Epigenetics
- Pharmacogenetics / pharmacogenomics
- Principles of acquired genetic disorders

Clinical understanding

- Common and unusual patterns of inheritance
- Taking a detailed medical and family history, pedigree construction
- Ability to perform genetic risk assessment, including the use of Bayes' Theorem to incorporate conditional risk information
- Ability to undertake risk assessment
- Diagnosis, investigation and management of individuals and their families with rare inherited/genetic diseases
- Therapeutic aspects and emerging innovative therapies in rare diseases
- Paediatric genetics including training in dysmorphology (knowledge of common dysmorphic syndromes, their aetiology and the use of dysmorphology databases)
- Adult rare disorders, including knowledge of late onset diseases and conditions with a significant genetic component presenting in adult life
- Prenatal rare diseases paradigms, fetal dysmorphology, and knowledge of the effects of common teratogens on fetal development
- Screening programmes
- Competent clinical examination of both paediatric and adult patients, especially in relation to dysmorphic signs and features, and neurological examination and interpretation
- Gene therapy, its current and future applications, and other strategies for the treatment of genetic disease.
- Common diseases with a rare component/variant

- Multifactorial/polygenic disorders in rare disease fields
- Sub-specialty areas, including:
  - Inherited metabolic disorders
  - Neurogenetic diseases
  - Neuromuscular rare diseases
  - Cardiovascular genetics
  - Reproductive genetics
  - Other subspecialties of specific interest to the trainee, e.g., connective tissue disorders, immunology, etc.

Technical skills:

Laboratory skills

- Thorough knowledge of principles of classic laboratory techniques used in genetic diagnostic testing
- Thorough knowledge of new laboratory techniques used in genetic diagnostic testing, including SNP and CGH arrays, whole genome sequencing and exome sequencing
- Understanding the interpretation of results from cytogenetic, molecular genetic, biochemical genetic and genomic analyses (array, exome and whole genome analyses)
- Knowledge about preanalytical handling of samples and logistics
- Awareness of quality issues in genetic testing
- Knowledge of international nomenclature systems used in genetic reporting
- The time spent and the practical expertise gained in laboratory work may vary among countries, but it should be sufficient to ensure highly specialized knowledge.

Biobanking

- Understand principles of biobanking
- Awareness of ELSI issues

IT

- Use of information technology including online resources and databases related to human genetics
- Rare diseases codification and ontologies
- Awareness and use of online data sharing resources

Non-technical skills:

Genetic counselling and communication skills

- Training in genetic counselling for all types of genetic diseases and genetics-related situations encountered in practice. This includes pre- and post-testing counselling in relation to reproductive options, including predictive genetic testing. Where applicable, training in co-counselling with other professionals, with specialists in other fields of medicine

- Understanding and handling of emotional reactions and personal and family crises in relation to the impact of genetic disease and the genetic diagnostic process
- Understanding ethical, legal and social issues, and the importance of consent and confidentiality
- Development of good communication skills with patients and families, colleagues in medical care centres and other specialists and healthcare professionals
- Understand ethical, legal and social issues in relation to genetic and genomic medicine
- Issues relating to patient confidentiality, consent and disclosure of results.

Management

- Knowledge of national laws relating to genetic services and practice, general healthcare policy, goals and priorities
- Understanding the organization and management of genetic services
- Opportunities to participate in departmental/service activities related to organizational planning, financial management, and monitoring and maintaining quality standards
- Development of multidisciplinary team operations and leadership skills

Teaching

- Develop teaching skills by participating in the education and training of various categories of staff
- Involvement with patient groups and patient/family education

Maintaining good medical practice

- Understand and practice medical professionalism, honesty, integrity, an aspiration to excellence, fairness, and avoidance of discrimination
- Develop a commitment to lifelong learning through continuing professional development and attend relevant courses and conferences.
- Participate in audit and clinical governance
- Adhere to accepted consent and confidentiality procedures
- Timely management of medical documentation and communication with patients, families, and professionals

Supplementary education and training

- Subcompetency training: Some trainees will elect to develop expertise in a subcompetency area such as cancer genetics, dysmorphology, neurogenetics, etc. This may also vary from country to country.
- Knowledge and understanding of the principles of evidence-based medicine
- Involvement and initiatives in courses, programmes and social issues related to rare diseases
- Knowledge of patient registries, patient support organisations

Technicals

- A written agreed curriculum for the training period should be set up as a contract between the trainee and the supervisor if not otherwise determined by national regulations, this must be within the frame of UEMS ETR scope of harmonization and standardization.
- Trainees should maintain a Training Logbook including details of clinical and laboratory experience, all educational activities, research, and publications
- A mechanism should be in place for continuous assessment of trainees against agreed quality standards; some countries will have a nationally prescribed system for assessment and certification
- Specialist examination may be compulsory in some countries

Research

- Medical genomics has a rapidly changing knowledge base and during competency training participation in research should be encouraged. Some trainees may wish to participate in scientific projects and research leading to a higher academic degree. On completion of training, some academic clinical/medical geneticists will continue to lead research programmes whilst many others will collaborate with laboratory-based colleagues within a broader team.
- Understand the principles of research methodology including clinical trials

Time frame for specialist training

- The training period should involve a minimum of 4 years full time work, with the option of one additional year spent in another competency before, after, or as a part of the specialist training. Part time work would extend the training period.
- In the longer training period (5 years), up to one year could be in another speciality relevant to rare diseases.
- The time spent in laboratory work may vary among countries according to national curricula.
- A period of research resulting in a PhD/other higher exam may, if appropriate, replace training for a variable period of time according to national guidelines. However, in absence of national guidelines, it is recommended that this time period should not be longer than 1/3 of the total training period.