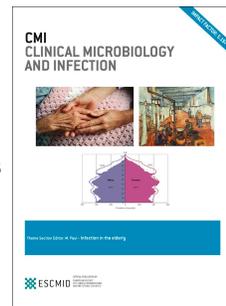


# Journal Pre-proof

Training and assessment of medical specialists in clinical microbiology and Infectious Diseases in europe

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1 **Training and assessment of medical specialists in Clinical**

2 **Microbiology and Infectious Diseases in Europe**

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38 **Key words**

39 Infectious diseases, clinical microbiology, medical microbiology, training, assessment, Europe

40

41 **Abstract**

42 Background

43 There is wide variation in the availability and training of specialists in the diagnosis and management  
44 of infections across Europe.

45 Objectives

46 To describe and reflect on the current objectives, structure and content of European curricula and  
47 examinations for the training and assessment of medical specialists in Clinical (Medical) Microbiology  
48 (CM/MM) and Infectious Diseases (ID).

49 Sources

50 Narrative review of developments over the past two decades and related policy documents and  
51 scientific literature.

52 Content

53 Responsibility for curricula and examinations lies with the European Union of Medical Specialists  
54 (UEMS). The ID Section of UEMS was inaugurated in 1997 and the MM Section separated from  
55 Laboratory Medicine in 2008. The Sections collaborate closely with each other and the European  
56 Society of Clinical Microbiology and Infectious Diseases (ESCMID). Updated European Training  
57 Requirements (ETR) were approved for MM in 2017 and ID in 2018. These comprehensive curricula  
58 outline the framework for delivery of specialist training and quality control for trainers and training  
59 programmes, emphasizing the need for documented, regular formative reviews of progress of  
60 trainees. Competencies to be achieved include both specialty-related and generic knowledge, skills  
61 and professional behaviours. The indicative length of training is typically 5 years; a year of clinical  
62 training is mandated for CM/MM trainees and 6 months of microbiology laboratory training for ID

63 trainees. Each Section is developing examinations using multiple choice questions to test the  
64 knowledge base defined in their ETR, to be delivered in 2022 following pilot examinations in 2021.

65 Implications

66 The revised ETRs and European examinations for medical specialists in CM/MM and ID provide  
67 benchmarks for national authorities to adapt or adopt locally. Through harmonisation of  
68 postgraduate training and assessment, they support the promotion and recognition of high standards  
69 of clinical practice and hence improved care for patients throughout Europe, and improved mobility  
70 of trainees and specialists.

71

**72 Introduction**

73 The shortage of medical specialists in Clinical/Medical Microbiology (CM/MM) and Infectious  
74 Diseases (ID) in Europe was highlighted in a joint statement in 2019 [1]. Both disciplines work  
75 together to promote excellence in specialist training and clinical practice in the ongoing battle  
76 against infection. The global financial and political challenges posed by infections were summarised  
77 by Anthony Fauci in a lecture to the Infectious Disease Society of America two decades ago [2]. His  
78 headings included emerging and re-emerging infections (including antimicrobial resistance),  
79 infectious causes of chronic disease, bioterrorism, the changing science base for investigation and  
80 diagnosis of infection (especially genomics), vaccinology, and global health. Events during the COVID-  
81 19 pandemic have emphasized many aspects of his predictions [3], together with increasing  
82 European focus on problems such as emerging and imported infections [4-7], antimicrobial  
83 resistance [8] and multidisciplinary provision of care for migrants [9,10].

84 Since then, there have been substantial changes in the organization and delivery of infection services  
85 and within the core medical disciplines of ID and its subspecialties and CM/MM, which includes  
86 bacteriology, mycology, parasitology and virology. Doctors working in the field of infections  
87 increasingly collaborate with colleagues of other medical specialties in multidisciplinary teams and  
88 with a range of other health care professionals, whose responsibilities may overlap with those of  
89 medically qualified specialists. Examples include nurses or pharmacists with prescribing rights, team  
90 leadership by non-medical infection control practitioners and laboratory leadership by non-medical  
91 scientists. For CM/MM, the picture is complicated further. In some European countries, clinical  
92 microbiology services are provided by doctors who are specialists in Laboratory Medicine (formerly  
93 Medical Biopathology/Laboratory Medicine). This includes several laboratory disciplines, with an  
94 emphasis on clinical chemistry [11]. In some areas, similar laboratory services may be provided by  
95 professionals without medical qualifications [12].

**96 Objectives**

97 Specialist training and subsequent continuing professional development have also evolved to cope  
98 with the changing and increasingly interchangeable roles of medical specialists in CM/MM and ID.  
99 The purpose of this review is to reflect on this evolution and to outline the roles of key European  
100 organizations in driving and supporting these changes. The objectives, structure and content of  
101 training curricula in CM/MM and ID in Europe are summarised, together with progress in developing  
102 European medical specialist examinations in ID and CM/MM. In subsequent articles in this issue, the  
103 current delivery of infection services and postgraduate training in individual countries in Europe are  
104 compared with these standards for CM/MM [13] and ID [14]. Although other professionals are active  
105 in the field of diagnosis and/or treatment of infections, this review focuses on the complementary  
106 UEMS medical specialties of ID and MM.

## 107 **Methods**

108 This is a narrative review of the literature relating to infection services and training in Europe,  
109 highlighting key professional position papers and sources of further information. These are discussed  
110 from the perspectives of the authors, who have substantial combined experience in developing  
111 European training curricula and examinations in ID and CM/MM.

## 112 **Harmony or diversity?**

113 The diversity of medical practice across Europe presents challenges but may also be a strength that  
114 generates innovation to solve different problems and provides opportunities for cross fertilisation of  
115 ideas and learning between different centres [15]. However, there have been increasing trends  
116 towards harmonisation of medical practice and training over the past 50 years, fuelled in part by  
117 European Community/Union (EU) directives ensuring mutual recognition of qualifications in 1976  
118 and, since 1993, free movement of medical specialists within the EU where the specialty in question  
119 is fully recognised [16]. This trend and the considerable committee work to enable and support it  
120 have been heavily criticised by some such as Brearley who noted in 1995 that “There are good  
121 practical reasons behind the evolution of Europe's disparate training schemes, and the arguments for

122 retaining diversity rather than continuing to strive for homogeneity are persuasive” [17].

123 Nevertheless, greater professional mobility and the EU Directives have increased the need for

124 European professional standards for the medical specialties of CM/MM and ID.

125 The drive for European harmonisation is facilitated by the European Union of Medical Specialists, or

126 Union Européenne des Médecins Spécialistes (UEMS), which is the oldest pan-European medical

127 organization. It was established as a non-profit making association in 1958 and 40 countries are now

128 full, associate or observer members [https://www.uems.eu/about-us/membership/national-](https://www.uems.eu/about-us/membership/national-associations)

129 [associations](https://www.uems.eu/about-us/membership/national-associations). The UEMS has no legal binding authority, but works as a lobby organisation, and its

130 mandate states that “By its agreed documents, UEMS sets standards for high quality healthcare

131 practice that are transmitted to the Authorities and Institutions of the EU and the National Medical

132 Associations stimulating and encouraging them to implement its recommendations”. One of its most

133 important tasks is to develop, recommend and monitor training programmes and examinations and

134 hence harmonise the training of medical specialists within its 43 Specialist Sections, which represent

135 independently recognized specialties. The UEMS recognises the Sections of Infectious Diseases

136 (UEMS-SID) and Medical Microbiology (UEMS-SMM) as separate specialty Sections, founded in 1997

137 ([uems-id.eu](https://www.uems-id.eu)) and 2008 ([uems-smm.eu](https://www.uems-smm.eu)), respectively. Before that, Medical Microbiology was part of

138 the UEMS Section of Medical Biopathology (now renamed as the Section of Laboratory Medicine or

139 UEMS-SLM ([uems-slm.org](https://www.uems-slm.org))).

140 The medical specialist training programmes and assessments approved by the UEMS are

141 complementary to training curricula and examinations carried out within individual countries and are

142 often used to benchmark standards by national authorities and professional societies of member

143 states. Specialist Sections usually work closely with the corresponding European Specialist Societies,

144 especially in the joint development and endorsement of specialist examinations. The largest

145 overarching scientific society that promotes dialogue between all professionals working in the field of

146 infections is the European Society of Clinical Microbiology and Infectious Diseases (ESCMID)

147 ([www.escmid.org](http://www.escmid.org)). First founded in 1983, this society is open to individual members and all  
148 professions and promotes science and education in the field of infection as well as standards of  
149 practice and training [18]. In addition to the many subspecialty groups within ESCMID which focus on  
150 different pathogen themes, the Professional Affairs Subcommittee (PAS) and Trainees Association  
151 (TAE) play very active roles in developing methods and opportunities for specialist training. ESCMID  
152 has sponsored workshops on training and practice in Birmingham, UK in 1999 [19], Leuven, Belgium  
153 in 2004 [20], Rome, Italy in 2008 [21,22] and Ljubljana, Slovenia in 2014 [23].

154

155 UEMS Sections are open to all member states in which the specialty in question is recognised and the  
156 representatives from these countries attend the meetings and other activities of the sections. UEMS-  
157 SMM and UEMS-SID have close links and mutual representation with each other and with the  
158 ESCMID PAS and TAE, and collaborate in many areas with ESCMID, such as the joint Declaration of  
159 Physicians Dedicated to the Diagnosis and Care of Patients with Infectious Diseases in 2019, aiming to  
160 improve political awareness of the need for appropriately trained infection specialists in Europe [1].

161 All groups collaborate with the ECDC to develop and promote better standards for infection  
162 prevention and control practitioners across Europe [24-26]. The two UEMS Sections also collaborated  
163 with ESCMID in the creation of a pan-UEMS "Multidisciplinary Joint Committee" on Infection Control  
164 in 2019, aiming to encourage adequate training in infection prevention and management in the  
165 specialist curricula of all medical and surgical specialties [27].

166 For many medical specialties, common training standards and free mobility do not pose great  
167 theoretical problems. Although logistic and economic factors often influence delivery of care in  
168 individual countries, the fundamental principles of practice are usually the same everywhere. This is  
169 more complex for physicians dealing with infection, as there is huge variation (even seasonal) in the  
170 most common pathogens causing specific infection syndromes in different parts of Europe.

171 Furthermore, the prevalence and types of antimicrobial resistance vary enormously within countries

172 as well as across international boundaries and the correct empirical and specific management of an  
173 infection in one city may be completely inappropriate in another. Thus, standards of training and  
174 professional guidelines need to encourage appreciation of this variation in pathogen ecology and a  
175 flexible approach is needed to optimise management of local and imported infections. In addition,  
176 training guidelines which promote UEMS standards of “high quality healthcare practice” have to  
177 allow for realistic deliverability in countries with less resources.

### 178 **Specialty status and practice across Europe**

179 Figure 1 summarises the official status of CM/MM and ID as medical specialties in the 35 countries  
180 that are full or associate members of UEMS in June 2021. Neither specialty is fully recognised in  
181 every country in Europe. Large variations in the proportions of CM/MM and ID doctors persist in  
182 different countries [13,14,22,28-32], with an overall average of 1 ID or CM/MM specialist per 100  
183 hospital beds in 2015 [32].

184 The traditional patterns of practice of ID and CM/MM vary widely and evolve at a different pace  
185 across Europe, often in a converging fashion. Over the last 30 years, inpatient ID practice in most  
186 countries has moved physically from location in stand-alone “fever hospital” sites to general hospital  
187 settings [19,28,29,32,33]. ID physicians usually retain primary responsibility for care of patients  
188 admitted to their own bed base, but less than 60% of hospitals had specialised ID wards in a large  
189 pan European survey in 2015 [32]. Apart from Spain [30], ID is now recognised as an independent  
190 specialty in 25/34 (74%) UEMS countries and as a subspecialty of internal medicine in the remaining  
191 8 (Fig. 1.) [14]. There has been a move away from adult ID specialists having direct care  
192 responsibilities for children with infection and Paediatric ID is a recognised specialty or subspecialty  
193 of Paediatrics in half of Europe [14,34] and is not described in further detail here. However, CM/MM  
194 and ID specialists often provide advice to those looking after children and retain a need for familiarity  
195 with diagnosis and especially prevention of infection in children.

196 CM/MM is recognized as a primary specialty for medical doctors in most European countries (Fig. 1).  
197 In some, such as France and Portugal, the function is usually taken care of by specialists in Laboratory  
198 Medicine including several laboratory disciplines [11] or by non-medical professions such as  
199 pharmacists or biologists [12]. In some countries where medical specialists and non-medical  
200 professionals work in the same laboratories, non-medical professionals remain laboratory-based,  
201 while duties of their clinical counterparts often overlap with ID. The physical location of CM/MM  
202 varies widely and may be within general biopathology centres located on a hospital site or  
203 elsewhere. There has been a general move towards better integration with secondary care as “bed-  
204 side” consult activity and hospital-wide infection control and antimicrobial stewardship roles have  
205 assumed greater importance [22,29,35-38]. This trend has to be balanced with pressure to centralise  
206 laboratories to improve economic efficiency in the use and timely modernisation of diagnostic  
207 equipment [36,37]. Wherever laboratories are placed physically, the continued need for medical  
208 leadership in CM/MM has recently been emphasized, despite the important roles that non-medical  
209 scientists play in running many laboratories [39].

210 CM/MM and ID have complementary roles and the daily work of both disciplines involves increasing  
211 amounts of bedside consultation advice and multidisciplinary clinical meetings with many different  
212 medical specialties, which may or not share direct care of patients (e.g. tuberculosis, HIV, hepatitis).  
213 The challenges of providing informal advice (“curbside consultations”) and remote advice and their  
214 clinical governance have long been recognised in ID and CM/MM settings [37,40]. These have been  
215 emphasized by recent changes in practice in response to the COVID-19 pandemic, with new solutions  
216 being explored to remote consult record keeping in compliance with data protection regulations [40].  
217 CM/MM doctors may be involved in outpatient clinic care, previously the reserve of ID specialists,  
218 and in joint or sole leadership of multi-specialty outpatient antibiotic therapy (OPAT) teams [41].  
219 Infection prevention and control (IPC) and antimicrobial stewardship have traditionally been  
220 strengths of CM/MM doctors, particularly in countries where there are few ID physicians, but rightly  
221 occupies an increasing part of the daily work plan of all specialists in the field of infections [25,27,32].

222 These developments underpin the need for the provision of medical specialists in CM/MM across  
223 Europe with adequate clinical training in ID and vice versa, with enhanced harmonised training for  
224 both specialty groups in infection prevention and control and antimicrobial stewardship.

### 225 **European Training Requirements/Curricula and Assessment**

226 Although differences in clinical practice and training requirements across Europe present many  
227 challenges, both UEMS Sections have published updated competence-based European Training  
228 Requirements (ETRs) approved by the UEMS. These documents include detailed descriptions of the  
229 competencies that should be achieved and the framework for delivering training throughout Europe,  
230 and provide a benchmark for national authorities to refer to when updating their own curricula  
231 ([https://www.escmid.org/profession\\_career/speciality\\_training\\_uems/](https://www.escmid.org/profession_career/speciality_training_uems/)). The ETRs also provide the  
232 basis for European Specialist Examinations under development by both Sections.

#### 233 *Generic issues*

234 The ETR is a comprehensive training curriculum including a detailed syllabus of knowledge and skills  
235 that trainees should acquire, with explicit descriptions of the responsibilities of trainees and trainers,  
236 the structure and delivery of training programmes and the accreditation and oversight of training  
237 centres/rotations and trainers [42]. The focus is on defining the levels of competence to be achieved  
238 in the three broad domains of knowledge, skills and attitude in each area of practice [43,44]. Training  
239 programmes should be organised to enable the trainee to acquire all the required competencies,  
240 rotating through different centres locally or nationally if necessary, with a predefined timetable for  
241 rotation and progression so both trainees and trainers know what to expect. In theory, progression  
242 should be determined by achievement of competencies rather than depending on finishing  
243 prespecified periods of time in each area of training. In practice, it is very difficult to organise training  
244 programmes without predefined "indicative" lengths of training likely to be needed for adequate  
245 exposure and learning.

246 Trainers should have adequate training in the specific skills required to mentor trainees, particularly  
247 those encountering personal or programmatic difficulties in their training, and be monitored with  
248 feedback on trainer and training programme performance that leads to corrective action when  
249 required without detriment to individual trainee career paths. Training requires a skillset that is  
250 different from (although may overlap with) excellence in academia and/or clinical practice. The  
251 importance of mentorship in facilitating learning is well described [45] and deficiencies in access to  
252 adequate training opportunities and in particular poor mentorship feature repeatedly in recent  
253 surveys of CM/MM and ID trainees [46-48].

254 Assessment methods are outlined in the ETR. They include trainee or trainer led “formative”  
255 exercises carried out in real time with immediate feedback and reflection, but without a formal pass  
256 or fail barrier to progression, or centrally organized “summative” pass or fail steps and tests, such as  
257 final examinations [44]. Progression through training is monitored with personal logbooks which vary  
258 from simple paper-based lists of numbers and types of clinics/patients/procedures seen and done,  
259 and time spent in each rotation, to comprehensive e-portfolios which also document a variety of  
260 workplace based assessments (WBAs) and formative and summative reviews and examinations  
261 throughout training.

262 WBAs include standardised documentation of a variety of types of observation of trainees  
263 performing a clinical or laboratory procedure, various types of case-based discussion, performance of  
264 quality improvement or audit projects etc. These should include immediate constructive feedback to  
265 the trainee. A portfolio including records of many different types of standardised assessment of the  
266 trainee by different trainers provides an evidence base of adequacy of progression which is  
267 particularly useful in documenting professional performance, communication and team working skills  
268 and in identifying trainees facing difficulties [49]. However, excessive reliance on WBAs and portfolio  
269 management takes time and can easily become a tedious and meaningless box ticking exercise, so

270 balance is important [50], and the evidence base for effectiveness of WBAs in everyday practice is  
271 not conclusive [51].

272 The ETRs promote documentation of regular formal reviews of progress including all forms of  
273 assessment, at least once a year, preferably with independent input to improve subjectivity –  
274 particularly important in centres where there are few trainers and trainees. A more detailed review  
275 approximately a year before the expected end of training (the “Penultimate Year Review”) can be  
276 especially helpful to identify remaining training needs that should be completed before attempting  
277 specialist accreditation.

278 Summative final examinations in both CM/MM and ID are used in most countries but have  
279 recognised limitations. Final examinations in different specialties are discussed at regular UEMS  
280 meetings under the umbrella of the Council for European Medical Assessment (CESMA). These  
281 meetings encourage sharing of problems and best practice in methods of assessment and the  
282 proceedings, presentations and technical documents are freely available  
283 (<https://www.uems.eu/areas-of-expertise/postgraduate-training/cesma>). The first European  
284 Diploma Examination was established in 1984 (Anaesthesiology) and today 34 disciplines have  
285 European examinations. While examinations organised under the aegis of UEMS are not considered  
286 formal qualifications, their quality and recognition have increased significantly over the past few  
287 years. As a result, some countries use or recognize European examinations as part of their national  
288 examination processes.

289 Examinations may include various types of multiple-choice questions (MCQs), written papers with  
290 short questions or long essays, viva voce examinations on core knowledge or based on case  
291 discussions, and observation of the trainee while performing laboratory procedures or clinical  
292 examinations at the bedside. Observations of clinical performance in examination settings can be  
293 standardised to improve objectivity but require substantial examiner training and quality control of  
294 inter-observer variability; the success of the trainee on the day is still subject to luck and chance as

295 well as ability. MCQs are easier to standardise and are most suitable for electronic delivery and  
296 marking, which can also be achieved more variably for written papers. It is particularly difficult to  
297 exclude observer bias and achieve fairness in viva voce examinations, although these remain popular  
298 in many specialties. It is logistically and financially impractical to provide fair and reproducible  
299 examinations in more than one language at the same time and English is the usual standard chosen,  
300 despite the recognised advantage this gives those with greater proficiency in written and spoken  
301 English.

### 302 *Specialist curricula in CM/MM and ID*

303 The core clinical and laboratory competencies for each discipline have been defined and are  
304 enumerated in more detail in the succeeding papers in this issue [13,14]. Both ETRs emphasize the  
305 importance of research in training and practice and the need for training in leadership and  
306 teamwork.

307 A curriculum and brief syllabus of specialist competencies to be achieved in ID was first published by  
308 the UEMS-SID in 1998, with minor yearly updates thereafter [28]. It was expanded substantially over  
309 the past decade and a new ETR was approved by UEMS Council in 2018 [52]. This includes a  
310 comprehensive syllabus defining the levels of knowledge, skills and attitudes that should be achieved  
311 in each specific area of specialist ID practice. It also suggests but does not mandate types of WBA  
312 that might be used to document acquisition of each competence. Generic specialist competences  
313 and internal medicine competences are mostly defined in the ETR in Internal medicine. Allowance  
314 was made for different patterns of training across Europe, with ID following a common trunk of  
315 internal medicine in many countries or both being delivered concurrently in some. The median  
316 indicative length of ID training in different countries is 5 years, with typical range of 4-6 years [14].

317 A few countries such as the UK still recognize Tropical Medicine as a separate specialty [53-55], but  
318 the care of imported infections is an essential part of general ID training and practice. The current ID  
319 ETR includes options for extra training in tropical medicine, including coursework, diplomas and

320 supervised clinical experience in resource poor settings. ID specialists should be familiar with  
321 pretravel medicine practice, which is evolving as a separate multidisciplinary and multiprofessional  
322 activity with its own standards and specialist societies [52,55].

323 The UEMS-SMM published a competence-based ETR in Medical Microbiology in 2013, augmented  
324 with a subsequent more detailed description of the training (Curriculum in Medical Microbiology),  
325 and approved by UEMS Council in 2017 [56]. CM/MM trainees must acquire generic professional  
326 competencies as well as those in bacteriology, mycology, parasitology, virology and clinical ID [10].  
327 The average indicative length of training is 5 years. In most countries all these areas of specialist  
328 practice fall under the remit of CM/MM, but a few such as the UK allow specific training and  
329 specialist certification in either CM/MM or medical virology. In all countries, any further  
330 subspecialisation typically occurs unofficially over the course of a specialist's career.

### 331 *Harmony or diversity in training CM/MM and ID specialists?*

332 The indicative length of training for both ID and CM/MM is 5 years. In general, most governments  
333 exert pressure to reduce, not extend, the length of specialist training. The ID ETR does not define  
334 many mandatory lengths of training but does recommend a minimum of 6 months of laboratory-  
335 based training for all ID trainees. The new CM/MM ETR mandates a minimum of 1 year of clinical  
336 training for all CM/MM trainees. However, the debate about combining training for CM/MM and ID  
337 completely or maintaining separate, partially harmonised training curricula has continued for several  
338 decades [20,22,29,57,58]. Joint training in ID and CM/MM is particularly suitable for specialists  
339 whose practice is not bed-based, while ID specialists who will have primary responsibility for patients  
340 in their own beds need to acquire (and maintain) adequate generic skills in internal medicine. Joint  
341 training in CM/MM and ID is only approved in Estonia, Turkey and the UK and is being introduced in  
342 Ireland in 2021 [14]. In the UK, an optional joint specialist training programme was introduced in  
343 2000, combining the core common elements of training as well as the extra skills (and assessments)  
344 for both MM and ID, and adding a year of training overall to acquire certification in both specialties

345 [57]. This proved popular but around 50% of trainees still preferred monospecialty training in either  
346 CM or ID (the latter with internal medicine). Following revision of the curricula in 2014, trainees in all  
347 infection specialties have to undertake at least two years training and pass exams (MRCP) in internal  
348 medicine before entry into specialist infection training. The first two years of subsequent specialist  
349 training are common to all infection trainees, including both ward and laboratory-based learning and  
350 consult and clinic activity. Following this, trainees can follow tracks in ID alone (with internal  
351 medicine), MM or Medical Virology (MV) alone, or combinations of ID with either MM or MV [58]. In  
352 the revised 2021 curricula, an extra year of internal medicine has been added to the ID/internal  
353 medicine pathway and an extra year of joint training has been added to the ID with MM or MV  
354 tracks, taking all programmes to 7 years duration or 8 years for Tropical Medicine combinations [55].

### 355 **Specialist examinations**

356 The recent approval of comprehensive ETRs for both CM/MM and ID provides the framework for  
357 harmonised European assessment of the knowledge, skills and professionalism of medical specialists  
358 as they progress through different levels of training and competence. The content and governance of  
359 such assessments is the responsibility of the respective Sections of UEMS, but will be delivered in  
360 close collaboration with ESCMID.

361 Many feel that mobility of trainees and specialists of CM/MM and ID would be supported by  
362 common European examinations and these options have been explored by both UEMS-Sections for  
363 some years, with support and collaboration with ESCMID and particularly helpful input from the  
364 trainees. Both Sections have opted to start with examinations using MCQs to test the knowledge  
365 base defined in the respective ETRs. A panel of MCQs in English was first trialled with members of the  
366 TAE in collaboration with the ID Section, followed by a survey of CM/MM and ID trainees in 2015  
367 [42]. Two thirds of trainees favoured development of European examinations, although more than  
368 half of those in favour said these should be voluntary. Cost to trainees was identified as a major  
369 potential barrier. The examinations of both Sections contain MCQs with a “Best of 5 answers”

370 format, which incorporates some clinical reasoning about the best solution to a diagnostic or  
371 management problem, rather than multiple “True false” MCQs. The CM/MM examination will also  
372 include some “Extended matching” MCQs, suitable for assessing knowledge such as matching  
373 multiple best antimicrobial treatments with multiple pathogens. The examinations will be voluntary  
374 and pass or fail only, rather than grading examinations, but with plans to provide feedback to  
375 candidates on their performance in each subject area.

376 With support from ESCMID, the UEMS-SMM had intended to hold a pilot examination in Paris at the  
377 time of ECCMID in April 2020, but this was cancelled due to COVID-19. Instead, a pilot online  
378 examination was held in late March 2021 with remote proctoring of candidates in their own training  
379 centres. The UEMS-ID Section had planned a 2-day workshop to train over 50 question writers from  
380 across Europe at ECCMID 2020. Instead, this was delivered virtually later in the year to specialists  
381 from more than 20 countries. A pilot ID examination is planned for late 2021. Both Sections hope to  
382 run definitive examinations in 2022 but are still debating the optimum timing and mode of delivery  
383 and other practical issues. Examinations are recognised to drive learning and the content of training  
384 programmes [59]. The key question for both Sections is whether robust examinations can overcome  
385 potential limitations imposed on the range of questions that can be standardised across Europe,  
386 given the wide geographical variations in pathogens and management approaches.

### 387 **Summary**

388 Progress towards harmonisation of practice and hence mobility of trainees and specialists in CM/MM  
389 and ID should be underpinned by recent UEMS approval of comprehensive curricula - the ETRs – by  
390 both Specialist Sections. These documents provide standards for improvement and modernisation of  
391 training in CM/MM and ID specialties across Europe. Following pilots in 2021, examinations on the  
392 knowledge base supporting CM/MM and ID specialist practice are planned for 2022. We hope the  
393 examinations will be a successful but voluntary addition to ongoing national assessments and provide

394 a benchmark and possible substitute for them in some countries. If successful, they might expand  
395 into more comprehensive European Fellowship certifications in the future.

396

Journal Pre-proof

397

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405

406

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416 **Figure 1.**

417 Summary of official status of the medical specialties of (a) Clinical/Medical Microbiology and (b)  
418 Infectious Diseases in the 35 European countries that are full or associate members of UEMS in June  
419 2021. Data in (a) do not include non-medical professional practice in Medical Microbiology. In (a)  
420 “subspecialty” means practicing Medical Microbiology alone after training in Laboratory Medicine. In  
421 (b) “subspecialty” means specialising in Infectious Diseases as a subsidiary specialty of Internal  
422 Medicine. Data in (b) reproduced with permission from Brockhoff et al [14]. Maps by Michael  
423 Schwartz.

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