**Supplementary materials, Appendix S3:**

**Table S1.** Expert panel members, by country

|  |  |  |
| --- | --- | --- |
| **Country** | **Number of participants in expert panel** | **Grouping for regional sub-group analysis** |
| Austria | 3 | South and East |
| Belgium | 4 | North and West |
| Bulgaria | 1 | South and East |
| Cyprus | 2 | South and East |
| Denmark | 2 | North and West |
| France | 3 | North and West |
| Germany | 3 | North and West |
| Greece | 1 | South and East |
| Hungary | 3 | South and East |
| Israel# | 4 | South and East |
| Italy | 3 | South and East |
| Latvia | 3 | South and East |
| Lithuania | 2 | South and East |
| Luxembourg | 2 | North and West |
| Malta | 2 | South and East |
| Netherlands | 4 | North and West |
| Norway\* | 3 | North and West |
| Poland | 3 | South and East |
| Romania | 3 | South and East |
| Slovenia | 3 | South and East |
| Spain | 6 | South and East |
| Sweden | 2 | North and West |
| Switzerland\* | 2 | North and West |
| United Kingdom | 2 | North and West |

Footnotes:

1. The countries included are all members of the European Union, or European Free Trade Association countries\*, or Turkey#, Israel#

2. No country coordinator could be identified for: Liechtenstein, Portugal or Slovakia. A potential country coordinator was identified but did not reply to the invitation to act as a country coordinator for: Croatia, Czech Republic, Estonia, Finland, Iceland, Ireland, Turkey.

**Table S2.** Backgrounds of expert panel members.

|  |  |  |
| --- | --- | --- |
| **Item** | **Response** | **N (%)** |
| Professional background | *Medical doctor* | 47 (72) |
|  | *Pharmacist* | 14 (22) |
|  | *Other* | 4 (6) |
| Specialty | *Infectious diseases* | 33 (51) |
|  | *Clinical microbiology* | 18 (28) |
|  | *Public Health* | 4 (6) |
|  | *Clinical pharmacy* | 2 (3) |
|  | *Primary care* | 1 (2) |
|  | *Other/non-clinical* | 7 (11) |
| Member of antimicrobial stewardship team | *Yes* | 49 (75) |
|  | *No / not applicable* | 16 (25) |
| Involved in teaching undergraduates or postgraduates on antimicrobial prescribing or stewardship | *Yes* | 57 (88) |
|  | *No* | 8 (12) |

**List S1.** Competencies set accepted by expert panel in final review round

**Section 1: Core concepts in microbiology, pathogenesis and diagnosing infections**

1.1. Every independent prescriber must demonstrate that s/he understands **the nature and classification of micro-organisms that commonly cause infections in humans**.

1.2 Every independent prescriber must demonstrate that s/he understands **the common microbiology aetiology of human infections**.

1.3 Every independent prescriber must demonstrate that s/he understands **the differences between colonisation (e.g. isolation of bacteria from venous leg ulceration with no signs of inflammation) and infection**.

1.4 Every independent prescriber must demonstrate that s/he understands**that an inflammatory response can be due to both infectious and non-infectious causes (e.g. acute pancreatitis)**.

1.5 Every independent prescriber must demonstrate that s/he understands **the ways in which micro-organisms are commonly acquired in community and hospital settings**.

1.6 Every independent prescriber must demonstrate that s/he understands **that transmission of micro-organisms in community and hospital settings can significantly amplify antimicrobial resistance**.

1.7 Every independent prescriber must demonstrate that s/he understands **how to take a thorough history and perform a physical examination to diagnose common infections and to assess their severity**.

1.8 Every independent prescriber must demonstrate that s/he understands **how to use and interpret investigations that can help inform diagnosis of an infection (e.g. microbiological investigations, biomarkers, point-of-care tests)**.

1.9 Every independent prescriber must demonstrate that s/he understands **how to use and interpret investigations (e.g. microbiological investigations, biomarkers, point-of-care tests) that can help in monitoring the response to treatment of infections**.

1.10 Every independent prescriber must demonstrate that s/he understands **that antimicrobials need to be used responsibly to prevent the emergence and spread of antimicrobial resistance**.

1.11 Every independent prescriber must demonstrate that s/he understands that **optimising antimicrobial use can limit the common side effects and collateral damage related to treatment (e.g. their disruptive effects on host normal flora, which may lead to *Clostridium difficile* infection, super-infection with *Candida spp.*)**.

**Section 2: Antimicrobial prescribing**

2.1 Every independent prescriber must demonstrate that s/he understands **when not to prescribe antimicrobials (e.g. antibiotics for viral infections, or when there is bacterial colonisation)**.

2.2 Every independent prescriber must demonstrate that s/he understands**best practices for some infections may not include antimicrobial treatment (e.g. incision and drainage of abscesses, removal of foreign material).**

2.3 Understands **the importance of avoiding the unnecessary use of antimicrobials, especially those with a broad-spectrum**.

2.4 Every independent prescriber must demonstrate that s/he understands **key elements of initiating prescribing an antimicrobial (indicated below)**, and uses this knowledge when prescribing:

* the choice and dose of agent
* the route of administration
* the timing of antibiotic administration in different situations (e.g. as soon as possible for life-threatening infections, less urgently for chronic bone infections)
* obtaining relevant microbiological cultures or relevant tests before commencing treatment
* the duration of treatment
* the review dates
* the stop dates

2.5 Every independent prescriber must demonstrate that s/he understands**the key elements of a logical approach to continuation and rationalisation of antimicrobial therapy (indicated below)**:

* adjusting doses (e.g. for patients with renal impairment), and where to seek advice about this
* monitoring antibiotic levels when indicated, and where to seek advice about this
* reviewing antibiotic therapy at 48 to 72h and regularly thereafter in hospitalised patients, and in appropriate situations in the community
* switching antibiotics from intravenous to oral administration as soon as possible when indicated (according to guidelines)
* changing antibiotics, ideally to a narrower spectrum (de-escalation) or broader (escalation), according to microbiology results and clinical condition
* stopping antibiotics if there is no evidence of infection based on clinical findings and investigations e.g. negative microbial cultures, imaging reports

2.6 Every independent prescriber must demonstrate that s/he understands **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**.

2.7 Every independent prescriber must demonstrate that s/he understands **single prophylactic antimicrobial dosing for surgical and other procedures for which prophylaxis has been shown to be effective**, and uses this knowledge when prescribing.

2.8 Every independent prescriber must demonstrate that s/he understands **that additional prophylactic antimicrobial doses can be needed (e.g. when the duration of the operation/procedure is prolonged)**.

2.9 When prescribing an antimicrobial, every independent prescriber must demonstrate that s/he **knows which antimicrobial class the agent belongs to, and that s/he understands the contraindications to its use.**

2.10 **If prescribing by trade name, every independent prescriber must know the generic name and class of antimicrobial being prescribed.**

2.11 Every independent prescriber must demonstrate that s/he understands**the clinically relevant spectrum of activity for commonly prescribed antimicrobials**, and uses this knowledge when prescribing.

2.12 Every independent prescriber must demonstrate that s/he understands **the basic principles of pharmacokinetics and pharmacodynamics**, and uses this knowledge when prescribing.

2.13 Every independent prescriber must demonstrate that s/he understands**common antimicrobial and drug/food interactions**, and uses this knowledge when prescribing.

2.14 Every independent prescriber must demonstrate that s/he understands **common side-effects of antimicrobials, including allergy**, and uses this knowledge when prescribing.

2.15 Every independent prescriber must demonstrate that s/he understands **how to monitor for common side-effects**, and uses this knowledge when prescribing.

2.16 Every independent prescriber must demonstrate that s/he understands **what to do when common side-effects of antimicrobial therapy are suspected (e.g. documenting allergic reactions in patient records, reporting side-effects)**.

2.17 Every independent prescriber must demonstrate that s/he understands **how to select the appropriate antimicrobial, using relevant guidance when possible**, and uses this knowledge when prescribing.

2.18 Every independent prescriber must demonstrate that s/he understands **how and where to access relevant guidance on antimicrobial prescribing and stewardship**, and uses this knowledge when prescribing.

2.19 Every independent prescriber must demonstrate that s/he understands**that empirical treatment should be guided by local antimicrobial susceptibility patterns**.

2.20 Every independent prescriber must demonstrate that s/he understands **any legal requirements for prescribing antimicrobials in their country, and complies with these when prescribing.**

**Section 3: Antimicrobial stewardship**

3.1 Every independent prescriber must demonstrate that s/he understands **local stewardship policies based on national (or international where these do not exist) evidence-based guidelines**.

3.2 Every independent prescriber must demonstrate that s/he understands**and engages 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 to 72h in hospitalised patients)**.

3.3 Every independent prescriber must demonstrate that s/he **knows how to communicate with patients and their carers, nurses, pharmacists and other healthcare professionals about (indicated below):**

* when antibiotics are not needed
* complying with the duration and frequency of administration of their prescribed antimicrobials

3.4 Every independent prescriber must **recognise 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**.

**List S2.** Competency points not selected for inclusion

**Section 1: Infection: diagnosis, prevention and control**

1. Every independent prescriber must demonstrate that s/he understands **the mechanisms of antimicrobial resistance,** and uses this knowledge when prescribing.

*Median score = 6*

2. Every independent prescriber must demonstrate that s/he understands **whether mechanisms of antimicrobial resistance are intrinsic or acquired,** and uses this knowledge when prescribing.

*Median score = 6*

3. Every independent prescriber must demonstrate that s/he understands **the potential for vaccines undergoing assessment to reduce the need for prescribing antimicrobials for hospital pathogens e.g. *Clostridium difficile, Staphylococcus aureus*.**

*Median score = 5*

4. Every independent prescriber must demonstrate that s/he understands **selection advantages (e.g. the greater ability for some micro-organisms to colonise, change in their ability to cause disease)**, and uses this knowledge when prescribing.

*Median score = 7*

5. Every independent prescriber must demonstrate that s/he understands **the modes of action of antibiotics and other antimicrobials**, and uses this knowledge when prescribing.

*Median score = 7*

6. Every independent prescriber must demonstrate that s/he understands **the use of microbiological investigations, other investigations (including biomarkers), and more rapid methods, to diagnose infections for public health purposes**, and uses this knowledge when prescribing.

*Median score = 7*

4. Every independent prescriber must demonstrate that s/he understands **the principles and practice of the prevention and control of infection**, and uses this knowledge when prescribing.

*Median score = 7*

5. Every independent prescriber must demonstrate that s/he understands **national evidence-based guidelines on the prevention and control of infection**, and uses this knowledge when prescribing.

*Median score = 7*

6. Every independent prescriber must demonstrate that s/he understands **local guidance documents on the prevention and control of infection**, and uses this knowledge when prescribing.

*Median score = 8*

7. Every independent prescriber must demonstrate that s/he understands **the need to have prevention and control of infection reflected in individual job descriptions**.

*Median score = 7*

8. Every independent prescriber must demonstrate that s/he understands **how current vaccines can reduce the need for prescribing antimicrobials e.g. for *Streptococcus pneumoniae***, which can lead to a decrease in resistant microbial strains.

*Median score = 7*

**Section 2: Antimicrobial prescribing**

1. Every independent prescriber must demonstrate that s/he understands **when to use a delayed antimicrobial prescription,** and uses this knowledge when prescribing.

*Median score = 7*

2. Every independent prescriber must demonstrate that s/he understands **how to negotiate use of a delayed antimicrobial prescription with the patient,** and uses this knowledge when prescribing.

*Median score = 7*

3. Every independent prescriber must demonstrate that s/he understands **key elements of initiating prescribing an antimicrobial (indicated below)**, and uses this knowledge when prescribing:

* **knowing where to find information on the costs of different antimicrobial treatments** (55% agree to include)
* **the generic and local trade names of available antimicrobials** (43% agree to include)

*[Note: the competency was selected, however these specific sub-points were excluded]*

4. Every independent prescriber must demonstrate that s/he understands **the key elements of a logical approach to continuation and rationalisation of antimicrobial therapy (indicated below)**, and uses this knowledge when prescribing:

* consider, if indicated, Outpatient Parenteral Antibiotic Therapy (OPAT) (37% agree to include)

*[Note: the competency was selected, however this specific sub-point was excluded]*

5. Every independent prescriber must demonstrate that s/he understands **that the use of broader spectrum antimicrobials does not lead to better patient outcomes unless a patient has risk factors for antimicrobial resistance.**

*Newly suggested at face-to-face meeting, not selected for assessment by full expert panel*

**Section 3: Antimicrobial stewardship**

1. Every independent prescriber must demonstrate that s/he understands

**how the use of the results of the following can inform, in a timely manner, best antimicrobial prescribing practices, and so produce sustained improvements in the quality of patient care:**

* Adverse event monitoring (69% agree to include)
* Laboratory susceptibility reports (89% agree to include)
* Antimicrobial prescribing audits (68% agree to include)
* Antimicrobial usage data (57% agree to include)

*[Note: the entire competency had a median score of 8, but was excluded. Laboratory susceptibility reports for individual patients were considered to be covered in other selected competencies]*

2. Every independent prescriber must **take part in continuing professional development in antimicrobial prescribing and stewardship by:**

* Engaging the views of others involved in antimicrobial treatment policy decisions including championing best practice (49% agree to include)
* Engaging regularly in team-based measurement of the quality and quantity of antimicrobial use (66% agree to include)
* Understanding that measurements of the quality and quantity of antimicrobial use should be shared with prescribers (74% agree to include)
* Understanding that measurements of the quality and quantity of antimicrobial use inform antimicrobial surveillance/infection prevention and control measures (68% agree to include)

*[Note: the competency was selected, however these specific sub-points were excluded]*