



Position paper

ESCMID generic competencies in antimicrobial prescribing and stewardship: towards a European consensus

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ARTICLE INFO

Article history:

Received 1 August 2018

Received in revised form

14 September 2018

Accepted 23 September 2018

Available online 8 November 2018

Editor: L. Leibovici

Keywords:

Education

Training

Antibiotic stewardship

Standards

Curriculum

Competency

Prescription

ABSTRACT

Objective: To develop a consensus-based set of generic competencies in antimicrobial prescribing and stewardship for European prescribers through a structured consensus procedure.**Methods:** The RAND-modified Delphi procedure comprised two online questionnaire rounds, a face-to-face meeting between rounds, and a final review. Our departure point was a set of competencies agreed previously by consensus among a UK multi-disciplinary panel, and which had been subsequently revised through consultation with ESCMID Study Group representatives. The 46 draft competency points were reviewed by an expert panel consisting of specialists in infectious diseases and clinical microbiology, and pharmacists. Each proposed competency was assessed using a nine-point Likert scale, for relevance as a minimum standard for all independent prescribers in all European countries.**Results:** A total of 65 expert panel members participated, from 24 European countries (one to six experts per country). There was very high satisfaction (98%) with the final competencies set, which included 35 competency points, in three sections: core concepts in microbiology, pathogenesis and diagnosing infections (11 points); antimicrobial prescribing (20 points); and antimicrobial stewardship (4 points).**Conclusions:** The consensus achieved enabled the production of generic antimicrobial prescribing and stewardship competencies for all European independent prescribers, and of possible global utility. These can be used for training and can be further adapted to the needs of specific professional groups. **O.J. Dyar, Clin Microbiol Infect 2019;25:13**© 2018 The Authors. Published by Elsevier Ltd on behalf of European Society of Clinical Microbiology and Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Using antimicrobials responsibly is an essential component of efforts to contain antimicrobial resistance (AMR), and to ensure that patients receive appropriate treatment [1,2]. The WHO global action plan on AMR emphasizes the importance of training

healthcare professionals in antimicrobial prescribing and stewardship (AMPS) [3]. There are several challenges, however, such as the wide range of healthcare professionals involved in the prescribing process, and the heterogeneity of prescribing rights and practices of different professional groups within and between countries. One way to address these challenges is through developing competencies, which define the minimum standards that all antimicrobial prescribers should reach.

Competencies can be viewed as representing a combination of knowledge, attitudes and skills. They have successfully been used in many healthcare disciplines, and competence-based learning and assessment in postgraduate training is now encouraged by the

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European Union of Medical Specialists [4,5]. There have been efforts in individual countries to define minimum standards of competence within AMPS, including by a multi-disciplinary group in the UK [6]. However, there is currently no widely accepted set of competencies that is considered relevant for all independent prescribers in European countries. Such a competency set could play a significant role in harmonizing approaches in AMPS, including both training and clinical practices.

In this context, an early draft of the UK AMPS competencies was presented at an ESGAP (ESCMID Study Group for Antimicrobial stewardship) educational workshop in 2012. This led to a consultative process within ESCMID (2014–2016) to adapt their relevance to the broader European context. The process was coordinated by ESGAP and involved over 100 queries and contributions from Study Groups, resulting in a set of draft competencies (see [Supplementary material, Appendix S1](#)). Following this, the ESCMID Executive Committee agreed that ESGAP should conduct a formal consensus procedure with a wider group. The aim of this study was therefore to develop a wider consensus-based set of generic AMPS competencies for prescribers across as much of Europe as possible.

Methods

Study design

We conducted a RAND-modified Delphi procedure [7–9] to reach consensus on a set of AMPS competencies, relevant to all independent prescribers in Europe (definitions in [Box 1](#)). We used the term ‘antimicrobial’ throughout for consistency with existing international work; the main focus was antibacterial agents, but many of the competency points are relevant to other antimicrobials. The procedure ran between February 2017 and February 2018 and comprised four stages: (i) a first questionnaire round; (ii) an expert panel meeting held during the ECCMID 2017 congress; (iii) a second questionnaire round; and (iv) a final review, conducted by e-mail. Questionnaire rounds were hosted online at Survey Monkey (SurveyMonkey Inc., California, USA), and data were analysed using

Box 1

Key definitions provided to the expert panel.

- *Competencies* are the minimum standards that all independent prescribers of antimicrobials should reach to practise according to the principles of responsible antimicrobial use
- *Generic competencies* are general competencies that can be used as a starting point by all prescribing professional groups for developing their own more specialized competencies
- An *independent prescriber* is in general an unsupervised and unrestricted prescriber, although specific prescribing rules vary from country to country. Examples include: **Primary care/family medicine doctors**, even if they can only prescribe oral antimicrobials; **First-year graduates** from medical school who can write and sign antimicrobial prescriptions; **Nurse or pharmacist prescribers** who can prescribe a range of antimicrobials for a range of clinical conditions, without supervision. Examples do not include: **Nurse or pharmacist prescribers** who can only prescribe specific antimicrobials (e.g. trimethoprim) in specific circumstances (e.g. urinary tract infections); **Final-year medical students** who are encouraged to write prescriptions, but need a qualified doctor to sign the prescription.

Microsoft Excel (Microsoft Inc., California, USA). The questionnaires are available in the [Supplementary material \(Appendix S2\)](#). Our study design did not require ethical approval.

Selection of expert panel

We shortlisted 34 European countries and invited participants through a two-stage process. First, a potential country coordinator was identified and invited for 31 of 34 countries (see [Supplementary material, Appendix S3, Table S1](#)), typically an ESGAP member with an interest and previous experience in antimicrobial stewardship (AMS) and education. In 24 of the 31 countries, this individual agreed to participate; no response was received from potential coordinators in the remaining seven countries. Second, each confirmed coordinator was asked to invite two additional participants, ideally resulting in one infectious diseases specialist, one clinical microbiologist and one pharmacist per country. Separately, 11 individuals were invited who had helped to develop the draft competencies set, on behalf of ESCMID Study Groups; eight agreed to participate, and three declined.

Introductory teleconferences were organized to ensure that the expert panel had a consistent understanding of the study's aim, definitions ([Box 1](#)) and procedure. Expert panel members were asked to contribute their viewpoints, drawn from their own experiences, rather than any from national societies or professional organizations. There was no financial compensation for participation.

First questionnaire round

The questionnaire was designed and piloted within the core working group (comprised of the six authors). This involved deconstructing the previously developed draft competencies into unique competency points for appraisal of relevance. Five competency points also included ‘sub-points’, which provided specific key points relevant to defining the competency. The competencies were divided into three sections: (i) Infection: diagnosis, prevention and control; (ii) Antimicrobial prescribing; and (iii) Antimicrobial stewardship.

Invitations were sent to 74 experts, asking them to assess the relevance of 46 competency points and 26 sub-points for all independent prescribers in their country. A Likert scale [10] was used ranging from 1 (‘not at all relevant’) to 9 (‘highly relevant’), including the option ‘Cannot assess’. Sub-points were assessed using a two-point scale (‘Include in the competency’ or ‘Do not include’). Respondents could provide comments for each competency, including suggestions for re-phrasing, as well as proposals for additional generic competencies. The questionnaire also contained questions on participant socio-demographics and involvement in AMS activities.

Competency points were accepted if the median score was ≥ 7 and $\geq 70\%$ of the expert panel member scores were in the top tertile (scores 7, 8 or 9). Competencies were discussed at the expert panel meeting if they had a median score ≥ 7 but $< 70\%$ of the scores were in the top tertile. Competencies with a median score < 7 were excluded. Sub-points were accepted if $\geq 80\%$ of the expert panel considered they should be included; scheduled for discussion (60%–79%); or, excluded ($< 60\%$). A subgroup analysis was conducted comparing median relevance scores between respondents based on geographic region (country groupings are shown in the [Supplementary material, Appendix S3, Table S1](#)).

Expert panel meeting

All first-round responders (referred to hereafter as ‘the expert panel’) were sent feedback reports detailing the overall first-round

scores and their individual scores, and were invited to attend the expert panel meeting either in person or via the internet. The meeting was chaired by an external AMS expert trained in moderating consensus procedures. The meeting aims were to (i) present the first-round results; (ii) discuss competency points and sub-points where there was disagreement; and (iii) discuss whether newly suggested competencies should be considered for assessment by the whole expert panel in a second round. Discussions were held until a consensus was reached (approximately two-thirds in agreement).

Second questionnaire round

The expert panel was invited to participate in a second questionnaire round, consisting of: (i) views on the decisions made at the face-to-face meeting ('Do you agree with all decisions (which included the list of excluded competencies) made at the expert panel meeting?'); (ii) assessment of the relevance of the newly suggested competencies, using the same scale as in the first round; and (iii) assessment of agreement with any re-phrasings made to the competencies.

Final review

The expert panel was sent an updated competencies set, together with explanations for re-phrasings. Each expert was asked whether they agreed that overall, the set of competencies as a whole was relevant for all independent prescribers of antimicrobials in Europe.

Results

First questionnaire round

Eighty-eight per cent (65/74) of individuals who had agreed to participate in the expert panel completed the first-round questionnaire in full, from all 24 countries. One partial response was received and was not included in the analyses. Most members of the expert panel were either doctors (72%, 47/65) or pharmacists (22%, 14/65), specializing in either infectious diseases (51%, 33/65) or clinical microbiology (28%, 18/65). Most were members of an antimicrobial stewardship team (75%, 49/65), and were involved in teaching undergraduates and/or postgraduates on antimicrobial prescribing and/or stewardship (88%, 57/65). Full backgrounds of the expert panel members are presented in the (Supplementary material, (Appendix S3, Table S2)).

Fig. 1 summarizes the results from the questionnaire rounds and face-to-face meetings. In the first round, 31 competency points were accepted by the expert panel, 12 had disagreement and three were excluded. Six potential new competencies were suggested.

Expert panel meeting

Thirty-eight per cent (25/66) of the expert panel members from 20 of the 24 countries attended the meeting, at which two of the 12 disputed competency points were accepted, and three new competencies were selected for assessment by the whole expert panel in the second round.

Second questionnaire round

Eighty-eight per cent (58/66) of expert panel members completed the second-round questionnaire. Seventy-eight per cent (52/58) stated that they agreed with all decisions from the expert panel meeting, with the most frequent reason for disagreement

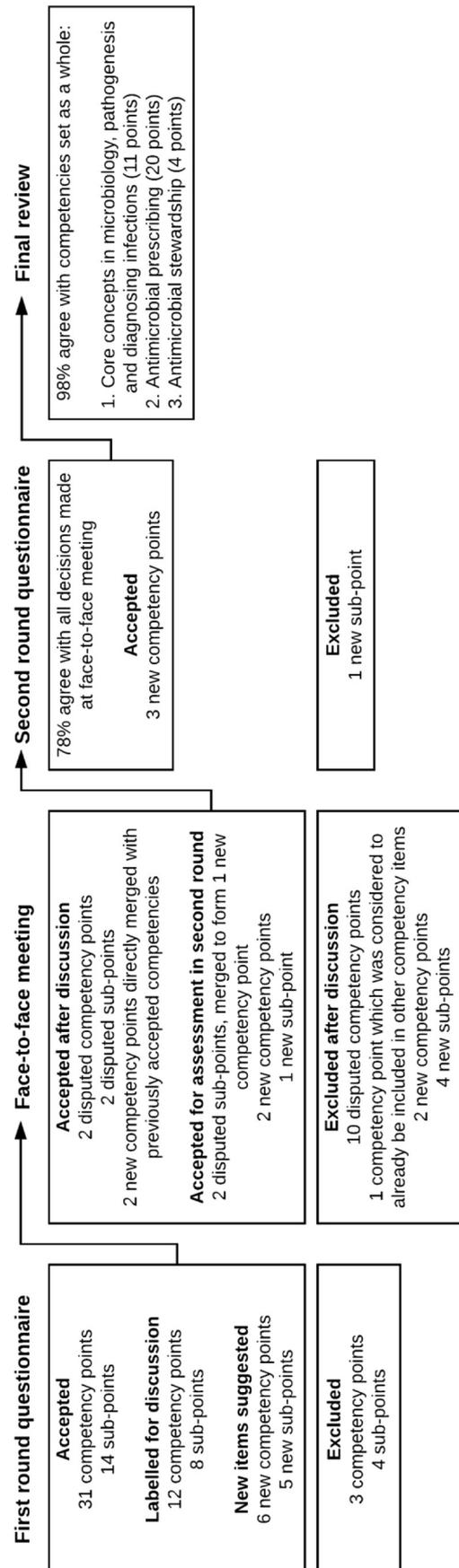


Fig. 1. Flowchart of consensus procedure.

(10%, 6/58) being the exclusion of competencies on delayed prescribing. The three new competencies were accepted. The core working group had re-phrased 13 competencies based on earlier comments. Across the re-phrasings, there was a median 91% (range 81%–100%) agreement that the new version maintained the originally intended meaning of the competency, whilst improving its readability.

Final review

Further re-phrasings were made based on the second-round feedback. The final set of 35 competency points was sent to the expert panel, with 98% of respondents (60/61, from 24/24 countries) agreeing that, overall, the competencies set was relevant for all independent prescribers of antimicrobials in Europe.

Editorial changes

The core working group subsequently made editorial changes to improve clarity and usability, such as re-ordering and grouping competencies together. This final set of competencies is presented in [Box 2](#). The unedited list of individual competencies accepted by the expert panel is included in the [Supplementary material \(Appendix S3, List S1\)](#), together with competencies that were assessed but ultimately excluded ([Appendix S3, List S2](#)).

Reasons for excluding competencies

Three main reasons were provided for excluding potential competencies, throughout the consensus procedure: (i) a point was not considered to be relevant to all independent prescribers; (ii) a point was considered to be specialist antimicrobial stewardship knowledge; and (iii) a point was considered to be primarily focused on other domains.

Sub-group analysis based on region

Responses to the first-round questionnaire were further analysed based on the country of origin of the respondent, with 26 responses from north or west countries, and 39 responses from south or east countries. Overall, there were no significant differences in responses. The median relevance scores were identical for 23 of 46 competency points and were within 1 point for 22 competency points. The median relevance score differed by 1.5 points for one competency point, which was discussed at the expert panel meeting, and was not selected for inclusion in the final competencies set.

Discussion

We have established through a consensus procedure a set of generic competencies in AMPS relevant to all European independent prescribers. The competencies that achieved the high relevance score required are presented in three sections. First, core concepts in microbiology, pathogenesis and diagnosing infections (11 points) including understanding the common microbiological causes of infection, differences between colonization and infection, and knowing how to diagnose common infections and use supporting investigations. Second, antimicrobial prescribing (20 points), including understanding when not to prescribe antimicrobials, how to initiate and review antimicrobial therapy, the clinically relevant spectrum for commonly prescribed antimicrobials, and documenting antimicrobial treatment plans. Third, antimicrobial stewardship (4 points), including understanding the need to use antimicrobials responsibly, engaging with local

stewardship policies and quality measures, and how to communicate about antimicrobial treatment decisions with patients, their carers, and other healthcare professionals.

Some of the draft competency items did not reach the threshold for selection. Expert panel members provided three main reasons for excluding potential competencies: (i) not relevant to all independent prescribers (e.g. using delayed prescribing); (ii) specialist AMPS knowledge (e.g. understanding how to use antimicrobial usage data, knowing the modes of action of antimicrobials); (iii) out of scope, primarily focused on other domains (e.g. infection prevention and control, public health, vaccines). The inconsistency in relevance scores for excluded items may in turn reflect differences between countries in terms of healthcare systems, specialties, general processes or even national cultures. For example, delaying prescribing pending the results of microbial culture or clinical evolution may reflect lack of readiness to take risks or a high level of uncertainty avoidance [11,12]. We have listed all excluded competencies in the [Supplementary material \(Appendix S3, List S2\)](#), together with their median relevance scores, to improve the potential utility of this study to other specialties and professions as well as non-participating or non-European countries.

Our study has several strengths: we used a robust methodology, and we made repeated efforts to ensure that expert panel members had a consistent understanding of the study's aim, processes and key definitions. The draft competencies set had been developed through two earlier structured phases, first a multi-disciplinary group in the UK [6], and second a consultative process with representatives from multiple ESCMID Study Groups. Our study's expert panel included representatives from 24 different countries, with multiple respondents in all but one country. There was extremely high satisfaction (98%) with the final competencies set, which we think was partly due to non-attendees of the expert panel meeting being able to comment on all proposals, and there being a final round for further reflection on the whole competency set. Neither of these opportunities have necessarily been included in previous consensus procedures. Furthermore, as English is not the first language in most European countries, another strength was our ability to identify and re-phrase potential misunderstandings, thus increasing the utility of the final competencies set.

Czabanowska et al. have pointed out some potential pitfalls of Delphi procedures [13]; we believe we have avoided many of these with our approach. The expert panel's professional backgrounds could be considered a limitation in achieving consensus on relevance for all independent prescribers: the majority were medical doctors and pharmacists, and most of these were specialists in infectious diseases or clinical microbiology. However, the draft competencies set assessed had involved broader input earlier in its development as the UK multi-disciplinary group included additional specialties and disciplines (e.g. surgeons, dentists, nurses) [6]. Furthermore, the vast majority of the expert panel were involved in AMPS teaching and were members of local AMS teams; they therefore had practical experience of working alongside other specialists and disciplines, and were likely to have a pragmatic understanding of their needs and expectations.

Despite our best intentions, seven European Union countries were not represented in this study, and this may limit the relevance of the final competencies set for these countries. A previous study has shown important differences throughout Europe in antimicrobial prescribing, so we analysed responses from the various European regions [14]. We found no differences between responses, suggesting that, although differences in clinical practice may exist, there was consistent agreement across different countries' representatives in terms of the minimum standards that independent prescribers should attain.

Box 2

ESCMID generic competencies in antimicrobial prescribing and stewardship.

Section 1: core concepts in microbiology, pathogenesis and diagnosing infections

- 1 Every independent prescriber must understand:
 - 1.1 The nature and classification of microorganisms that commonly cause infections in humans
 - 1.2 The common microbiological aetiology of human infections, and the ways in which microorganisms are commonly acquired in community and hospital settings
 - 1.3 The differences between colonization (e.g. isolation of bacteria from a venous leg ulcer with no signs of inflammation) and infection
 - 1.4 That an inflammatory response can be due to both infectious and non-infectious causes (e.g. acute pancreatitis)
- 2 Every independent prescriber must know how to:
 - 2.1 Take a thorough history and perform a physical examination to diagnose common infections and to assess their severity
 - 2.2 Use and interpret investigations that can help in informing diagnosis of an infection and in monitoring the response to treatment (e.g. microbiological investigations, biomarkers, point-of-care tests)

Section 2: antimicrobial prescribing

- 1 Every independent prescriber must understand:
 - 1.1 How and where to access relevant guidance on antimicrobial prescribing and stewardship
 - 1.2 When not to prescribe antimicrobials (e.g. antibiotics for viral infections, or when there is bacterial colonization)
 - 1.3 That best practices for some infections may not include antimicrobial treatment (e.g. incision and drainage of abscesses, removal of foreign material)
- 2 Every independent prescriber must understand how to select the appropriate antimicrobial, using relevant guidance when possible, as well as the key elements of initiating prescribing an antimicrobial:
 - Obtaining relevant microbiological cultures or relevant tests before commencing treatment
 - The timing of antimicrobial administration in different situations (e.g. as soon as possible for life-threatening infections, less urgently for chronic bone infections)
 - The choice and dose of agent, and the route of administration
 - The duration of treatment, review dates and stop dates
- 3 Every independent prescriber must understand the key elements of continuing and rationalizing antimicrobial therapy:
 - Monitoring antimicrobial levels when indicated, and adjusting doses (e.g. for patients with renal impairment)
 - Changing antibiotics according to microbiology results and clinical condition, ideally to a narrower spectrum (de-escalation), or if needed to a broader spectrum (escalation)
 - Reviewing antibiotic therapy at 48–72 hours and regularly thereafter in hospitalized patients, and in appropriate situations in the community
 - Switching antibiotics from intravenous to oral administration as soon as possible when indicated (according to guidelines)
 - Stopping antimicrobials if there is no evidence of infection based on clinical findings and investigations (e.g. negative microbial cultures, imaging reports)
- 4 Every independent prescriber must understand the need to document the important details of the antimicrobial treatment plan (e.g. agent, dosing, administration route, clinical indication, duration and review dates) in the prescription chart, medical records and transfer notes to other healthcare institutions
- 5 Every independent prescriber must understand:
 - 5.1 That empirical treatment should be guided by local antimicrobial susceptibility patterns
 - 5.2 The clinically relevant spectrum of activity for commonly prescribed antimicrobials
 - 5.3 The basic principles of pharmacokinetics and pharmacodynamics
- 6 When prescribing an antimicrobial, every independent prescriber must know:
 - 6.1 The antimicrobial class that the agent belongs to, and the contraindications to its use
 - 6.2 The name and class of antimicrobial being prescribed, if prescribing by trade name
- 7 Every independent prescriber must understand single prophylactic dosing for surgical and other procedures for which prophylaxis has been shown to be effective, and that additional prophylactic antimicrobial doses can occasionally be needed (e.g. when the duration of the operation/procedure is prolonged)
- 8 Every independent prescriber must know:
 - 8.1 Common antimicrobial and drug/food interactions
 - 8.2 Common side-effects of antimicrobials, including allergy, how to monitor for them, and what to do when they are suspected (e.g. documenting allergic reactions in patient records, reporting side-effects)
- 9 Every independent prescriber must understand any legal requirements for prescribing antimicrobials in their country, and comply with these when prescribing

Section 3: antimicrobial stewardship

- 1 Every independent prescriber must understand that:
 - 1.1 Antimicrobials need to be used responsibly to prevent the emergence and spread of antimicrobial resistance
 - 1.2 Optimizing antimicrobial use can limit the common side-effects and collateral damage related to treatment (e.g. their disruptive effects on the normal host flora, which may lead to *Clostridium difficile* infection, super-infection with *Candida* spp.)
 - 1.3 It is important to avoid unnecessary uses of antimicrobials, especially those with a broad spectrum
 - 1.4 Transmission of microorganisms in community and hospital settings can significantly amplify antimicrobial resistance
- 2 Every independent prescriber must understand local stewardship policies based on national (or international where these do not exist) evidence-based guidelines
- 3 Every independent prescriber must understand and engage with any locally or nationally agreed quality measures for assessing antimicrobial prescriptions (e.g. compliance with guidance, adverse events, reviews of antibiotic therapy at 48–72 hours in hospitalized patients)
- 4 Every independent prescriber must know how to communicate with patients and their carers, nurses, pharmacists and other healthcare professionals about:
 - 4.1 When antimicrobials are not needed
 - 4.2 Complying with the duration and frequency of administration of their prescribed antimicrobials
- 5 Every independent prescriber must recognize that it is a duty of care to co-operate with others more expert than oneself, such as the antimicrobial stewardship team, when such expertise is needed

This, the first set of internationally agreed generic competencies in AMPS for all independent prescribers in Europe, has several potential uses. The competencies can be used by regulators and professional bodies to inform standards [5,15]; by undergraduate and postgraduate educators to design curricula, create teaching materials and assess outcomes [16,17]; and by individuals to monitor their own competency. Where relevant, ideally these uses would be in conjunction with any existing competencies on infection prevention and control, and vaccine use.

The WHO recently published a competency framework for health workers' education and training on AMR [15], developed through a global mapping of education and training resources and refined through expert consultation. We shared an early draft of our competencies with those leading the process, and this is referenced in the final publication. We believe that our final competencies set complements this framework, and there is indeed overlap on several points. Nonetheless, a few differences should be recognized. A major difference is that we followed a structured consensus methodology, in which each expert panel member is provided with an equal voice, and in which we attempted to have equal representation across a large number of European countries. Furthermore, our focus was narrower in terms of target groups and content: our set is primarily intended for prescribers in European countries (a more homogeneous group than all prescribers globally), and our set is restricted to AMPS, rather than broader aspects related to AMR (infection prevention and control, surveillance, leadership). Consequently, many individuals in Europe whose primary focus is AMPS may find it easier to make immediate use of our set.

Over the coming years ESCMID and ESGAP will support efforts to implement these *ESCMID generic competencies in antimicrobial prescribing and stewardship*, including encouraging other professional societies to tailor the competencies set to their members' needs. Such adaptations could include adding further competencies, for example competency points that were excluded in our consensus process because they were considered relevant to specific groups of prescribers, rather than to all independent prescribers (see [Supplementary material, Appendix S3, List S2](#)). Although the competencies set was developed for European countries, we believe that the majority of the accepted competencies are relevant to prescribers working in a far broader range of

settings, as evidenced by the overlap with the WHO competency framework. The timing of these initiatives is particularly urgent given the ever-increasing threats of AMR to effective antimicrobial therapy and the need for global activity to prevent and combat its spread [3,18].

Transparency declaration

The authors declare that they have no conflicts of interest.

Funding

This work was supported through an ESCMID Study Group research fund grant (number 307–18).

Acknowledgments

The ESCMID generic competencies working group consisted of: Diane Ashiru-Oredope, István Barcs, Hege Salvesen Blix, Franky Buyle, Michal Chowers, Milan Čizman, Barry Cookson, Jose Luis Del Pozo, Aleksander Deptula, Uga Dumpis, Dragos Florea, Ewoudt van de Garde, Yuval Geffen, Christian G. Giske, Santiago Grau, Edit Hajdú, Markus Hell, Łukasz Hondo, Khetam Hussein, Benedikt Huttner, Winfried Kern, Solen Kernéis, Viviane Knepper, Diamantis Kofteridis, Tomi Kostyanev, Ed Kuijper, Hristina Lebanova, Russell Lewis, Claire Marantidis Cordina, Raimonda Matulionyte, Florian Maurer, Peter Messiaen, Jolanta Miciuleviciene, Aleš Mrhar, Margje Nabuurs-Franssen, Reinout Naesens, Cynthia Oxacelay, Leonardo Pagani, José Ramón Paño-Pardo, Mical Paul, Georgios Petrikkos, Catherine Pluess-Suard, Gabriel Adrian Popescu, Ulla Porsche, Jan Prins, Céline Pulcini, Jordi Rello, Jesús Rodríguez-Baño, Gian Maria Rossolini, Bernd Salzberger, Katja Seme, Gunnar Skov Simonsen, Mardale Sînziana, Sissel Skovgaard, Ingrid Smith, Ute Sönsken, Alex Soriano, Inese Sviestīņa, Emese Szilagyi, Thomas Tängdén, Pierre Tattevin, Constantinos Tsiouts, Aija Vilde, Monika Wanke-Rytt, Agnes Wechsler-Fördös and Peter Zarb. We would like to acknowledge the following individuals and study groups who contributed to the consultative process within ESCMID that led to the competencies set used as the basis of this study: ESGAP (Barry Cookson, Bojana Beović, Diane Ashiru-Oredope, Céline Pulcini, Dilip Nathwani); ESGNI (Markus Hell); ESGIAI (Alex Soriano); ESGIE

(Mical Paul); ESGCIP (Jordi Rello); ESGBIS (W. Joost Wiersinga); ESGCD (Ed Kuijper); ESCMID executive committee (Evelina Tacconelli, Jesús Rodríguez-Baño). We also thank Jeroen Schouten for chairing the expert panel meeting. A poster describing the results of this study was presented at the 28th European Congress of Clinical Microbiology & Infectious Diseases, in Madrid, Spain, on 23 April 2018.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cmi.2018.09.022>.

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