EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

TECHNICAL REPORT

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This report was sent for consultation to The Project Advisory Group - a multidisciplinary group consisting of representatives of each EU/EEA country as well as representatives of EU health professional organisations.

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Abbreviations

AMR	Antimicrobial resistance
EAAD	European Antibiotic Awareness Day
EEA	European Economic Area
EU	European Union
IPC	Infection, Prevention and Control
PAG	Project Advisory Group
PHE	Public Health England
WHO	World Health Organization

Executive summary

This report presents the results of the first multi-country and multi-professional study on the knowledge, attitudes and behaviours of healthcare workers regarding antibiotics[1], antibiotic use and antibiotic resistance across 30 European Union (EU) and European Economic Area (EEA) countries. While several studies have assessed the knowledge, attitudes and behaviours of the general public, healthcare students and individual professional groups in EU Member States, there is a lack of literature on the topic which considers the full breadth of healthcare workers.

Understanding the barriers to prudent antibiotic use is vital in order to develop and deliver interventions that increase awareness and knowledge and ultimately change behaviour on antibiotic use. Based on the COM-B behavioural change model - a theoretical framework that can be used for understanding and changing behaviour - the study sought to understand the Capabilities (C), Opportunities (O) and Motivations (M) which enable prudent Behaviour (B) on antibiotic use amongst healthcare workers in EU/EEA countries. The survey findings can support strategies for policy development, education and communication campaigns targeting healthcare workers that aim to address prudent use of antibiotics, and prevention and control of antibiotic resistance in the EU/EEA.

A questionnaire was developed following a systematic literature review and a two-round modified Delphi consensus process with a Project Advisory Group (PAG) (consisting of designated country representatives and selected European health professional organisations/groups). The questionnaire was piloted across EU/EEA countries before translation into the 24 official EU languages and Norwegian.

A quota sampling approach based on the EU healthcare personnel statistics per profession and country was used to determine the target survey sample size for each country and professional group. A sample of 0.2% of the workforce was sought for each healthcare profession in each country, except for nursing professionals for whom, because of higher numbers, a sample of 0.1% of the workforce was sought. Based on these calculations, the target survey sample size was calculated as 11 929 for the EU/EEA overall.

The final questionnaire was distributed via an online survey tool by PAG members to healthcare workers in their respective countries, as well as promoted via social media with the hashtag #ECDCAntibioticSurvey. Participation was voluntary and the online questionnaire was open between 28 January to 4 March 2019.

Over 18 000 individuals responded to the questionnaire, thanks in part to the engagement of PAG members, who actively disseminated the link to the questionnaire within their professional circles. In total, 24 (80%) countries met or exceeded their target quota sample size. The number of respondents exceeded the target quota sample size for medical doctors, nursing professionals, dentists and pharmacists, but there was a lower response rate (55% of the calculated return requirement) for the group 'other healthcare professionals' that consisted of hospital managers, pharmacy/dental technicians and allied health professionals. This may have reflected the strong representation of certain professional groups amongst PAG members or differences in engagement between groups.

Medical doctors correctly answered all seven survey questions assessing knowledge of antibiotics, antibiotic use and antibiotic resistance more often than other healthcare professionals. Overall, the responding healthcare workers had good awareness and knowledge of the absence of effect of antibiotics in treating self-limiting conditions such as colds and influenza (97% correctly answered this question). However, there was less knowledge on the link between treatment with antibiotics and an increased risk of antibiotic-resistant infection (75%), as well as whether healthy people can carry antibiotic-resistant bacteria (88%). The three questions with the highest proportion of respondents providing the correct answer were consistent with the key messages that have been promoted across the EU/EEA for several years. However, the topics covered by the remaining four questions have not been actively promoted and could be considered in future campaigns.

Effective infection prevention and control measures are also critical to tackling antibiotic resistance, with 87% of respondents replying that they would perform hand hygiene, i.e. disinfect or wash hands, as often as recommended even if gloves had been used in contact with patients or biological material. This is in line with WHO recommendations. Nurses and nursing associates/technicians were the professions most likely to perform hand hygiene in this situation.

Healthcare workers highlighted a few key barriers to providing advice and education to patients including resource constraints and time pressures, along with difficulties in ensuring that patients understand what was being discussed/advised. Among those respondents who defined themselves as prescribers, the majority agreed that antibiotic resistance is an important factor to consider when treating patients. However, the survey highlighted that 'fear of patient deterioration or fear of complications' is a common driver for prescribing antibiotics even when the prescriber would have preferred not to.

[1] This survey focused on antibiotics, i.e. antibacterial agents, and resistance thereof, rather than on all antimicrobials.

A summary of the key findings and options for action at the EU/EEA level is presented below. It is important to note that the survey showed wide variation between EU/EEA countries in the knowledge, attitudes and behaviours of healthcare workers on antibiotics, antibiotic use and antibiotic resistance. Country-specific strategies and actions are therefore encouraged, some of which could be achieved through increased campaigning efforts, advisory and policy documents, stewardship programmes, healthcare worker-specific engagements, and the development of interventions informed by behaviour change theories and models.

Key findings at EU/EEA level

Demographics

In total, 18 506 participants responded to the survey. The majority (99%, n=18 365) were healthcare workers from across 30 EU/EEA countries, thus exceeding the calculated quota sample size of 11 929 respondents.

Most (97%) of the respondents were adults over the age of 25 years; 70% were women and 30% had worked in their profession for 25 years or longer.

The respondents predominantly practised in hospitals (49%) followed by community/primary healthcare settings (22%), pharmacies (10%), long-term care facilities (6%), public health institutes (4%), governmental organisations, industry or professional organisations (4%), academic settings (2%) and 'other settings' (<1%).

Only 28% of respondents stated that they were either contributing to, or leading on antimicrobial stewardship-related programmes[2], or directly tackling antibiotic resistance in their current role.

Capability

Overall, 96% of the respondents agreed or strongly agreed that they know what antibiotic resistance is, and 80% agreed or strongly agreed that they had sufficient knowledge on how to use antibiotics appropriately in their current practice. Only 58% of respondents were able to answer all seven knowledge questions correctly, with an average score of 6.35/7.

The knowledge statements 'Antibiotics are effective against viruses', 'Antibiotics are effective against cold and flu' and 'Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergies', had the highest proportion of respondents providing the correct answer (98%, 97% and 97%, respectively). The statement 'Unnecessary use of antibiotics makes them become ineffective' was answered correctly by 94% of respondents. The statements 'Healthy people can carry antibiotic resistant bacteria' and 'Antibiotic resistant bacteria can spread from person to person' had a lower percentage of respondents providing the correct answers (88% and 87%, respectively). The statement 'Every person treated with antibiotics is at an increased risk of antibiotic resistant infection' had the lowest proportion of respondents providing the correct answer (75%).

There was a wide variation (40–73%) across the 30 EU/EEA countries in the percentage of respondents answering all seven key knowledge questions correctly. No country had 100% of respondents achieve 7/7 in the knowledge score; although 21/30 countries had more than 50% of respondents answer all seven key knowledge questions correctly. The countries with the highest proportion of respondents answering all questions correctly were Croatia (73%) and Ireland (71%). The countries where less than 50% of respondents answered all seven questions correctly were Bulgaria, Denmark, Estonia, Greece, Hungary, Latvia, Malta and Slovakia. (NB. the professional mix of respondents was not the same in all the countries, with differing proportions of, for example, doctors and nurses. These differences could affect the overall knowledge score for a given country.)

Capability–One Health

Only 27% of respondents were aware that it is illegal in the EU to use antibiotics to stimulate growth in farm animals; 29% believed it was legal and 44% were unsure.

Capability–infection prevention and control (hand hygiene)

Only 56% respondents stated that they could list WHO's 'five moments for hand hygiene'. Nurses and nursing associates were the professions that were most aware of these (73%), and the most likely to perform hand hygiene even if using gloves when dealing with patients or biological material (96% and 92%, respectively). This proportion was significantly less for other healthcare workers.

[2] This is the only point in the questionnaire where we write 'antimicrobial' rather than 'antibiotic'. This is because these stewardship programmes cover all antimicrobials, including antibiotics.

Opportunities

Among respondents who said that they had direct patient or public involvement, 75% agreed or strongly agreed that they had easy access to guidelines on managing infections; 68% agreed or strongly agreed that they had easy access to materials to give advice on prudent antibiotic use and antibiotic resistance; and 72% agreed or strongly agreed they had good opportunities to provide advice on prudent antibiotic use and antibiotic resistance.

More than 75% of respondents from 14 countries stated that they had easy access to guidelines on managing infections.

Dentists were the professional group that had the lowest proportion who agreed or strongly agreed that they had easy access to guidelines on managing infections.

Motivation/attitude towards antibiotic resistance

Overall, most (89%) respondents agreed or strongly agreed that there was a connection between their prescribing/dispensing/administering of antibiotics and the emergence and spread of antibiotic-resistant bacteria, but only 58% agreed or strongly agreed they have a key role in helping control antibiotic resistance. The latter was higher for medical doctors than for any other profession.

This was confirmed when focusing on only respondents with direct patient or public involvement, of whom 92% agreed or strongly agreed that there is a connection between their prescribing/dispensing/administering of antibiotics and emergence and spread of antibiotic-resistant bacteria, but only 63% agreed or strongly agreed that they have a key role in helping control antibiotic resistance.

Behaviour/practice

Published guidelines and group training were reported as having the most influence on changing the views of respondents on avoiding unnecessary prescribing OR administering OR dispensing of antibiotics. The workplace and colleagues/peers had the least influence in changing a respondent's views.

For questions related to the frequency with which healthcare workers provided advice or gave out resources on prudent antibiotic use or management of infections in the week prior to the survey, many stated that they did not carry out such activities (20% did not provide advice and 51% did not give out resources).

Respondents who were unable to give out resources to patients on prudent antibiotic use or management of infections as frequently as they prescribed, dispensed or administered antibiotics indicated that this was due to lack of resources, insufficient time to provide this information to patients, or a lack of interest shown by patients in the information being provided.

Awareness of national initiatives and campaigns, and their perceived effectiveness

Overall, 41% of respondents agreed or strongly agreed there had been good promotion of prudent antibiotic use and information about antibiotic resistance in their country; 12 countries (Austria, Bulgaria, Cyprus, Czech Republic, Germany, Greece, Hungary, Italy, Latvia, Poland, Slovakia, Spain) had more respondents who disagreed or strongly disagreed than who agreed or strongly agreed that there had been good promotion of prudent antibiotic use and information about antibiotic resistance in their country.

Overall, only 27% of respondents agreed or strongly agreed that they believed that the national campaign had been effective in reducing unnecessary antibiotic use and controlling antibiotic resistance in their country; 33% of respondents disagreed or strongly disagreed with this statement. In 20 of the 30 countries, larger proportions disagreed or strongly disagreed (rather than agreed or strongly agreed) with this statement.

When assessing what antibiotic-related initiatives respondents were aware of within their individual countries, the most commonly cited examples were national or regional guidelines on management of infections, toolkits for healthcare workers, advertising for the public, and focused conferences/events.

Awareness of national action plans, European Antibiotic Awareness Day and World Antibiotic Awareness Week, and their perceived effectiveness

Overall, about half (52%) of respondents were unsure about whether their country had a national action plan on antimicrobial resistance (AMR) in place. Only eight countries (France, Ireland, Luxembourg, Norway, Portugal, Spain, Sweden, United Kingdom) had more than 50% of respondents who replied that their country had such a plan in place. In reality, 24 of the 30 EU/EEA countries had a national action plan on AMR in 2018, while the six remaining EU/EEA countries had a plan under development as per country self-assessments reported to WHO ,.

This indicates that healthcare workers' awareness of these initiatives significantly underestimates what actually exists.

Overall, only 32% respondents had heard of European Antibiotic Awareness Day (EAAD) and only 26% about World Antibiotic Awareness Week (WAAW).

Among the respondents who had heard of these campaigns, about half were undecided on their effectiveness in raising awareness about prudent use of antibiotics and antibiotic resistance in their country (52% for EAAD and 54% for WAAW). Only 27% (EAAD) and 21% (WAAW) believed that the campaigns had been effective or very effective in raising awareness about these issues in their country. There was wide variation between countries in the proportion of respondents who agreed about the effectiveness of the EAAD and WAAW campaigns.

A further analysis for those respondents who replied that they themselves currently have a role in contributing to or leading antimicrobial stewardship programmes, or in tackling AMR showed 59% had heard of EAAD and 48% had heard of WAAW, but most of the respondents in this group were also undecided (50% for EAAD and 53% for WAAW) on whether these campaigns had been effective in raising awareness about prudent use of antibiotics, and about antibiotic resistance in their country.

Resources for management of patients with infections

Clinical practice guidelines were the most frequently used resource by healthcare workers in influencing their management of infections (cited by 66% of all respondents), followed by 'previous clinical experience' (40%) and 'continuing education training courses' (33%) (more than one answer allowed for each respondent). Social media and the pharmaceutical industry (medical representatives or documentation) were the resources least used by healthcare workers. This order - i.e. clinical practice guidelines, previous clinical experience, continuing education training courses - was consistent regardless of setting, but it is worth noting that respondents in the pharmacy setting were the least likely (only 38%) to use clinical practice guidelines as a resource as compared to those working in other settings.

Use of social media

When asked which social media platform was most commonly used for professional activities (as opposed to personal use), the majority selected 'None' (42%), however from the list of social media platforms suggested in the survey, Facebook was the most commonly used platform (27%) while the second most popular platform varied across countries.

Topics respondents would like to receive more information on

When asked which topics respondents would like to receive more information on from a pre-defined list, 55% replied resistance to antibiotics; 47% links between the health of humans, animals and the environment; 42% how to use antibiotics; 32% medical conditions for which antibiotic are used; and 26% prescribing of antibiotics.

Although an option on communicating with patients was not provided in this pre-defined list, it was clear from other parts of this study that this would be an important area to consider for intervention.

Prescribers (capability, opportunity and motivation)

'Prescribers' are defined as those healthcare professionals who prescribe medications for patients; they are distinct from those who may, for example, administer the drugs or who otherwise have patient contact. The majority (90%) of responding prescribers agreed or strongly agreed that they considered antibiotic resistance when treating a patient, and that they personally have a key role to play in helping control antibiotic resistance (90%). A smaller proportion of prescribers (77%) were also confident when making antibiotic prescribing decisions.

Whilst most prescribers (85%) agreed or strongly agreed they had easy access to antibiotic guidelines they need to treat infections, only 69% were confident in the antibiotic guidelines that were available to them.

Regarding prescribers' motivations to initiate antibiotic prescriptions, 31% of prescribers said they would have preferred not to prescribe an antibiotic at least once in the week prior to completing the survey, but did so anyway. The most common reason for this was 'fear of patient deterioration or fear of complications': 43% reported that these fears affected their prescribing decision at least once per week, and 11% at least once per day. This varied across countries, with the highest proportion stating such fears as a factor for initiating prescribing at least once a week reported in Slovakia, and the lowest proportions in the Netherlands and Sweden. Other drivers included an uncertain diagnosis (26%); impossible to follow up on the patient (23%); limited time to explain the reason why antibiotic is not indicated (10%); and maintaining the patient relationship (8%).

Prescribers in hospitals prescribed antibiotics even when they would have preferred not to more frequently than their peers working at community/primary healthcare level (51% of all respondents during the week prior to the survey compared to 40% respectively). Similarly, 82% of hospital prescribers prescribed antibiotics during the week prior to the survey because it took less time than to explain the reason why they would not, compared to 72% working in community/primary healthcare. However, community/primary healthcare prescribers prescribed an antibiotic more often during the week prior to the survey in order to maintain the relationship with the patient than hospital-based prescribers (87% compared to 72% respectively)

The top three strategies that prescribers said they use to prescribe antibiotics prudently (selected from a pre-defined list), were patient education (65% of all respondents), new patient consultations (51%), and delayed or back-up prescribing (39%).

Conclusions and options for action

Based on the findings from the study, the following action points are suggested for consideration:

- Educational training and communication initiatives on antibiotics, antibiotic use and antibiotic resistance for healthcare workers in Europe should take into account the findings of this study, particularly when developing curricula, content and materials.
- Interventions for healthcare workers based on education and/or the provision of resources and guidelines should be designed and evaluated with a focus on the promotion of prescribing, dispensing and administering behaviours that lead to prudent antibiotic use. One suggested model is the 'Antibiotic Guardian' strategy [https://antibioticguardian.com/], which works through the principle of pledging.
- Particular attention should be paid to those groups of healthcare workers with sub-optimal knowledge, or a self-perception that they do not have sufficient knowledge or skills, on how to work appropriately with antibiotics in their current practice.
- Ongoing training for healthcare workers with direct patient contact is needed, particularly to enhance communication skills and hand hygiene practices.
- Develop new and/or expand existing educational materials aimed at healthcare workers to ensure that the following topics/statements are covered: the development and spread of antibiotic resistance; 'Every person treated with antibiotics is at an increased risk of antibiotic resistant infection'; 'Antibiotic resistant bacteria can spread from person to person'; and 'Healthy people can carry antibiotic resistant bacteria'.
- Barriers to providing patients with written resources on antibiotics and antibiotic resistance should be addressed. Existing patient brochures covering topic such as 'When should I worry?' and 'Treating Your Infection' summarising the likely duration of self-limiting infections and offering advice on when to re-consult with a health professional along with self-care recommendations are examples of patient resources that could be promoted for use by healthcare professionals across the EU/EEA countries, or adapted as appropriate for local/national contexts.
- The effectiveness of an intervention on antibiotic prescribing depends to a large extent on the particular prescribing behaviour as well as any barriers to change that may exist within the targeted community. Multi-faceted interventions occurring on multiple levels can only be effective after addressing locally existing barriers.
- There is a need to address the factors that influence prescribers to prescribe even where they think it is not clinically necessary. Qualitative research in particular, may improve the understanding of these factors and contribute to the development of interventions to effectively address these factors.
- When considering interventions to change behaviours, it would be important to evaluate their effectiveness, thereby ensuring a process of continual improvement. Countries could consider using the data from this study as a baseline for such evaluations, and use the survey tool as a means of assessing changes in the different variables that have been measures.

Background

Scale of the issue

Antimicrobial resistance and infections with antimicrobial-resistant miccroorganisms are becoming an increasingly dominant threat to healthcare both across Europe and the globe. Although there is a level of AMR that occurs due to natural selection and mutations, two main factors - i.e. overuse and misuse of antimicrobials and sub-optimal infection prevention and control (IPC) practices - are driving levels of AMR to worrying levels in many parts of the world [1]. The scale of the problem was quantified in a report published in 2016 which highlighted that infections with antimicrobial-resistant miccroorganisms are responsible for at least 700 000 deaths per year globally [2]. Further, if the current trajectory continues, projections indicate that infections with antimicrobial-resistant microorganisms could be responsible for 10 million deaths per year by the year 2050, and with a potential annual economic cost of over USD 1 trilllion by 2030 [2, 3]. Infections such as healthcare-associated infections, tuberculosis and gonorrhoea are becoming increasingly difficult to treat because the microorganisms responsible for these infections are resistant to antimicrobials [1]. In 2015, the World Health Organisation (WHO) Member States adopted a Global Action Plan on AMR, outlining key objectives to be met and providing a framework under which national action plans could be developed to tackle this issue. The plan underscores the need for collaboration between the human, animal, food and environmental sectors to establish a 'one-health' approach to tackling AMR [4]. This highlights the necessity of setting in place guidelines, measures and action plans to combat AMR, regardless of the socioeconomic level of the country.

In the European Union (EU) and European Economic Area (EEA), variations exist between countries on antimicrobial use, prevalence of AMR, and the level of implementation of actions and policies to tackle AMR. Overall, an estimated 1.5 billion Euros is spent annually on healthcare costs and loss of productivity due to AMR [1]. A study published in 2018 highlighted that each year 33 000 people die as a diret consequence of an infection with an antibiotic-resistant bacterium [5]. At country-level, this same study found that Italy and Greece had a vastly higher estimated health burden due to infections with antibiotic-resistant bacteria than other EU/EEA countries, highlighting the need to tailor strategies at country level [5].

Although the misuse or overuse of antimicrobials, particularly in human health, is a multifactorial issue. A lack of understanding and clarity about prudent antibiotic use and the spread of antimcirobial-resistant microorganisms, as well as relevant social and cultural factors, constitute important barriers to the prevention and control of AMR [6-8]. Therefore, increasing awareness, knowledge and understanding of AMR through effective communication, education and training as well as interventions which aim to change behaviour is essential [1-4, 6-8]. Of equal importance are effective IPC policies. Strategies for preventing infection in the first instance reduce the possibility of disease and, subsequently, any need for treatment, including possibly with antibiotics [1]. Establishing key strategies that target these drivers are essential in order to bring about any sustainable impacts on AMR.

Previous studies and current evidence

A number of studies assessing knowledge and awareness of AMR have been conducted. Eurobarometer surveys carried out since 2010 have assessed knowledge of AMR among the general public across EU Member States and showed that the level of awareness and knowledge of the relationship between the use of antimicrobials and the development and spread of AMR is low [9-11]. The most recent Eurobarometer, published in 2018, noted that since the 2016 survey there has been a small improvement in the knowledge of Europeans about AMR [9]. The European Action Plan highlights the fact that a lack of awareness on the importance of prudent use of antimicrobials and of AMR was a major cause for inappropriate use of antimicrobials in humans and animals, and more needs to be done to raise awareness of and education on AMR [1]. The European action plan recommended that EU-level communication initiatives should support Member States in improving public and professional understanding of AMR, promote prudent use and support more informed clinical decision-making and judicious prescribing.

While previous multi-country/EU-wide studies have focused on the knowledge and attitudes of the general public [9-11] regarding antibiotics (i.e. antibacterial agents rather than all antimicrobials) and antibiotic resistance, there is a paucity of literature focused on healthcare workers and professionals. This is particularly important because healthcare workers play a critical role in the use of antimicrobials, education of patients, and reducing the spread of infections in healthcare settings, especially where they are directly involved in the management of infections through prescribing, dispensing and/or administering antimicrobials [7]. Across the EU/EEA, most of the epidemiological and clinical burden of infections with antibiotic-resistant bacteria is associated with healthcare [12], and over 50% of healthcare-associated infections are estimated to be preventable, highlighting the importance of focusing on healthcare workers [12].

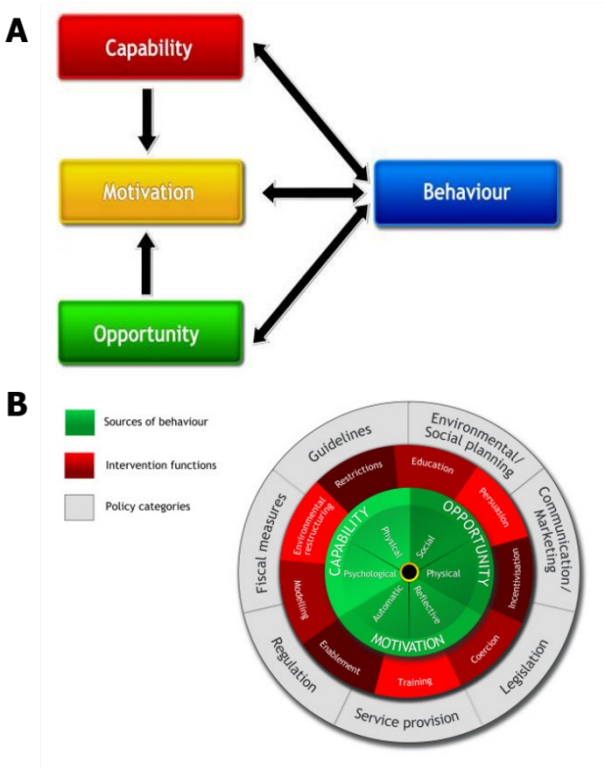
There is a good theoretical understanding that interventions that can influence antibiotic prescribing behaviours have the capacity to reduce antibiotic resistance. A literature review carried out as part of this project aimed to elucidate the available evidence on the knowledge (capability), opportunities and attitudes (motivations) of healthcare workers on antibiotics, antibiotic use and antibiotic resistance. The articles reviewed highlighted the factors that most influence healthcare workers' behaviours with regard to antibiotic resistance include insufficient or inadequate knowledge, information, education, training, and supervision by senior colleagues. The review also found that the focus of the studies reviewed was either profession- or country-specific, highlighting the need for a Europe-wide study that includes the full range of healthcare workers.

Link between behaviour and tackling AMR

The 'behaviour change wheel' was selected as the theoretical basis for this study. It was developed, following a systematic search of electronic databases and a consultation process with behaviour change experts, to meet three criteria: comprehensiveness, coherence, and a clear link to an overarching model of behaviour. The behaviour change wheel does not provide a detailed design for behaviour change interventions, but it does provide a systematic and theoretically guided method for identifying the types of interventions and supporting policies that can be expected to be effective for a given behaviour [13,14].

The behaviour change wheel model used in this study is based on a system where 'capability', 'opportunity', and 'motivation' interact to generate behaviour that in turn influences these components. This model is called the 'COM-B model' (Figure 1). Interventions need to change one or more of the three components in such a way as to put the system into a new configuration and minimise the risk of a former, undesired behaviour reverting. Surrounding the hub (the COM-B model) is a layer of nine intervention functions that can be selected from based on the COM-B analysis undertaken. The outmost layer of the wheel identifies seven policy categories that can help support the delivery of these intervention functions. The behaviour change wheel highlights the sources of the behaviour that could prove fruitful targets for interventions by providing a framework for behavioural exploration, along with a further framework for intervention development and implementation.

Figure 1. The relationship between capability, motivation, opportunity and behaviour as represented by the COM-B behaviour model [14]



- *Capability is defined as the psychological and/or physical ability to engage in a behaviour*
- *Motivation includes the want or need to perform the behaviour more than any other competing behaviours at that moment. This is driven by both reflective and automatic brain processes.*
- *Opportunity includes physical and social factors that are external to the individual and that make their behaviour possible or prompted.*

With more than 2 800 citations in the scientific literature, the behaviour change wheel, including the COM-B model, has been widely adopted as a means of characterising and designing behaviour change interventions.

Based on the COM-B behavioural model, the literature provides good evidence of strong 'capability' amongst healthcare professionals while also identifying a lack of 'opportunity' as the key underlying factors impacting prescribing behaviour [15-18]. Opportunity in the form of adherence and access to guidelines is also seen as one of the critical determinants of appropriate prescribing [17]. One study assessing antimicrobial prescribing practice among junior doctors cites the need for appropriate support and organisational structures for clinicians. It showed that a high proportion of junior doctors reported prescribing antimicrobials without senior supervision, while also facing challenges in accessing help when required, especially during weekends and nights [16]. This outlines the influence that years of experience and organisational structures can have on prescribing behaviours, as well as the need for early education of healthcare professionals in addition to easily accessible resources to support prescribing in practice.

It is argued that clinicians may feel a conflict between the need to address antibiotic resistance and the necessity of avoiding a negative outcome in their patient due to their prescribing. As the problem of antibiotic resistance may be perceived as a distant problem with the consequences of antibiotic prescribing far removed, the patients' distress and clinical decline are often seen as more immediate factors that can influence a prescribers' decision [15].

Much of the literature available has focused [15-18] exclusively on physicians, with only one qualitative, multi-professional study, that looked at antibiotic prescribing in long-term care facilities [18]. This study interviewed 37 healthcare professionals (10 general practitioners, 4 consultants, 14 nurses, 9 pharmacists) working in long-term care facilities, and found that factors such as 'Environmental context and resources', 'Social influences' and 'Beliefs about consequences' [7,14] are vital components which require attention for effective antimicrobial stewardship programmes.

While there is consensus across the literature on the focus areas needed for developing antimicrobial stewardship interventions that will elicit changes in behaviours, the perspective is generally from physician prescribers with limited evidence on the potential role of other healthcare professionals. We sought to address this gap in the literature through a multi-professional study based in multiple countries, which would allow for a more systematic and targeted approach to intervention development in different settings.

In 2018, WHO published its Competency Framework for Health Workers' Education and Training on AMR, which sought to support healthcare workers to acquire sufficient training and education on AMR. This framework was required because healthcare workers and students frequently cited a lack of understanding and/or expertise as barriers to their promoting prudent antibiotic use [19]. Aimed at the country level, this framework acts as a reference guide that is designed to be applied locally. It divides healthcare workers into four distinct categories - all healthcare workers; prescribers of antimicrobials; non-prescribers of antimicrobials; and public health officers and health service managers - and it is structured to show what level of knowledge and skills each category of healthcare worker should be able to demonstrate. There are four main AMR domains identified by WHO: building awareness of AMR; appropriate use of antimicrobials; infection prevention and control; and diagnostic stewardship and surveillance [19].

Within the WHO competency framework, demonstrable competences are further broken down by skills, knowledge and attitudes necessary to tackle AMR, therefore it is important to establish how each competency is influenced.[9]. Understanding the capability, opportunity, motivation and behaviours (COM-B) that are barriers to prudent antibiotic use is vital in order to develop and deliver suitable interventions. Having the physical and psychological skills (capability) necessary to enact the behaviour, the reflective and automatic mechanisms (motivation) to enable or block the behaviour, and the physical and social factors (opportunity) to promote or inhibit the behaviour are all determining factors on behaviour [14]. By identifying the barriers and enablers related to antimicrobial use and the spread of AMR, sources of behaviour can be targeted through interventions aimed at effecting change.

In this survey, we focused specifically on antibiotics (i.e. antibacterial agents rather than all antimicrobials), and we used the COM-B model to strengthen the evidence base regarding healthcare workers' knowledge and awareness of antibiotics, antibiotic use and antibiotic resistance, thereby filling an important gap in the evidence for policy and practice aimed at combatting AMR.

Objectives

In 2018, the European Centre for Disease Prevention and Control (ECDC) procured the services of Public Health England (PHE) to lead the coordination of a survey of healthcare workers' knowledge, attitudes and behaviours on antibiotics, antibiotic use and antibiotic resistance, as part of its delivery of the European Antibiotic Awareness Day initiative.

The objectives of the project were for ECDC to:

- gain a better understanding of healthcare workers' knowledge and perceptions in order to provide an evidence base to support future needs in terms of policy and education changes
- obtain information to contribute to the evaluation of communication campaigns targeting healthcare workers.

The survey was to include all EU Member States as well as Norway and Iceland (Table 1), and it requested information on:

- knowledge of antibiotic use and antibiotic resistance among healthcare workers
- access to resources on advice regarding antibiotic use or antibiotic resistance (e.g. leaflets or pamphlets)
- management of infections
- awareness and effectiveness of country-specific, regional and global antibiotic awareness campaigns, action plans and training opportunities.

Having a study that assesses the knowledge and attitude of healthcare workers, along with any related factors influencing behaviours, not only increases the information available in this area but also enables organisations such as ECDC to consider relevant Europe-wide resources and activities to address any relevant findings.

Methods

Survey development

European level professional and national organisations, in addition to representatives from individual countries, were invited to participate in this study as part of a 'Project Advisory Group' (PAG). The PAG consisted of 81 individuals representing 55 organisations as well as all EU and two EEA countries, and it worked together as a Delphi consensus group to develop and validate the online survey tool. The individuals who comprised the PAG were either nominated by their respective professional organisation, or – for the countries – were officially mandated National Focal Points or their nominated representative.

The initial phase of developing the survey involved reviewing the literature, guided by four core themes that covered the study objectives ('health worker', 'knowledge and attitudes', 'survey' and 'antibiotic'). Through this, a set of search terms was developed for the literature search in PubMed (listed in Table 1). Abstracts of the identified papers were scanned, thereby generating a list of papers related to knowledge, attitudes and behaviour of healthcare professionals. Survey tools from eligible papers were reviewed and discussed with the project team. The criteria for inclusion were studies published in the previous five years and those conducted within Europe. Published and grey literature including policy documents were also eligible for inclusion and used in the review. Figure 2 shows the flowchart of studies for inclusion.

Through this process, a bank of questions was produced, aimed at assessing healthcare workers' knowledge and attitudes on antibiotics and antibiotic resistance. The initial questions were divided into four themes based on the COM-B model (capability - including knowledge and perceived capability, opportunities, motivation, and behaviour):

1. Questions on capability included an assessment of knowledge and understanding of AMR, and of the guidelines and policies that healthcare workers were aware of, either at a national level or international level. Four of the seven knowledge questions in this survey were modelled on the questions the public are asked as part of the regular Eurobarometer survey series, which tracks progress on public use of and knowledge about antibiotics [6]:
    - antibiotics kill viruses (FALSE)
    - antibiotics are effective against colds (FALSE)
    - unnecessary use of antibiotics makes them become ineffective (TRUE)
    - taking antibiotics often has side-effects, such as diarrhoea (TRUE)
2. Opportunity-based questions assessed the availability of information and any noted time pressures.
3. Motivation-based questions considered whether there were competing priorities, whether the consequences of prescribing were embedded in prescribing decisions, and whether antimicrobial stewardship played a role in respondents' professional decisions.
4. Questions on behaviour focused on IPC measures, for example, hand hygiene; use of guidelines; the provision of resources to patients; and antibiotic prescription decisions under conditions of clinical uncertainty.

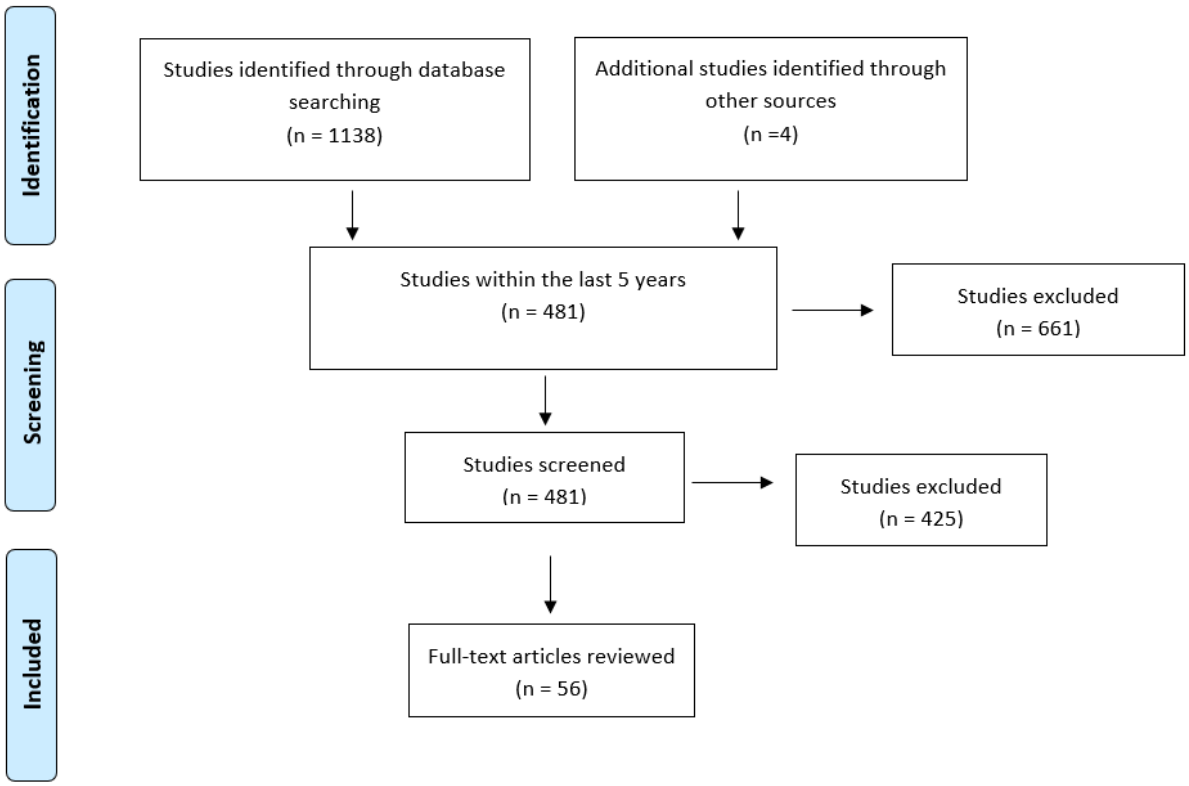
As in the WHO competency framework [20] which separated out prescribers from non-prescribers, the project team felt it was important to distinguish between the two groups. Therefore, prescriber-related questions (e.g. concerned with prescribing decisions) were also included in this survey. The survey questions and sections are available in the Annex.

Development of the survey instrument took place through an iterative process whereby PAG members were tasked at each round with assessing the relevance and commenting on the proposed questions. For the first round, a draft set of survey questions was sent to the PAG members prior to an initial teleconference meeting, in order to evaluate the perceived relevance of each question on a three-point scale ('relevant', 'not relevant' and 'cannot assess'). This resulted in the addition and removal of some questions. The next round was the assessment of the newly added questions and the rephrasing, where appropriate, of the questions. This round was conducted on an online platform available through Public Health England, with 286 comments received. Following the two rounds, the online survey tool was piloted to 224 healthcare professionals and workers from 24 countries with additional comments received on the content, interpretation of questions, and the time taken for survey completion. Feedback from the pilot was then addressed, and explanations for updates to the survey were shared with the PAG to develop a consensus that the survey appropriately addressed the specified task: assessment of healthcare professionals and workers' knowledge and attitudes on antibiotics, antibiotic use and antibiotic resistance across Europe. Following the consensus process and pilot, a final survey including 43 questions was confirmed. The survey was translated into 25 languages, and was then shared with members of the PAG to confirm that each question was appropriately translated.

Table 1. Search terms used for literature search

Theme	Search term
Healthcare workers	Healthcare worker Healthcare provider Healthcare professional Health worker Health provider Health professional Health personnel [MESH]
Knowledge and attitudes	Attitudes Knowledge Behaviour
Survey	Surveys and questionnaires [MESH] Survey
Antibiotics	Antibiotic Antimicrobial Antibiotic resistance Antimicrobial resistance Antimicrobial stewardship

Figure 2. Flowchart of identified articles



The initial draft included questions which assess some of the core knowledge competences across the 4 domains in WHO's competences for health workers on AMR [8].

Sample size

The questionnaire was developed to survey all core health professions including doctors (physicians and surgeons), nurses and midwives, pharmacists and dentists as well as allied health professional groups such as pharmacy technicians, physiotherapists and biomedical scientists. Whilst infection specialists were not excluded from completing the survey, it was important that the survey also sought input from non-specialists. In this report, respondents who have direct interaction with patients or members of the public in terms of diagnosis, prescribing, clinical checking prescriptions, dispensing, administration, or provision of advice of antibiotics to patients or members of the public will be referred to as 'respondents with direct patient/public involvement'.

A quota sampling approach based on the EU healthcare personnel statistics per profession and country was used to determine the target survey sample size for each country and professional group [20]. A sample of 0.2% of the workforce was calculated and sought for each healthcare profession in each country, except for nursing professionals for whom a sample of 0.1% of the workforce was sought, because the nursing profession accounts for more 63% of all healthcare professionals (doctors, nurses, dentists and pharmacists) in the EU/EEA. The overall sample size for the EU/EEA as well as the sample size per country was calculated using the European Union healthcare personnel statistics. The statistics included data from the 28 EU countries as well as Iceland and Norway. Estimates from 2015 of practising healthcare professionals across the EU, Iceland and Norway including physicians, nurses, and dentists, pharmacists and physiotherapists, are given in Table 2.

This process produced a target sample size of 11 929 respondents.

Although quota sampling does not offer the same degree of statistical purity as random probability sampling it has a good record in producing reliable results. It also systematically takes into account different populations, which in this case related to variations in different categories of healthcare workers across EU/EEA countries. The use of an online survey also provides a cost-effective method for reaching large numbers of healthcare workers in multiple countries over a short period of time.

Throughout this report, where the professional setting is described for respondents, 'hospital' and 'community/primary healthcare' are defined as being independent to 'pharmacy'.

Distribution of survey

The online questionnaire was distributed via PAG members to healthcare workers in each country, and also promoted via social media using #ECDCAntibioticSurvey. Participation was voluntary, with the questionnaire open between 28 January and 4 March 2019. Regular updates on the number of participating respondents from each country and healthcare worker categories was provided to the PAG group.

Data management and analysis

Data were collected anonymously, although survey respondents could voluntarily provide their name and email address should they wish to be contacted following the survey with information related to the survey or other AMR-related information. All data were held securely on PHE's internal networks and in line with the General Data Protection Regulation (EU) 2016/679. Descriptive statistics on the frequency distributions and percentages were used to analyse the respondents' knowledge and understanding, and comparisons were made using logistical regression. Data were analysed using Microsoft® Excel (2010) and STATA release 15 (https://www.stata.com/).

Table 2. European Union healthcare personnel statistics and quota sample size for survey

Country	Physicians		Nurses, nursing professionals & midwives		Dentists		Pharmacists		Other healthcare workers (e.g. hospital managers, pharmacy/dental technicians, allied health professionals)	Total
	Total register	Quota sample	Total register	Quota sample	Total register	Quota sample	Total register	Quota sample	Quota sample	Overall quota sample size
Austria	44 816	90	71 246	71	4 954	10	6 194	12	37	220
Belgium	34 834	70	125 581	126	8 478	17	13 876	28	48	288
Bulgaria	29 492	59	34 230	34	8 011	16	6 256	13	24	146
Croatia	13 504	27	28 096	28	3 341	7	3 062	6	14	81
Cyprus	3 209	6	4 745	5	882	2	761	2	3	17
Czech Republic	38 776	78	89 208	89	7 955	16	7 172	14	39	236
Denmark	20 902	42	97 924	98	4 205	8	2 918	6	31	185
Estonia	4 548	9	8 469	8	1 257	3	963	2	4	26
Finland	17 511	35	80 150	80	3 988	8	5 941	12	27	162
France	209 367	419	704 246	704	43 026	86	70 025	140	270	1 619
Germany	344 755	690	1 081 000	1 081	70 305	141	52 430	105	403	2 419
Greece	70 964	142	37 720	38	13 225	26	11 300	23	46	274
Hungary	31 515	63	64 786	65	6 083	12	7 353	15	31	186
Iceland	1 292	3	5 035	5	278	1	166	0	2	10
Ireland	13 959	28	61 360	61	2 949	6	5 387	11	21	127
Italy	239 642	479	354 022	354	48 559	97	70 074	140	214	1 285
Latvia	6 295	13	9 489	9	1 411	3	1 643	3	6	34
Lithuania	12 812	26	23 020	23	2 787	6	3 276	7	12	73
Luxembourg	1 683	3	7 047	7	550	1	406	1	2	15
Malta	1 743	3	3 916	4	214	0	605	1	2	11
Netherlands	59 569	119	184 040	184	9 337	19	3 659	7	66	395
Norway	23 619	47	94 476	94	4 527	9	4 100	8	32	191
Poland	88 437	177	219 845	220	12 603	25	28 121	56	96	574
Portugal	49 541	99	69 486	69	9 875	20	8 788	18	41	247
Romania	55 975	112	134 537	135	16 285	33	17 104	34	63	376
Slovakia	18 864	38	20 435	20	2 701	5	4 183	8	14	86
Slovenia	6 224	12	20 114	20	1 421	3	1 356	3	8	46
Spain	177 731	355	300 679	301	35 716	71	56 167	112	168	1 008
Sweden	41 848	84	115 702	116	7 813	16	7 427	15	46	276
United Kingdom	182 534	365	548 291	548	34 867	70	56 542	113	219	1 315
Total	**1 845 961**	**3692**	**4 598 895**	**4 599**	**367 603**	**735**	**457 255**	**915**	**1 988**	**11 929**

Results and discussion

Assessing capability, opportunities, motivation, behaviour of all healthcare workers

The results are presented at an EU/EEA level and, where relevant, are presented by country and/or by healthcare worker groups and setting (hospital or community). The responses by antibiotic prescribers to some of the questions are presented separately.

Country and healthcare workers participation in survey

In total, 18 506 participants responded to the online survey. The majority (99%; 18 365) were healthcare professionals from across 30 EU/EEA countries; the planned overall sample size of 11 929 was easily exceeded (Table 3). The numbers of responses by country and by profession against the calculated quota sample size are presented in Table 4. The UK had the highest number of respondents, followed by Italy, Spain and Norway. Although the focus of the survey was EU and EEA countries, there were 140 respondents from five other continents (Table 5).

Twenty four EU/EEA countries (80%) achieved or exceeded the quota sample size of respondents; and some countries exceeded their target numbers significantly. The six countries that achieved less than the target sample size were Croatia (91%), Greece (81%), France (54%), the Netherlands (48%), Bulgaria (21%), and Germany (17%). Pharmacists had the highest overall response rate, with 3.5 times the target number responding; at country level, Austria, Estonia, Finland and Portugal achieved at least ten times the target number. Physicians had twice the target response rate (Table 3), with four countries achieving at least ten times the target number of responding physicians (Cyprus, Czech Republic, Latvia and Norway) (Table 4). Dentists had 1.5 times the target response rate, while nurses, nursing professionals and midwives collectively achieved just over 100% of the target. These good response rates are likely due to the membership of the PAG which had significant representation from medical, nursing, dental and pharmacy European Professional groups. It may also be due in part to these professional groups being relatively engaged with the clinical management of infections.

The strong engagement of PAG members - -consisting of European professional groups and organisations as well as country representatives - in developing and disseminating the survey links had an important impact on the response rate. Around 34% of the respondents found out about the survey through their professional organisation (Figure 3). By monitoring the response rate by country and professional group and feeding this information back to the Project Advisory Group along with targeted promotion (e.g. translation of country-specific social media posts and communications) in those countries with lower response rates, it was possible to enhance representation across professional groups and countries. This was particularly the case at the start of the online survey, where there were periods of slow connection due to significant numbers of people attempting to access the site at the same time.

Table 3. Number of responses from each profession versus their quota sample size, 30 EU/EEA countries

Profession	Quota sample size	Actual number of responses	Percentage of quota sample size (%)
Physicians	3 692	7 351	199.1
Nurses, nursing professionals & midwives	4 599	4 772	103.8
Nurse (n=4 312)			-
Midwife (n=210)			-
Nursing associate (n=250)			-
Dentists	735	1 085	147.2
Pharmacists	915	3 258	356.1
Other healthcare workers (e.g. hospital managers, pharmacy/dental technicians, allied health professionals)	1 988	1 092	54.9
Allied Health Professional (n=633)			
Pharmacy Technician (n=250)			
Dental care professionals (n=33)			
Scientist (n=461)		*807*	*NA*
Other (n=200)			
Unknown (n=146)			
All healthcare workers	**11 929**	**18 365**	**147.2**

Table 4. Number of responses and quota sample size by country and profession, 30 EU/EEA countries

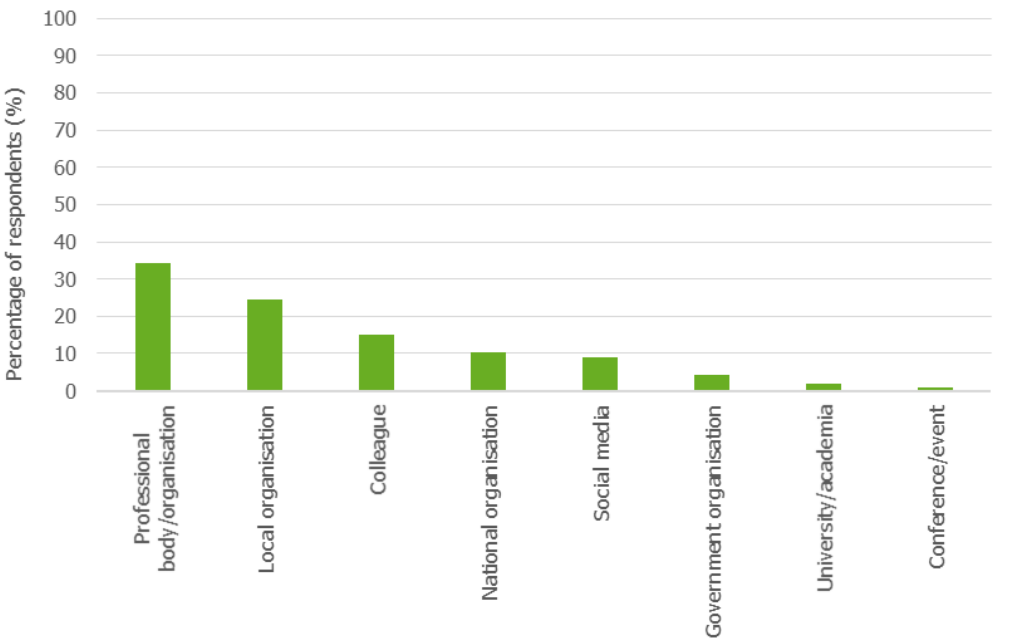
	Physicians		Nurses, nursing professionals & midwives		Dentists		Pharmacists		Other healthcare workers		Responses from healthcare workers without quota size	Total	
Country	Quota sample size	Total responses	Quota Sample Size	Total responses	Quota sample size	Total responses	Quota sample size	Total responses	Quota sample size	Total responses		Number required based on quota sample size	Total responses
Austria	90	366	71	274	10	87	12	200	37	95	103	220	1 125
Belgium	70	177	126	69	17	14	28	86	48	33	20	288	399
Bulgaria	59	7	34	1	16		13	22	24	1	0	146	31
Croatia	27	40	28	2	7	9	6	18	14	0	5	81	74
Cyprus	6	65	5	32	2		2	6	3	5	0	17	108
Czech Republic	78	936	89	4	16	1	14	5	39	6	12	236	964
Denmark	42	251	98	253	8	119	6	55	31	45	50	185	773
Estonia	9	35	8	37	3		2	48	4	5	3	26	128
Finland	35	81	80	457	8	39	12	120	27	51	22	162	770
France	419	376	704	203	86	11	140	224	270	36	20	1 619	870
Germany	690	151	1081	28	141	7	105	200	403	3	17	2 419	406
Greece	142	38	38	20	26	15	23	136	46	3	9	274	221
Hungary	63	105	65	187	12		15	11	31	46	29	186	378
Iceland	3	3	5	7	1	31	0	2	2	1	0	10	44
Ireland	28	63	61	14	6	24	11	25	21	6	5	127	137
Italy	479	890	354	276	97	131	140	700	214	82	88	1 285	2 167
Latvia	13	138	9	5	3	89	3	3	6	4	3	34	242
Lithuania	26	80	23	34	6	1	7	2	12	11	9	73	137
Luxembourg	3	7	7	16	1		1	5	2	6	2	15	36
Malta	3	6	4	10	0	10	1	9	2	21	1	11	57
Netherlands	119	119	184	7	19	48	7	7	66	0	9	395	190
Norway	47	616	94	630	9	38	8	35	32	88	59	191	1 466
Poland	177	363	220	193	25	92	56	259	96	81	134	574	1 122
Portugal	99	74	69	87	20	19	18	184	41	11	11	247	386
Romania	112	314	135	158	33	18	34	68	63	15	14	376	587
Slovakia	38	221	20	179	5	1	8	27	14	8	0	86	436
Slovenia	12	60	20	10	3	9	3	8	8	3	5	46	95
Spain	355	1 080	301	310	71	247	112	210	168	18	27	1 008	1 892
Sweden	84	262	116	307	16	3	15	60	46	48	40	276	720
United Kingdom	365	427	548	962	70	22	113	523	219	360	110	1 315	2 404
EU/EEA	**3 692**	**7 351**	**4 599**	**4 772**	**735**	**1 085**	**915**	**3 258**	**1 988**	**1 092**	**807**	**11 929**	**18 365**

Table 5. Number of responses from countries outside of the EU/EEA, by continent

Continent	Number of responses (%)
Europe (non-EU/EEA)	49 (35.0)
Africa	42 (30.0)
Asia	24 (17.1)
Northern America	11 (7.9)
South America	10 (7.1)
Australasia	4 (2.9)
Total	**140**[3]

[3] One respondent did not specify their geographical region. This respondent, along with those who were non-EU/EEA, was excluded from further analysis.

Figure 3. Sources for hearing about the #ECDCAntibioticSurvey (only one option allowed)



Demographics of respondents

Most of the respondents were adults over the age of 25 years; 70% were women and 30% had worked in their profession for 25 years or longer (Table 6). The higher response rate from women can perhaps partially be explained by the high representation of women among nurses and midwives. Evidence also suggests that women may, in general, be more willing to participate in online surveys than men [21, 22].

Table 6. Respondents' age, gender they most identify with and number of years they have been practicing in their current profession, EU/EEA (n=18 365)

Age (years)	Number of respondents (%)
<18	8 (0.0)
18-25	556 (3.0)
26-35	4 307 (23.5)
36-45	4 325 (23.6)
46-55	4 695 (25.6)
56-65	3 716 (20.2)
>66	705 (3.8)
Prefer not to say	53 (0.3)
Gender	**Number of respondents (%)**
Female	12 850 (70.0)
Male	5 162 (28.1)
Prefer not to say	353 (1.9)
Years in profession	**Number of respondents (%)**
0-2	1 847 (10.1)
3-5	2 256 (12.3)
6-10	2 577 (14.0)
11-15	2 123 (11.6)
16-20	2 269 (12.4)
21-25	1 853 (10.1)
>25	5 440 (29.6)

The respondents predominantly practised in hospitals (49%) while 22% worked in the community, 9% in pharmacies, 6% in long-term care facilities, 4% in public health institutes, 2% in academic settings, and 4% in governmental organisations, industry or professional organisations; 0.6% of respondents said they practiced in 'other settings' (Table 7).

Table 7. Settings in which respondents predominantly practice (i.e. >50% of their time), EU/EEA

Setting	Number of respondents (%)
Hospital	8 972 (48.9)
Community*	3 982 (21.7)
Pharmacy	1 742 (9.5)
Long-term care facility	1071 (5.8)
Public health institute	664 (3.6)
Unknown	583 (3.2)
University (as an academic) or research institute	359 (2.0)
Governmental organisation	331 (1.8)
Professional body	246 (1.3)
Industry	233 (1.3)
Other	118 (0.6)
Not specified	64 (0.3)

**'Community' was defined as primary healthcare e.g. general practice*

Only 28% (n=5 160) of respondents stated that they were either contributing to or leading on AMR-related programmes or tackling AMR in their current role, while 67% (n=12 337) said this was not part of their role, and 5% (n=868) responded that they did not understand the question. This information was important to capture as the survey focused on non-specialists, and it was important to ensure that the findings or recommendations would be applicable to non-specialist healthcare workers rather than solely and specifically for infection specialists.

Use of social media for professional activities

When asked which social media platform was most commonly used for professional activities (with up to two response options), the highest proportion selected 'None' (42%). From the options of social media platforms provided in the survey, Facebook was the most commonly used across EU/EEA countries (27%). The second most commonly used platform across EU/EEA countries was Google+ (18%) (Table 8). It is important to note that this question focused on use of social media platforms specifically for professional activities, not personal use.

Table 8. Use of social media for professional activities, by country, EU/EEA

Country	Number of respondents	Twitter (%)	Facebook (%)	LinkedIn (%)	Google + (%)	YouTube (%)	Instagram (%)	Do not use any social media (%)
Austria	1 125	6.5	25.5	6.9	21.7	8.6	6.6	40.4
Belgium	399	3.0	18.0	15.8	9.0	4.8	4.0	58.1
Bulgaria	31	9.7	29.0	32.3	22.6	19.4	0.0	19.4
Croatia	74	0.0	39.2	17.6	27.0	20.3	9.5	14.9
Cyprus	108	4.6	45.4	12.0	33.3	9.3	8.3	23.1
Czech Republic	964	1.1	12.7	3.2	23.7	6.7	1.3	54.7
Denmark	773	2.2	34.2	13.8	20.6	9.4	4.3	33.5
Estonia	128	1.6	36.7	7.0	23.4	10.9	2.3	39.1
Finland	770	4.0	29.5	4.8	18.6	4.9	5.3	46.1
France	870	5.9	9.3	10.3	10.6	5.1	0.3	64.7
Germany	406	4.7	9.4	5.2	10.3	6.2	2.2	65.8
Greece	221	3.2	59.7	18.6	19.9	5.0	11.3	17.6
Hungary	378	0.5	29.4	3.7	35.4	18.0	2.6	32.8
Iceland	44	0.0	45.5	4.5	6.8	4.5	6.8	36.4
Ireland	137	21.9	12.4	10.2	8.8	8.0	2.9	51.8
Italy	2 167	3.9	30.9	8.5	23.5	6.2	7.4	38.0
Latvia	242	2.5	31.8	5.8	22.3	15.3	3.3	33.5
Lithuania	137	0.0	27.7	6.6	34.3	21.2	1.5	23.4
Luxembourg	36	5.6	16.7	27.8	13.9	2.8	0.0	55.6
Malta	57	8.8	59.6	14.0	12.3	15.8	0.0	21.1
Netherlands	190	6.3	15.8	35.8	7.9	5.8	3.2	43.7
Norway	1 466	3.0	42.8	7.2	14.9	10.0	8.4	34.2
Poland	1 122	2.7	38.5	2.9	17.1	11.1	4.6	38.9

Country	Number of respondents	Twitter (%)	Facebook (%)	LinkedIn (%)	Google + (%)	YouTube (%)	Instagram (%)	Do not use any social media (%)
Portugal	386	3.1	40.4	12.4	18.1	6.0	9.1	33.4
Romania	587	1.7	46.0	6.8	34.1	8.0	4.6	22.3
Slovakia	436	0.2	17.4	2.5	40.1	11.9	1.6	36.7
Slovenia	95	3.2	16.8	11.6	24.2	13.7	2.1	43.2
Spain	1 892	24.5	20.3	10.3	15.9	6.4	6.5	38.4
Sweden	720	1.7	15.7	4.7	15.1	5.3	9.3	57.1
United Kingdom	2 404	22.8	23.8	9.9	7.8	6.2	5.2	44.4
EU/EEA	**18 365**	**8.1**	**27.3**	**8.5**	**18.2**	**7.8**	**5.4**	**41.7**

Perceived capability and actual capability as assessed by knowledge test on antibiotics, antibiotic use and antibiotic resistance

As previously stated, changing behaviour can be seen as an interaction between three core components – capability, motivation and opportunity. In this study, perceived capability and actual capability as assessed by a knowledge test were assessed and compared.

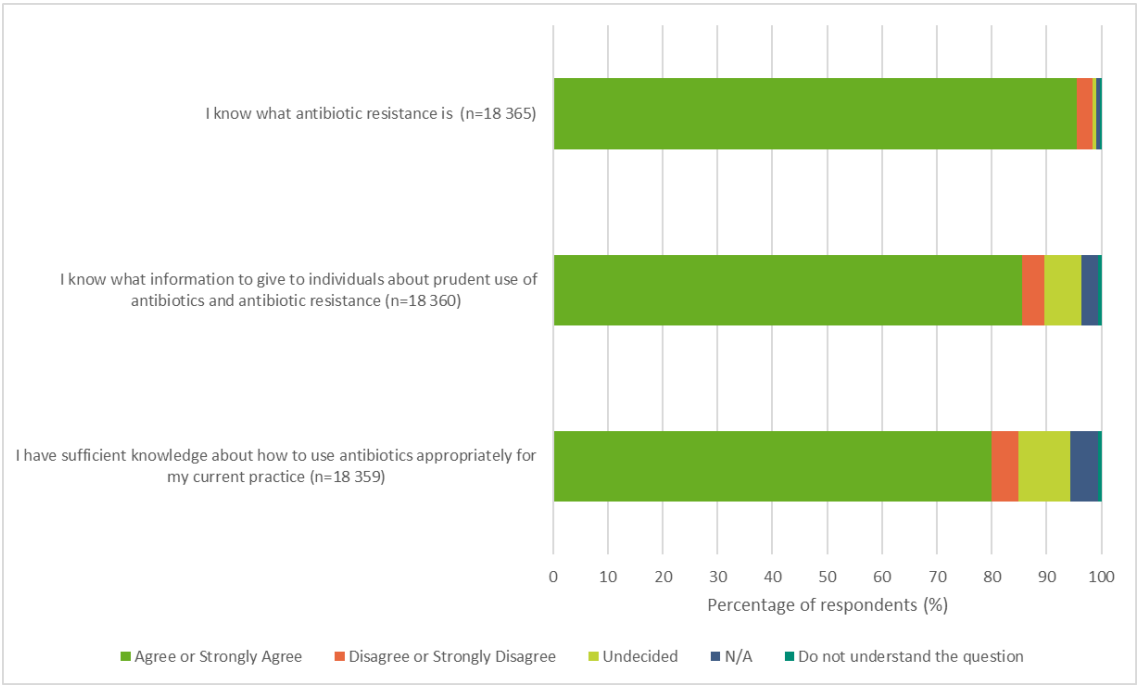
Perceived capability

Overall, the great majority of respondents (96%) agreed or strongly agreed that they know what antibiotic resistance is (Figure 4). All countries except Malta, Romania, Austria, Sweden, Iceland, Norway, Slovakia, Ireland, Czech Republic and Poland had more than 96% of their respondents agreeing or strongly agreeing.

When respondents were asked whether they felt they had sufficient knowledge on using antibiotics appropriately in their current practice, more than 80% (EU/EEA average) agreed or strongly agreed with this statement (Figure 4). There were 11 countries with a lower proportion: Luxembourg (61%), Malta (63%), France (71%), Slovenia (74%), Germany (74%), Austria (75%), Poland (76%), Belgium (78%), Finland (78%), UK (78%), and Denmark (79%).

More than 86% (EU/EEA average) of respondents strongly agreed or agreed that they know what information to give individuals about prudent use of antibiotics and antibiotic resistance. There were 12 countries with a lower proportion: Malta (74%), Denmark (74%), Sweden (76%), Luxembourg (78%), Norway (78%), UK (79%), Austria (80%), Belgium (84%), Ireland (85%), Germany (85%), and Slovenia (85%)

Figure 4. Percentage of respondents who agreed or strongly agreed to the statements assessing their perceived capability with respect to antibiotics, antibiotic use and antibiotic resistance



Actual capability as assessed by a knowledge test

To test knowledge of antibiotic resistance in human health, there were seven knowledge statements for which the answer was either true or false. The questions 'Antibiotics are effective against viruses', 'Antibiotics are effective against cold and flu', and 'Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergies', had the highest proportion of respondents providing the correct answer (97.5%; 97% and 96.5% respectively). The question with the lowest proportion of respondents providing the correct answer was 'Every person treated with antibiotics is at increased risk of antibiotic resistant infection' (75%). The questions 'Healthy people can carry antibiotic resistant bacteria' and 'Antibiotic resistant bacteria can spread from person to person' also had a lower percentage of respondents providing the correct answer: 88% and 87% respectively (Table 9). The three questions with the highest proportion of respondents providing the correct answer are consistent with the key messages that have been promoted across EU/EEA for several years [23]. The topics covered by the remaining four questions have not been actively promoted and could be considered for future campaigns.

Table 9. Percentage of respondents who answered each key knowledge question correctly (all healthcare workers), EU/EEA

Key knowledge question (n)	Correct answer	% Correct (country range)	% Incorrect (country range)	% Unsure (country range)
Antibiotics are effective against viruses (n=18 357)	False	97.5 (91.7-100.0)	1.7 (0.0-8.3)	0.8 (0.0-5.6)
Antibiotics are effective against cold and flu (n=18 356)	False	97.0 (89.5-100.0)	1.7 (0.0-7.0)	1.3 (0.0-8.3)
Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergies (n=18 356)	True	96.5 (88.9-98.7)	1.9 (0.0-5.6)	1.7 (0.0-11.1)
Unnecessary use of antibiotics makes them become ineffective (n=18 356)	True	94.0 (85.3-99.1)	4.1 (0.0-11.4)	1.9 (0.0-6.3)
Healthy people can carry antibiotic resistant bacteria (n=18 348)	True	88.2 (66.5-97.1)	3.8 (0.0-13.0)	8.0 (2.2-20.5)
Antibiotic resistant bacteria can spread from person to person (n=18 350)	True	86.9 (66.7-95.8)	7.4 (1.4-20.4)	5.7 (1.8-16.1)
Every person treated with antibiotics is at an increased risk of antibiotic resistant infection (n=18 354)	True	75.0 (60.2-93.4)	13.7 (0.0-29.5)	11.3 (1.5-21.9)

Across the EU/EEA, 58% of respondents were able to answer all seven questions correctly, with an average score of 6.35/7. This varied significantly across countries (Table 10). There was a variation in the percentage of respondents answering all seven key knowledge questions correctly across the thirty EU/EEA countries (40%–73%). No country had 100% of respondents who achieved 7/7 in the knowledge score, however, most countries (21/30) had more than 50% of respondents answer all the key knowledge questions correctly (Table 10). The countries where fewer than 50% of respondents answered all seven questions correctly were Bulgaria, Denmark, Estonia, Greece, Hungary, Latvia, Malta and Slovakia. Two countries had at least 70% of respondents answering all questions correctly: Croatia and Ireland. However, it is important to note that the number of respondents as well as the quota sample size for these two countries are lower than in several other countries. In addition, the professional mix of respondents was not the same in all countries, with differing proportions of, for example, doctors and nurses. These differences could affect the overall knowledge score for a given country.

Table 10. Average score for the seven knowledge questions, and the percentage of respondents answering all questions correctly, by country, EU/EEA

Country	Number of respondents	Number of respondents who provided and completed all seven key knowledge questions (% total number of survey participants)	Average score (out of 7)	% of respondents answering all questions correctly (7/7)
Austria	1 125	1 124 (99.9)	6.17	53
Belgium	399	399 (100.0)	6.38	59
Bulgaria	31	31 (100.0)	6.16	48
Croatia	74	74 (100.0)	6.58	73
Cyprus	108	108 (100.0)	6.34	61
Czech Republic	964	963 (99.9)	6.48	62
Denmark	773	773 (100.0)	6.24	49
Estonia	128	127 (99.2)	5.87	40
Finland	770	769 (99.9)	6.48	64
France	870	870 (100.0)	6.58	69
Germany	406	406 (100.0)	6.55	68
Greece	221	221 (100.0)	6.17	48
Hungary	378	378 (100.0)	6.02	46
Iceland	44	44 (100.0)	6.43	61
Ireland	137	137 (100.0)	6.61	71
Italy	2 167	2 167 (100.0)	6.19	50
Latvia	242	239 (98.8)	5.82	41
Lithuania	137	137 (100.0)	6.56	66
Luxembourg	36	36 (100.0)	6.06	53
Malta	57	57 (100.0)	6.04	47
Netherlands	190	190 (100.0)	6.42	57
Norway	1 466	1 465 (99.9)	6.40	59
Poland	1 122	1 118 (99.6)	6.48	68
Portugal	386	385 (99.7)	6.33	53
Romania	587	586 (99.8)	6.24	56
Slovakia	436	436 (100.0)	6.15	48
Slovenia	95	95 (100.0)	6.39	51
Spain	1 892	1 892 (100.0)	6.49	65
Sweden	720	718 (99.7)	6.38	55
United Kingdom	2 404	2 403 (100.0)	6.36	59
EU/EEA	**18 365**	**18 348 (99.9)**	**6.35**	**58**

Even more variation was observed in the percentage of respondents by profession who provided the correct answer for all seven questions (range 29-68%). Fifty per cent or more of the respondents who were members of the core healthcare professions (medicine, nursing, pharmacy and dentistry) answered all seven knowledge questions correctly. Medical doctors had the highest proportion of respondents answering all questions correctly (68%), followed by scientists (64%) and pharmacists (59%). Fewer than 40% of the Allied Health Professionals, Dental care professionals, and Nursing associates/assistants achieved a score of 7/7 (Table 11).

Table 11. Average score on the seven key knowledge questions per professional group, and the percentage of respondents from each profession who achieved all correct answers (7/7)

Profession	Number of respondents	Number of respondents answering all seven key knowledge questions (% of total number of participants)	Average score	% of respondents answering all questions correctly
Medical doctor	7 351	7 350 (100.0)	6.56	68
Scientist	461	461 (100.0)	6.47	64
Pharmacist	3 258	3 256 (99.9)	6.41	59
Nurse	4 312	4 307 (99.9)	6.22	51
Dentist	1 085	1 082 (99.7)	6.18	50
Midwife	210	209 (99.5)	6.24	49
Other healthcare worker	176	175 (99.4)	5.85	41
Unknown	146	143 (97.9)	5.54	40
Pharmacy technician	250	250 (100.0)	6.03	40
Allied health professional	633	632 (99.8)	5.88	38
Dental care professional	33	33 (100.0)	5.61	33
Nursing associate/assistant	250	250 (100.0)	5.58	30
Other	200	200 (100.0)	5.43	29
All professions	**18 365**	**18 348 (99.9)**	**6.35**	**58**

More than 80% of respondents across all healthcare worker groups correctly answered the questions on the use of antibiotics; 'Antibiotics are effective against viruses' (Figure 5), 'Antibiotics are effective against cold and flu' (Figure 6), 'Unnecessary use of antibiotics makes them become ineffective' (Figure 7), and 'Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergies' (Figure 8).

There was higher variation, and generally lower scores, across healthcare worker categories for the questions on the spread of antibiotic resistance; 'Every person treated with antibiotics is at an increased risk of antibiotic resistant infection' (Figure 9), 'Antibiotic resistant bacteria can spread from person to person' (Figure 10), 'Healthy people can carry antibiotic resistant bacteria' (Figure 11).

Figure 5. Knowledge question 1: Antibiotics are effective against viruses (correct answer=FALSE)

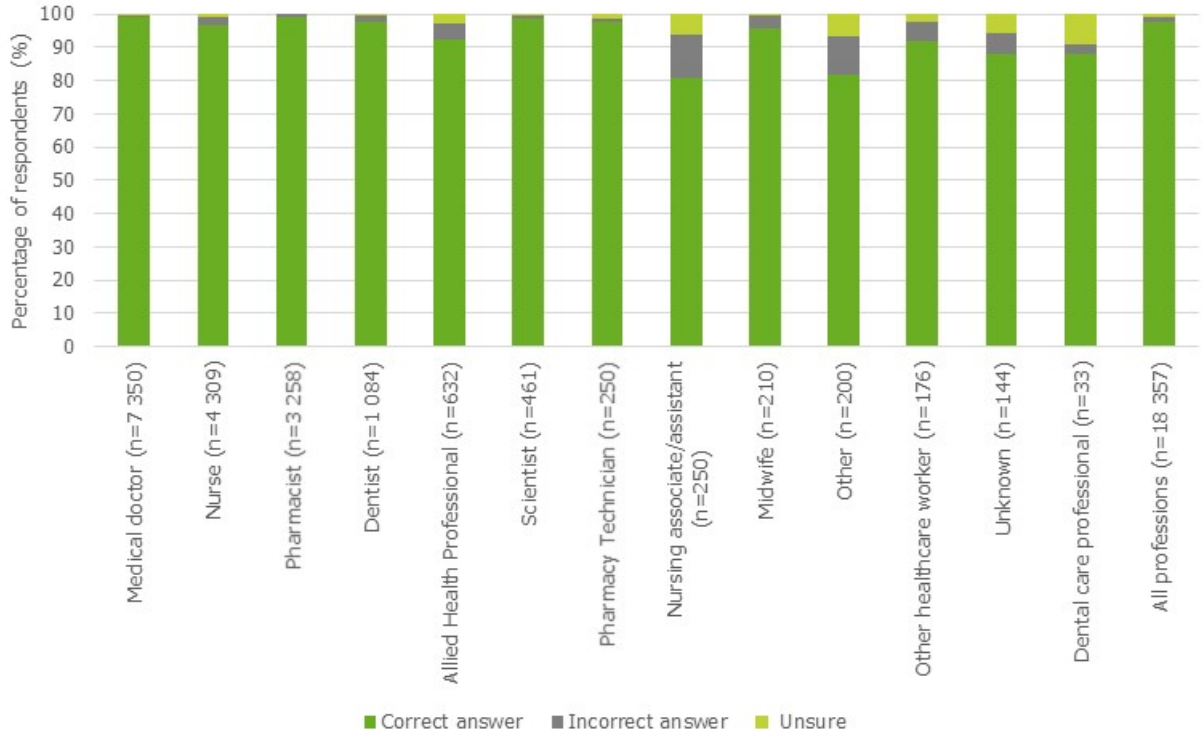


Figure 6. Knowledge question 2: Antibiotics are effective against cold and flu: (correct answer=FALSE)

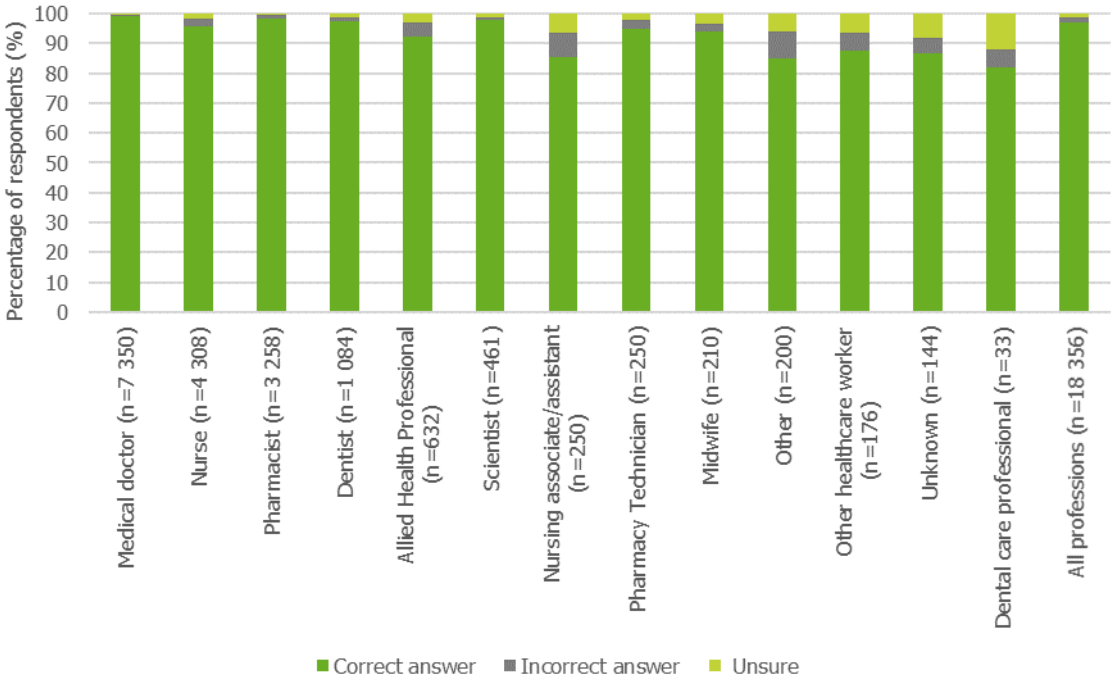


Figure 7. Knowledge question 3: Unnecessary use of antibiotics makes them become ineffective (Correct answer=TRUE)

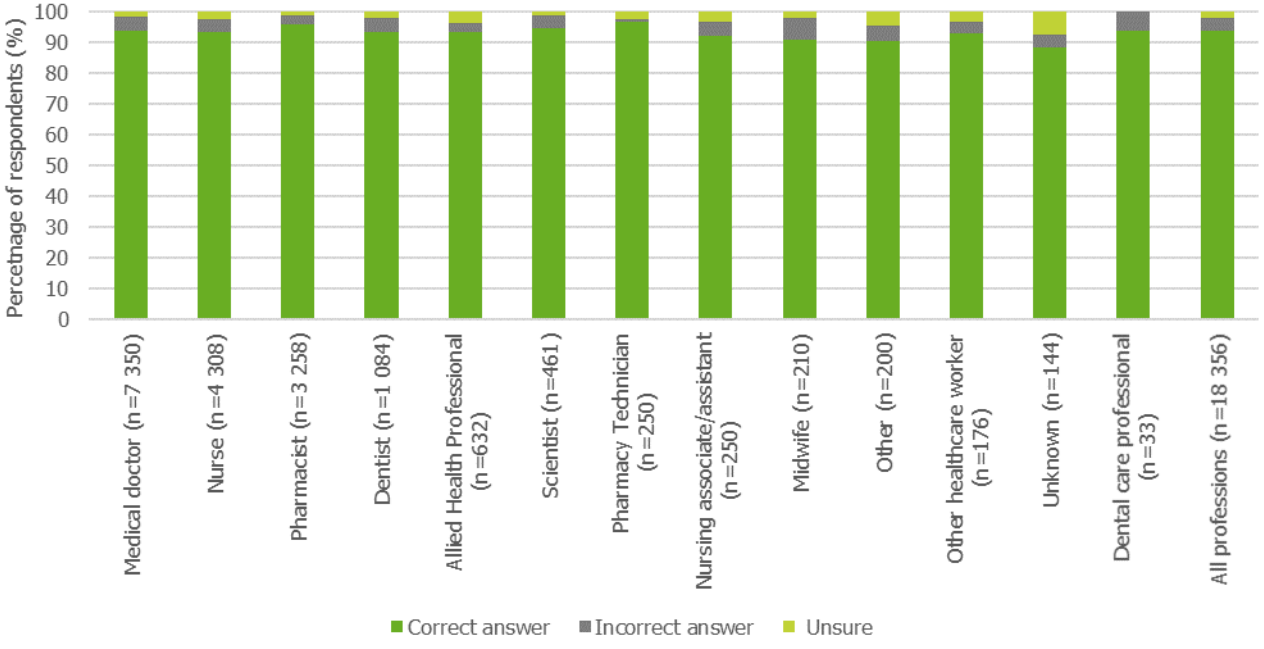


Figure 8. Knowledge question 4: Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergies (Correct answer=TRUE)

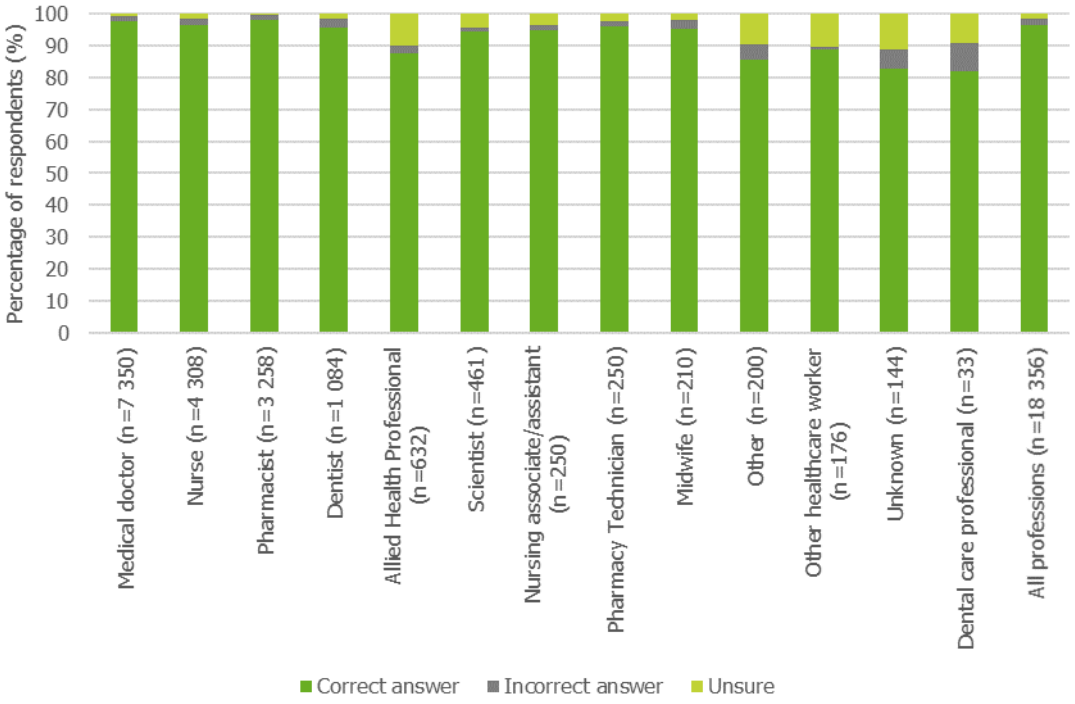


Figure 9. Knowledge question 5: Every person treated with antibiotics is at an increased risk of antibiotic resistant infection (Correct answer=TRUE)

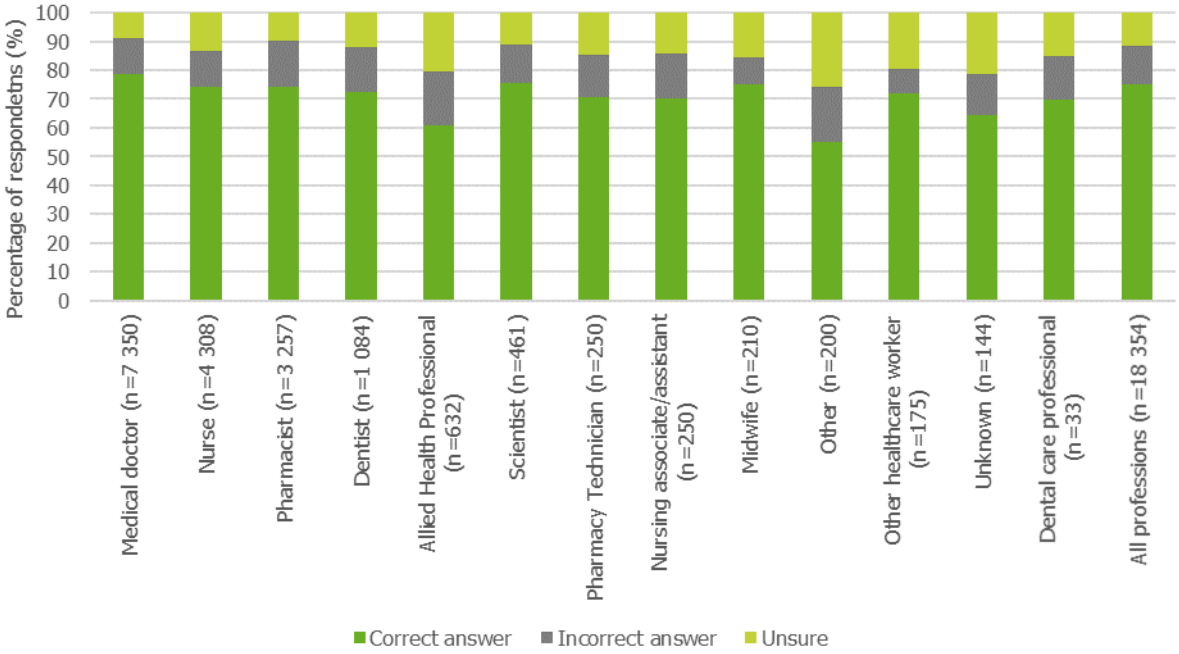


Figure 10. Knowledge question 6: Antibiotic resistant bacteria can spread from person to person (Correct answer=TRUE)

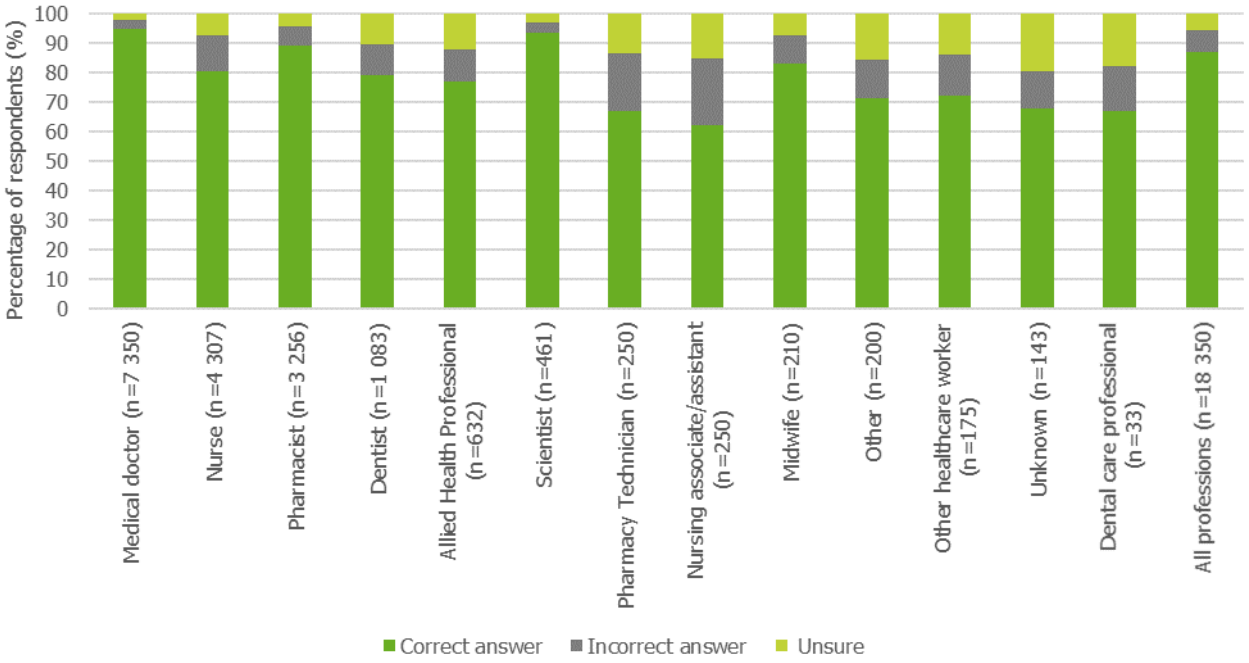
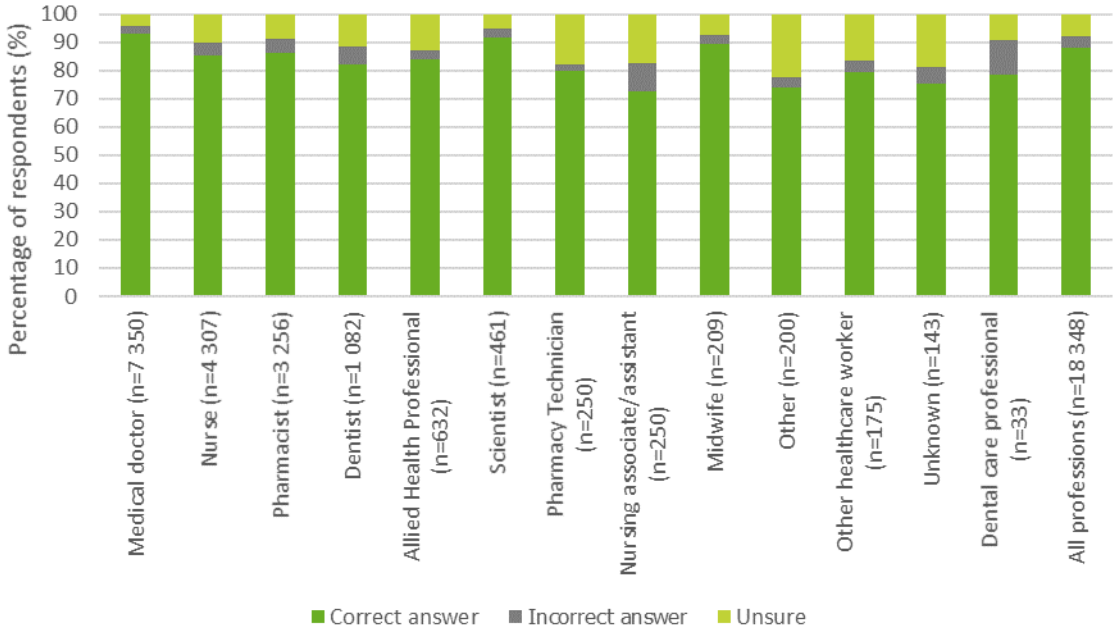


Figure 11. Knowledge question 7: Healthy people can carry antibiotic resistant bacteria (Correct answer=TRUE)



Comparing healthcare workers' knowledge with knowledge of the public (from the Eurobarometer surveys)

It is reassuring that key and consistent messages promoted throughout Europe (such as 'antibiotics are not effective against viruses, colds and flu') had the highest proportion of correct responses among the healthcare worker respondents, and that the proportion of respondents answering these questions correctly is also significantly higher than the public. According to the Eurobarometer survey (which focuses on the general public [9]), across the EU only 43% of respondents correctly identified that it is false that antibiotics kill viruses, while a slightly larger proportion (48%) incorrectly thought that that antibiotics do kill viruses. By contrast, in this survey of healthcare workers, 98% correctly identified that it is false that antibiotics are effective against viruses.

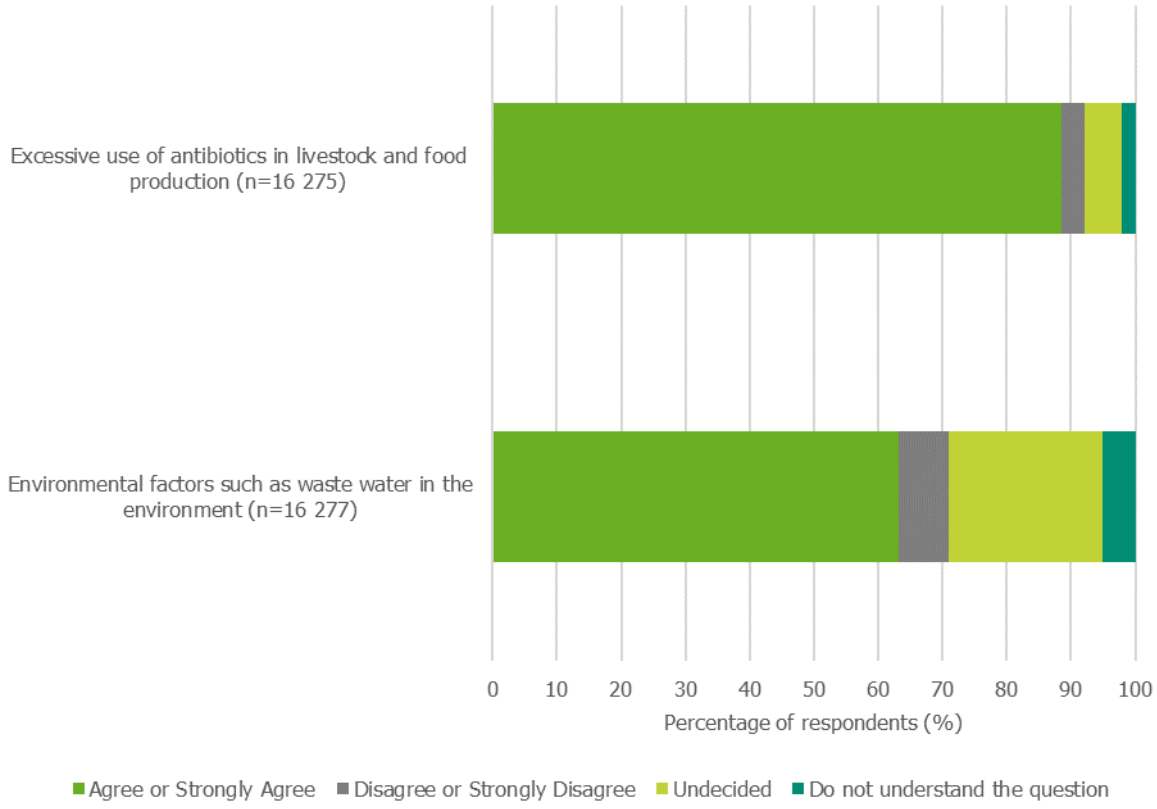
Two thirds (66%) of public respondents across the EU correctly stated that it is false that antibiotics are effective at treating colds; for healthcare workers, 97% correctly identified that antibiotics are not effective against colds and flu. The question with the highest number of respondents from the public survey responding correctly was 'unnecessary use of antibiotics makes them ineffective' (85%); the corresponding proportion in the healthcare workers survey is 94%. Around two thirds of the general public in Europe (68%) know that taking antibiotics often leads to side effects, such as diarrhoea, by comparison with 97% of healthcare workers.

Capability – knowledge test (One Health)

To effectively tackle antibiotic resistance, it is important to have a holistic and multisector approach that considers human and animal health as well as the environment. This is often referred to as 'One Health' [24].

Although the target group for the survey was healthcare workers who focus on human health, the survey included questions to assess healthcare workers knowledge on antibiotic resistance in the context of the animal, food and environmental sectors. When asked to what extent various environmental and animal health factors are important in contributing to antibiotic resistance in bacteria for humans, the great majority (89%) of respondents agreed or strongly agreed that excessive use of antibiotics in livestock and food production contributes to antibiotic resistance in bacteria in humans; however, only around two-thirds (63%) agreed or strongly agreed that environmental factors such as environmental waste water was a contributing factor to AMR in bacteria in humans (Figure 12). Scientists had the highest number of respondents strongly agree or agree that environmental factors such as waste water in the environment are important in contributing to antibiotic resistance in bacteria in humans.

Figure 12. Proportion of respondents who agreed or strongly agreed that environmental and animal health factors are important in contributing to antibiotic resistance in bacteria from humans



Only 27% (n=4 998) of respondents knew it is illegal to use antibiotics to stimulate growth in farm animals in the EU, most were either unsure (44%, n=8 054) or believed this to be legal practice (29%, n=5 291).

Capability–knowledge test (hand hygiene)

Effective IPC measures, especially for hand hygiene is critical to the prevention and control of antibiotic resistance. Understanding healthcare workers' knowledge and competence in this area is key for sustaining and/or developing effective interventions. WHO introduced a 'My 5 Moments for Hand Hygiene' approach which defines the key moments when healthcare workers should perform hand hygiene (Figure 13) [25].

While only 56% of healthcare workers in the survey responded that they could state the WHO's five moments for hand hygiene, 87% responded they would perform hand hygiene as often as recommended if gloves had been used in contact with patients or biological material. Nurses and nursing associates/technicians were the professions most aware of the WHO's five moments for hand hygiene (73%), and were the most likely category of healthcare worker to perform hand hygiene if their gloves had had contact with patients or biological material (96% and 92%, respectively) (Figure 14).

WHO recommends the following on hand hygiene and medical glove use [25]:

- the use of gloves does not replace the need for cleaning your hands
- hand hygiene must be performed when appropriate, regardless of the indications for glove use
- remove gloves to perform hand hygiene, when an indication occurs while wearing gloves
- discard gloves after each task and clean your hands – gloves may carry germs
- wear gloves only when indicated according to Standard and Contact Precautions, otherwise they become a major risk for germ transmission.

Figure 13. WHO five moments for hand hygiene, adapted from WHO guidance document [25]

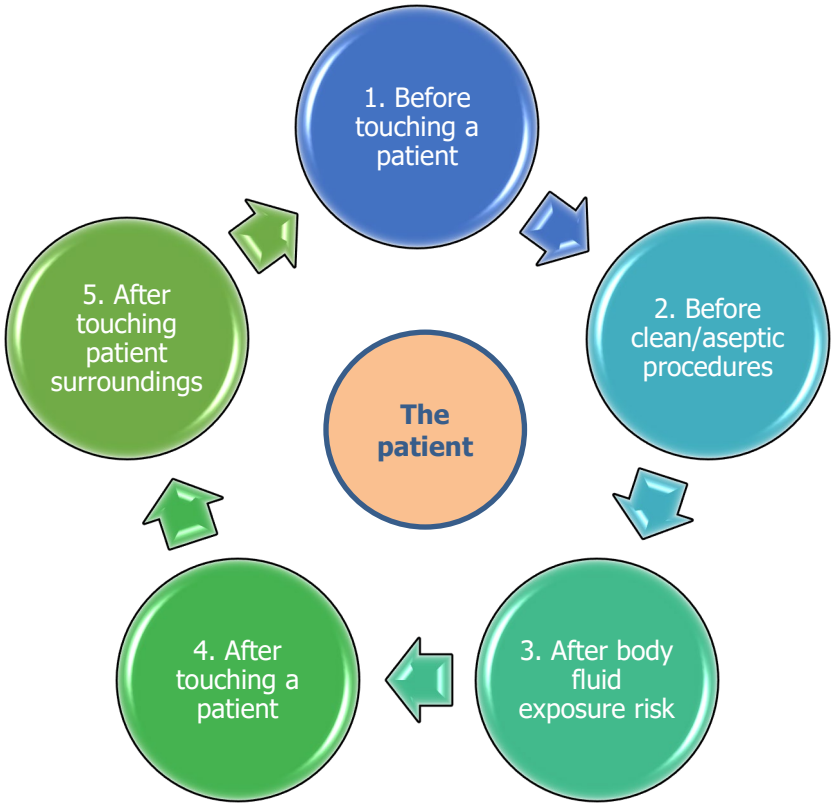
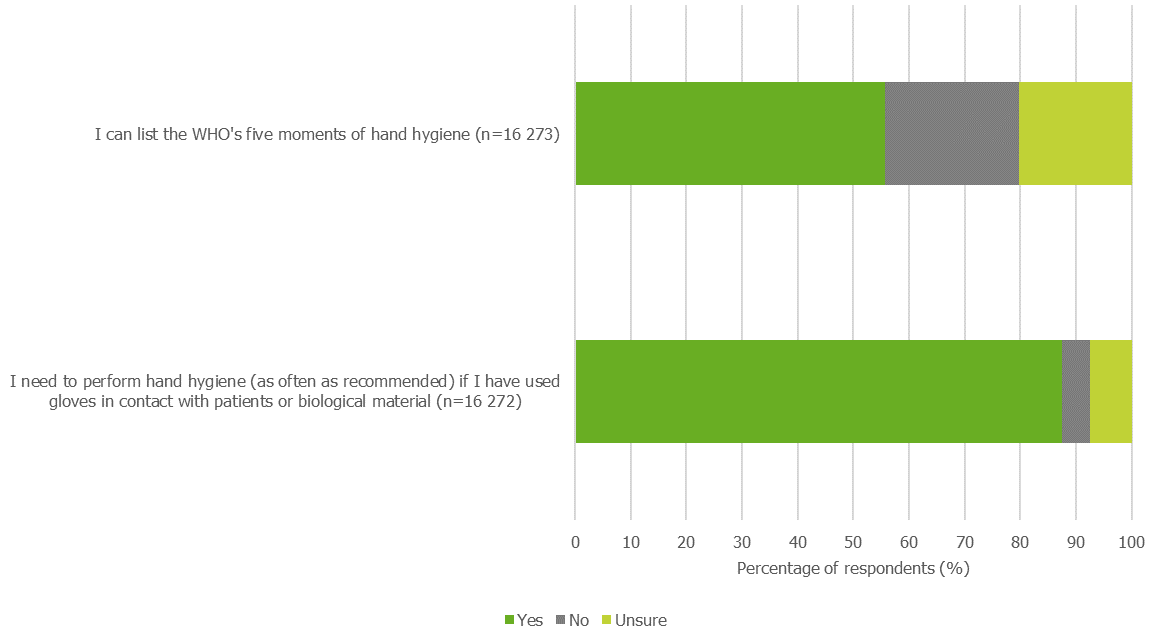


Figure 14. EU/EEA-Percentage of respondents who stated they could list the WHO's five moments for hand hygiene, and who thought they needed to perform hand hygiene even if gloves were used as recommended by WHO



Across the EU/EEA countries, there was substantial variation in the percentage of respondents who reported that they could list the WHO five moments of hand hygiene, ranging between 29% and 78% (Figure 15). However, higher proportions of respondents across the 30 countries agreed that they need to perform hand hygiene (i.e. wash hands) as often as recommended (i.e. 'I perform hand hygiene as often as recommended if I had gloves on when in contact with patients or biological material'), ranging from 76% to 96% depending on the country. This points to a gap between knowledge about hand hygiene and practicing the relevant behaviours (Figure 15).

Figure 15. Percentage of respondents who stated they could list the WHO's five moments for hand hygiene, by country

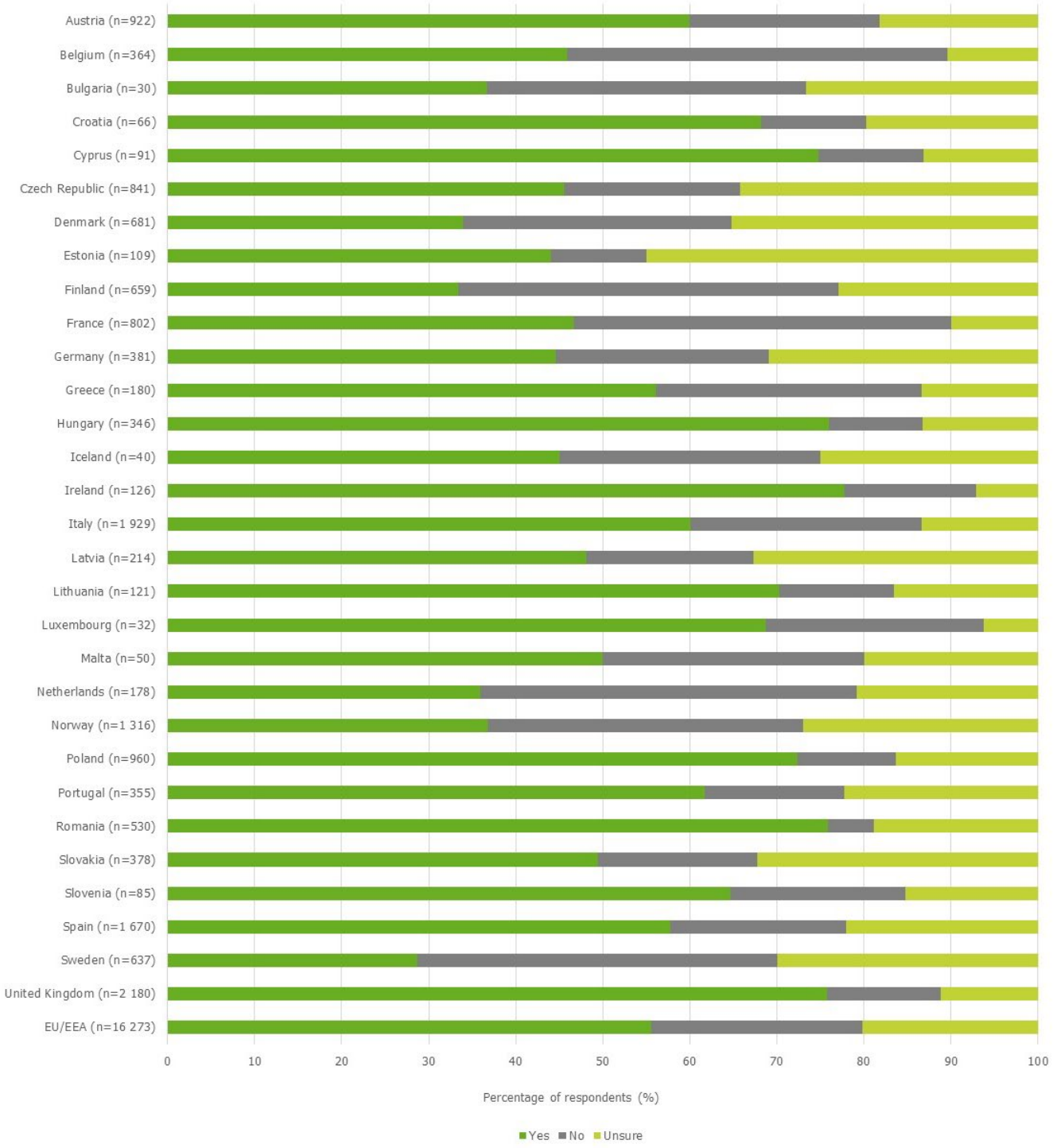
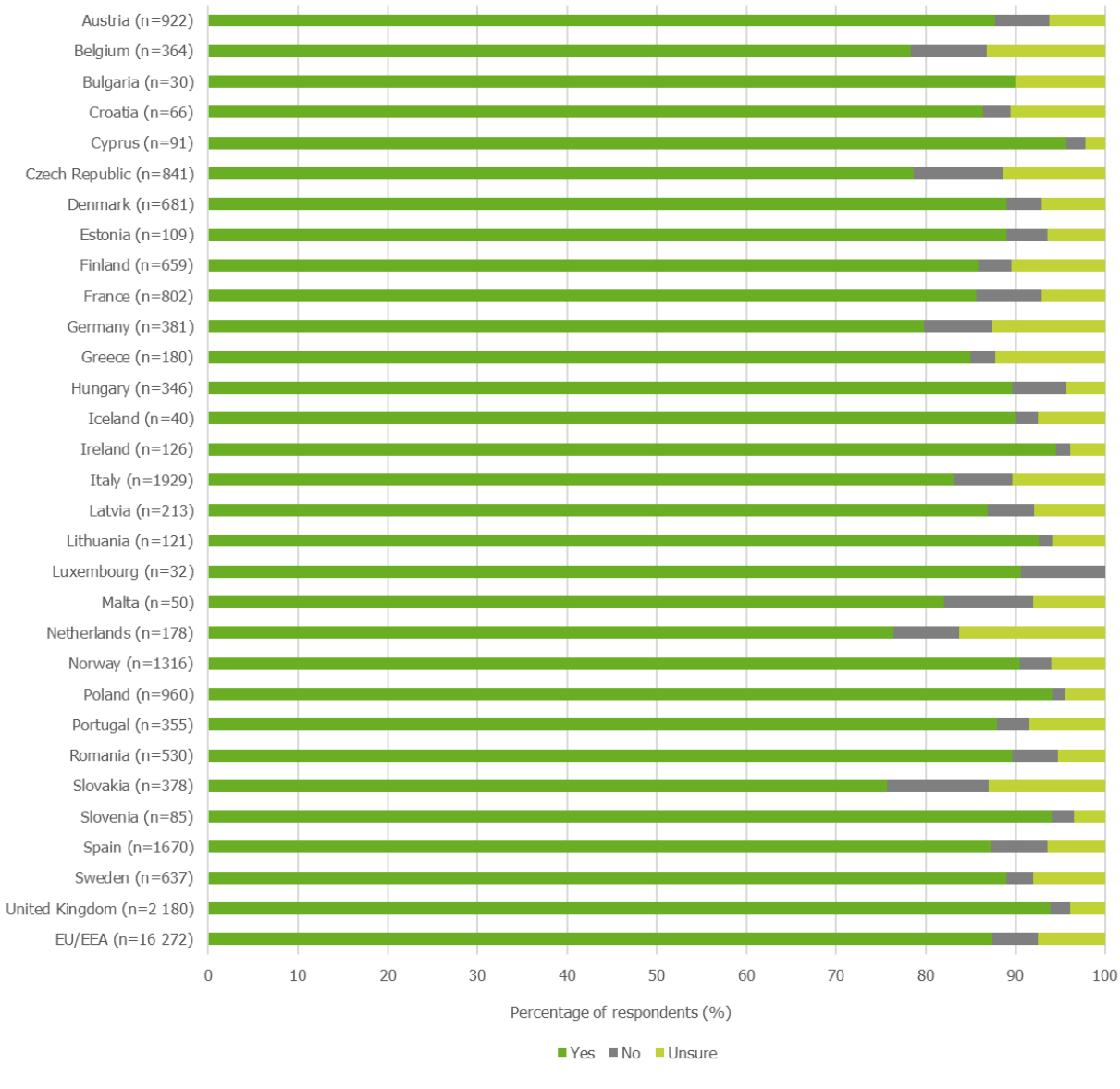


Figure 16. Country breakdown on percentage of respondents who stated they thought they needed to perform hand hygiene as recommended



Opportunities (physical or social environments that influence/enable behaviour)

The questionnaire also assessed opportunities that either promote or impede relevant behaviours important for preventing and controlling AMR (e.g. effective hand-washing techniques, prudent prescribing, and management of infections) either through the physical or social environment. If the healthcare worker has the capability and motivation to enact positive behaviours, but lacks the opportunity to do so, this presents a barrier and thereby a potential point for intervention [13, 14]. Across EU/EEA countries overall, 75% of those who said they had direct patient or public involvement agreed or strongly agreed they had easy access to guidelines on managing infections; 68% agreed or strongly agreed they had easy access to materials for advising on prudent antibiotic use and antibiotic resistance; and 72% agreed or strongly agreed they had good opportunities to advise individuals on prudent antibiotic use (Table 12).

Table 12. Proportion of respondents who have direct patient/public involvement and who agreed or disagreed with the following statements in relation to the management of infections and providing advice

Opportunity statement	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	N/A (%)	Do not understand the question (%)
I have easy access to guidelines I need on managing infections (n=14 301)	75.1	9.0	12.4	3.0	0.5
I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance (n=14 299)	67.5	12.9	17.1	2.1	0.4
I have good opportunities to provide advice on prudent antibiotic use to individuals (n=14 296)	72.3	9.5	14.9	2.9	0.4

Across professions, medical doctors and pharmacists were the most likely to state that they had easy access to guidelines they needed on managing infections. This was similar for doctors across both hospital and community settings, but for the pharmacy profession, a higher proportion in the hospital setting compared to community stated they had easy access to guidelines for managing infections (Table 13). Although 71% of all healthcare workers stated they had easy access to guidelines they need on managing infections, a lower percentage (64%) stated they had easy access to materials they need to give advice on prudent antibiotic use and antibiotic resistance (Table 14) which points to a potential gap that could be filled by suitable interventions.

Table 13. Percentage of respondents by profession and setting who agreed or disagreed with the statement 'I have easy access to guidelines I need on managing infections'

Profession	Setting	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	Not applicable (%)	Do not understand (%)
Allied health professional (n=578)	Hospital (n=289)	36.3	11.1	14.2	36.7	1.7
	Community (n=171)	32.7	19.9	17.0	30.4	0.0
	Other settings (n=118)	41.5	17.8	16.1	24.6	0.0
Dental care professional (n=29)	Hospital (n=7)	57.1	42.9	0.0	0.0	0.0
	Community (n=6)	50.0	33.3	16.7	0.0	0.0
	Other settings (n=16)	31.3	18.8	18.8	31.3	0.0
Dentist (n=1 013)	Hospital (n=92)	59.8	13.0	23.9	3.3	0.0
	Community (n=602)	66.6	11.6	19.4	0.8	1.5
	Other settings (n=319)	61.8	15.0	18.2	3.1	1.9
Medical doctor (n=7 007)	Hospital (n=3 683)	83.1	6.9	8.5	1.3	0.2
	Community (n=1 678)	82.1	7.5	8.9	1.1	0.3
	Other settings (n=1646)	77.2	7.9	9.8	4.5	0.6
Midwife (n=196)	Hospital (n=118)	66.1	12.7	17.8	3.4	0.0
	Community (n=43)	60.5	14.0	14.0	11.6	0.0
	Other settings (n=35)	71.4	8.6	5.7	11.4	2.9

Profession	Setting	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	Not applicable (%)	Do not understand (%)
Nurse (n=4 020)	Hospital (n=2 404)	70.7	9.3	12.9	6.3	0.8
	Community (n=910)	68.6	9.1	13.4	8.2	0.7
	Other settings (n=706)	65.7	9.5	16.0	8.5	0.3
Nursing associate/assistant (n=234)	Hospital (n=136)	54.4	14.0	16.2	14.7	0.7
	Community (n=34)	47.1	23.5	17.6	8.8	2.9
	Other settings (n=64)	60.9	12.5	12.5	10.9	3.1
Other (n=181)	Hospital (n=74)	41.9	4.1	8.1	45.9	0.0
	Community (n=28)	42.9	7.1	14.3	35.7	0.0
	Other settings (n=79)	45.6	7.6	11.4	35.4	0.0
Other healthcare worker (n=164)	Hospital (n=70)	58.6	8.6	11.4	21.4	0.0
	Community (n=29)	31.0	13.8	13.8	41.4	0.0
	Other settings (n=65)	55.4	7.7	10.8	26.2	0.0
Pharmacist (n=3 078)	Hospital (n=1 152)	84.5	5.2	8.4	1.6	0.3
	Community (n=208)	75.5	10.1	9.1	4.3	1.0
	Other settings including pharmacy (n=1 718)	53.1	16.2	21.0	9.1	0.5
Pharmacy technician (n=227)	Hospital (n=94)	67.0	7.4	9.6	16.0	0.0
	Community (n=37)	83.8	5.4	2.7	8.1	0.0
	Other settings including pharmacy (n=96)	47.9	13.5	22.9	11.5	4.2
Scientist (n=426)	Hospital (n=250)	64.4	4.4	8.4	22.8	0.0
	Community (n=7)	28.6	28.6	0.0	42.9	0.0
	Other settings (n=169)	50.3	9.5	10.7	29.6	0.0
Unknown (n=130)	Hospital (n=62)	64.5	4.8	8.1	21.0	1.6
	Community (n=26)	69.2	7.7	7.7	11.5	3.8
	Other settings (n=42)	42.9	9.5	16.7	31.0	0.0
All professions (n=17 283)	Hospital (n=8431)	75.7	7.7	10.4	5.7	0.5
	Community (n=3 779)	72.3	9.6	12.2	5.3	0.6
	Other settings (5 073)	62.7	11.9	15.6	9.2	0.7

Table 14. Percentage of respondents by profession and setting who agree or disagree with the statement, 'I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance'

Profession	Setting	Agree or Strongly Agree (%)	Disagree or Strongly Disagree (%)	Undecided (%)	Not applicable (%)	Do not understand (%)
Allied health professional (n=578)	Hospital (n=289)	27.7	13.8	11.8	45.7	1.0
	Community (n=171)	22.8	21.6	19.9	35.7	0.0
	Other settings (n=118)	32.2	22.0	16.1	29.7	0.0
Dental care professional (n=29)	Hospital (n=7)	28.6	28.6	28.6	14.3	0.0
	Community (n=6)	66.7	33.3	0.0	0.0	0.0
	Other settings (n=16)	25.0	18.8	25.0	31.3	0.0
Dentist (n=1 013)	Hospital (n=92)	59.8	19.6	19.6	1.1	0.0
	Community (n=602)	54.8	18.3	24.8	1.3	0.8
	Other settings (n=319)	57.7	16.9	22.3	1.3	1.9
Medical doctor (n=7007)	Hospital (n=3 683)	69.9	11.6	16.9	1.2	0.3
	Community (n=1 678)	69.7	11.5	17.4	0.9	0.5
	Other settings (n=1 646)	70.7	11.7	13.5	3.8	0.2
Midwife (n=196)	Hospital (n=118)	45.8	25.4	24.6	3.4	0.8
	Community (n=43)	62.8	11.6	16.3	9.3	0.0
	Other settings (n=35)	57.1	17.1	14.3	11.4	0.0
Nurse (n=4 019)	Hospital (n=2 403)	58.8	14.5	18.9	7.3	0.5
	Community (n=910)	60.8	13.6	18.2	6.9	0.4
	Other settings (n=706)	60.5	13.6	18.6	6.7	0.7
Nursing associate/assistant (n=234)	Hospital (n=136)	41.9	19.1	16.2	22.1	0.7
	Community (n=34)	41.2	26.5	17.6	14.7	0.0
	Other settings (n=64)	50.0	15.6	20.3	12.5	1.6
Other (n=181)	Hospital (n=74)	32.4	5.4	4.1	58.1	0.0
	Community (n=28)	50.0	14.3	7.1	28.6	0.0
	Other settings (n=79)	44.3	6.3	15.2	32.9	1.3
Other healthcare worker (n=164)	Hospital (n=70)	47.1	10.0	15.7	25.7	1.4
	Community (n=29)	51.7	10.3	3.4	34.5	0.0
	Other settings (n=65)	46.2	13.8	13.8	24.6	1.5
Pharmacist (n=3 078)	Hospital (n=1 152)	76.6	9.1	12.4	1.6	0.3
	Community (n=208)	75.5	10.6	13.5	0.0	0.5
	Other settings (n=1 718)	66.1	14.6	16.6	2.5	0.3
Pharmacy technician (n=227)	Hospital (n=94)	66.0	8.5	12.8	11.7	1.1
	Community (n=37)	75.7	2.7	16.2	5.4	0.0
	Other settings (n=96)	66.7	9.4	16.7	7.3	0.0

Profession	Setting	Agree or Strongly Agree (%)	Disagree or Strongly Disagree (%)	Undecided (%)	Not applicable (%)	Do not understand (%)
Scientist (n=425)	Hospital (n=249)	55.4	4.0	7.6	32.5	0.4
	Community (n=7)	28.6	42.9	0.0	28.6	0.0
	Other settings (n=169)	53.3	11.8	8.3	26.0	0.6
Unknown (n=130)	Hospital (n=62)	62.9	9.7	6.5	21.0	0.0
	Community (n=26)	69.2	7.7	11.5	11.5	0.0
	Other settings (n=42)	40.5	11.9	19.0	28.6	0.0
All professions (n=17 281)	Hospital (n=8 429)	64.2	12.3	16.3	6.8	0.4
	Community (n=3 779)	62.7	13.6	18.4	4.8	0.5
	Other settings (n=5 073)	63.8	13.5	16.0	6.2	0.5

Figures 17-19 provide the national picture (for those respondents who had direct patient/public involvement) of their perceived opportunities to address AMR, regarding access to guidelines or managing infections, materials to provide advice on antibiotic use and antibiotic resistance, and their opportunities to provide advice to patients.

Across the EU/EEA, 75% of respondents stated that they had easy access to the guidelines they need on managing infections. However, substantial differences in this were noted between countries, which suggests that while some countries may have structures in place that promote or prompt easy access to guidelines or materials on management of infections, other countries may find it more challenging. Once again, this provides an opportunity for intervention.

Overall, across the EU/EEA, 72% of all respondents with direct patient/public involvement agreed or strongly agreed that they had good opportunities to provide advice on prudent antibiotic use to individuals (Figure 18). However, a slightly lower proportion of all respondents with direct patient/public involvement (67%) agreed or strongly agreed that they had easy access to materials they needed to give advice on prudent antibiotic use and antibiotic resistance (Figure 19).

Figure 17. Percentage of respondents with direct patient/public involvement who agreed/disagreed with the statement, 'I have easy access to guidelines I need on managing infections', by country (n=14 301)

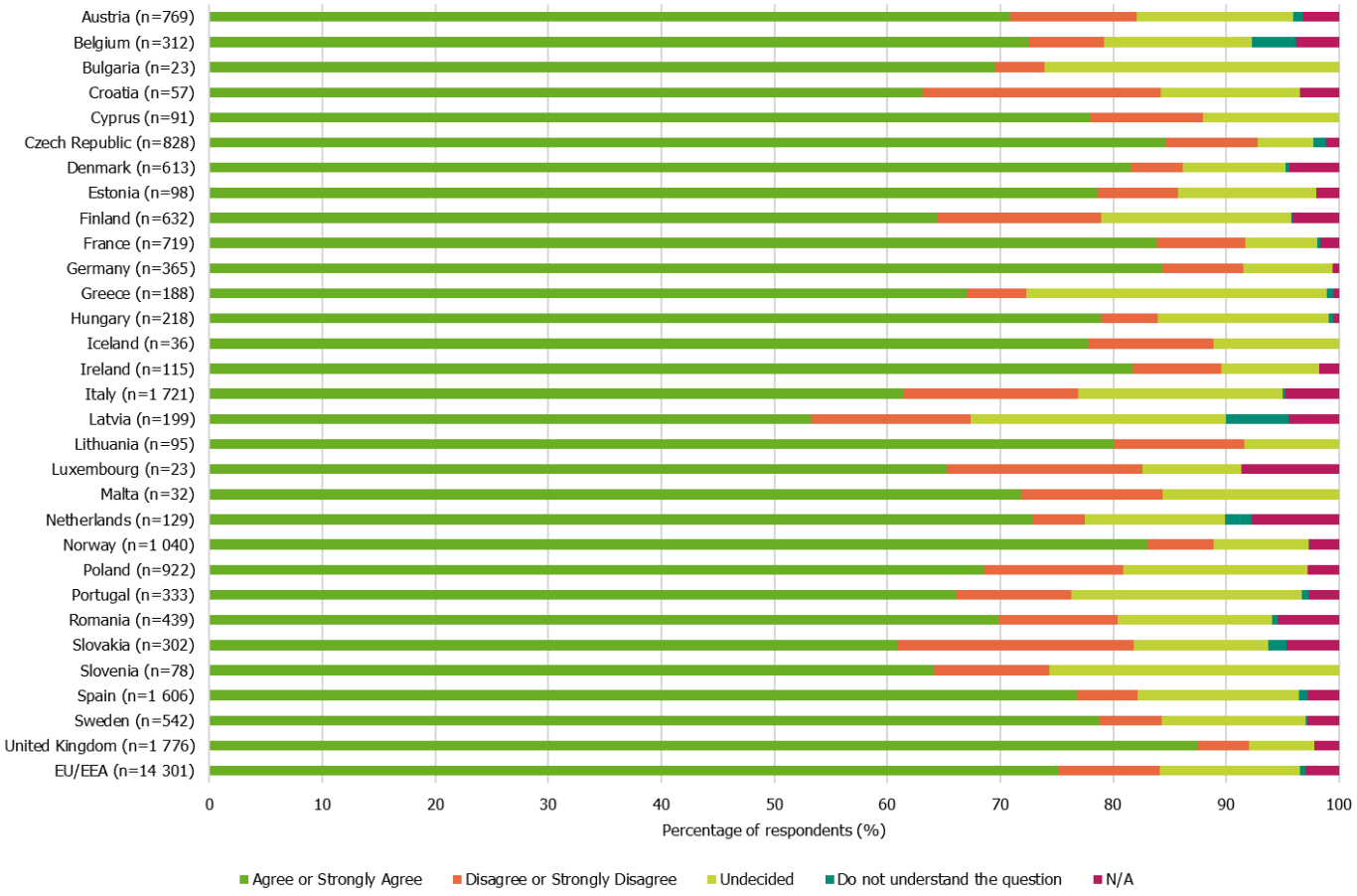


Figure 18. Percentage of respondents with direct patient/public involvement who agreed/disagreed with the statement 'I have good opportunities to provide advice on prudent antibiotic use to individuals', by country (n=14 296)

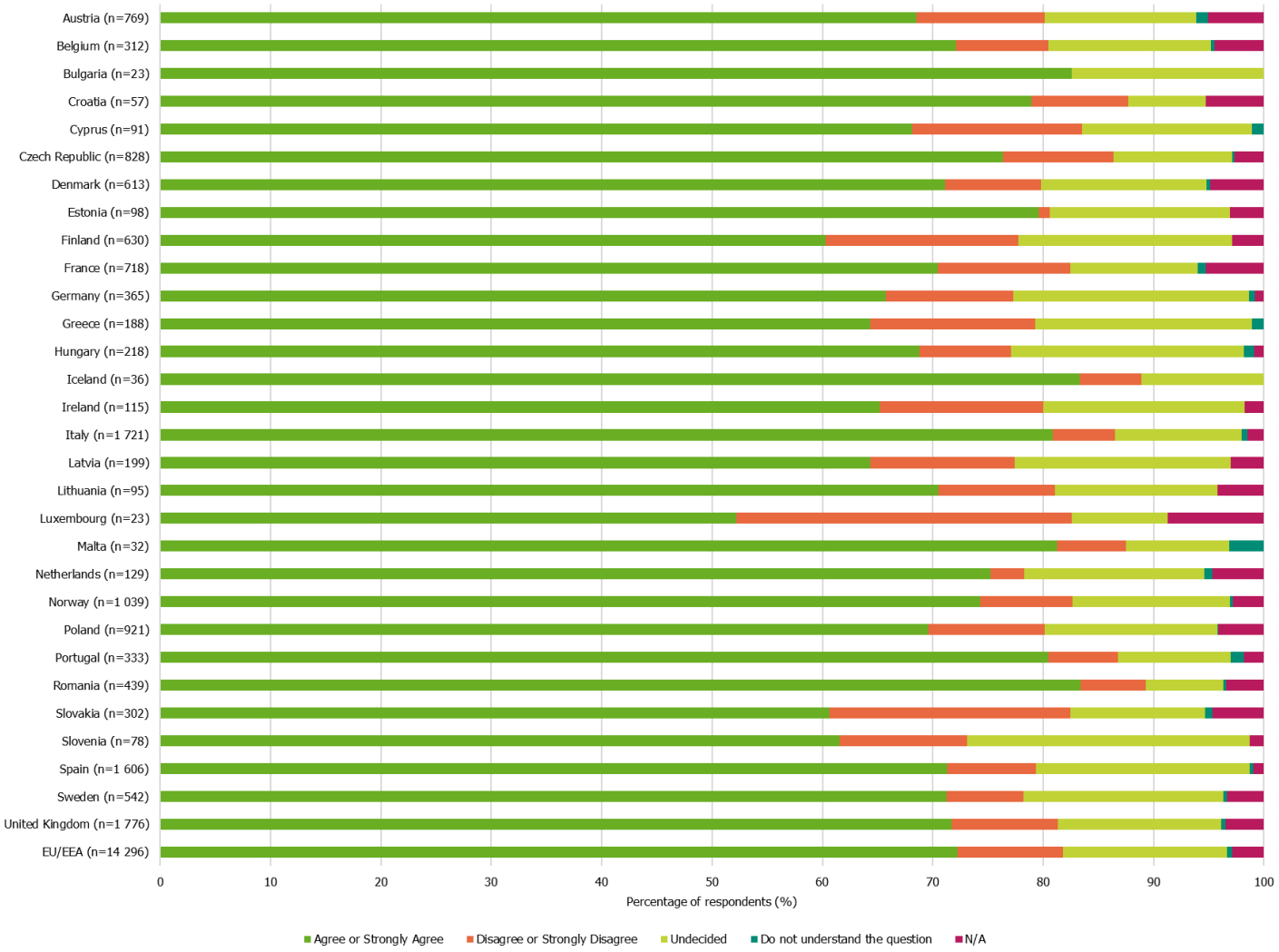
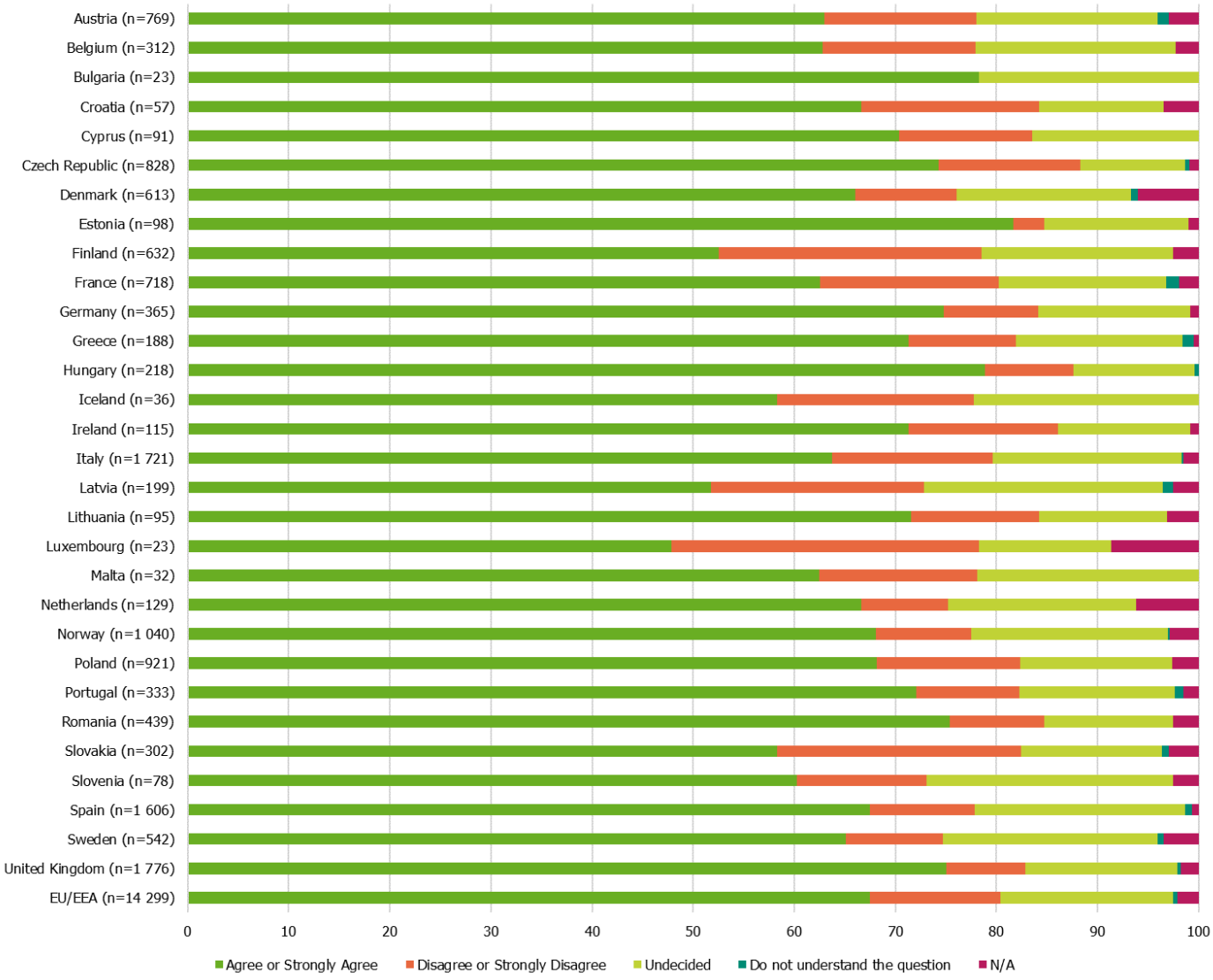


Figure 19. Percentage of respondents with direct patient/public involvement who agreed/disagreed with the statement 'I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance', by country (n=14 299)



Motivation

Role in emergence and spread of antibiotic resistance

Motivation is defined as brain processes that energise and direct behaviour, and these include habitual processes, emotional responding (fear, attitudes), as well as analytical decision-making. Collectively they can be a powerful drive towards whether or not a given behaviour is performed [13, 14]. In a professional context, motivation can be reflective (based on a conscious, analytical decision-making process) or automatic (based on habitual processes and emotional responses).

When asked what interaction respondents had with patients or members of the public in terms of diagnosis, prescribing, clinical checking prescriptions, dispensing, administration, or provision of advice on antibiotics to patients or members of the public (i.e. direct patient/public involvement), 82% of all EU/EEA respondents stated their role involved one or more of these interactions at some stage.

A high proportion of all respondents i.e. including respondents without direct patient/public involvement (89%) agreed or strongly agreed that they know there is a connection between their prescribing/dispensing/administering of antibiotics and the emergence and spread of antibiotic-resistant bacteria (Table 15). For the respondents with direct patient/public involvement (i.e. both prescribers and those engaged more generally in patient care), (92%) agreed or strongly agreed that they know there is a connection between their prescribing/dispensing/administering of antibiotics and the emergence and spread of antibiotic resistant bacteria (Figure 20). Interestingly, whilst almost all respondents with direct patient/patient facing roles agreed they know there is a connection between their prescribing, dispensing or administering of antibiotics on the emergence and spread of antibiotic resistant bacteria, only two-thirds (63%) of them agreed or strongly agreed that they have a key role in helping control antibiotic resistance (Figure 20). The proportion of respondents who strongly agreed or agreed that they have a key role in helping control antibiotic resistance was higher for those that work in community settings (65%) compared to hospital (56%) and other settings (55%) (Table 16).

Figure 20. Percentage of respondents with direct patient or public involvement that agreed with the following motivation statements

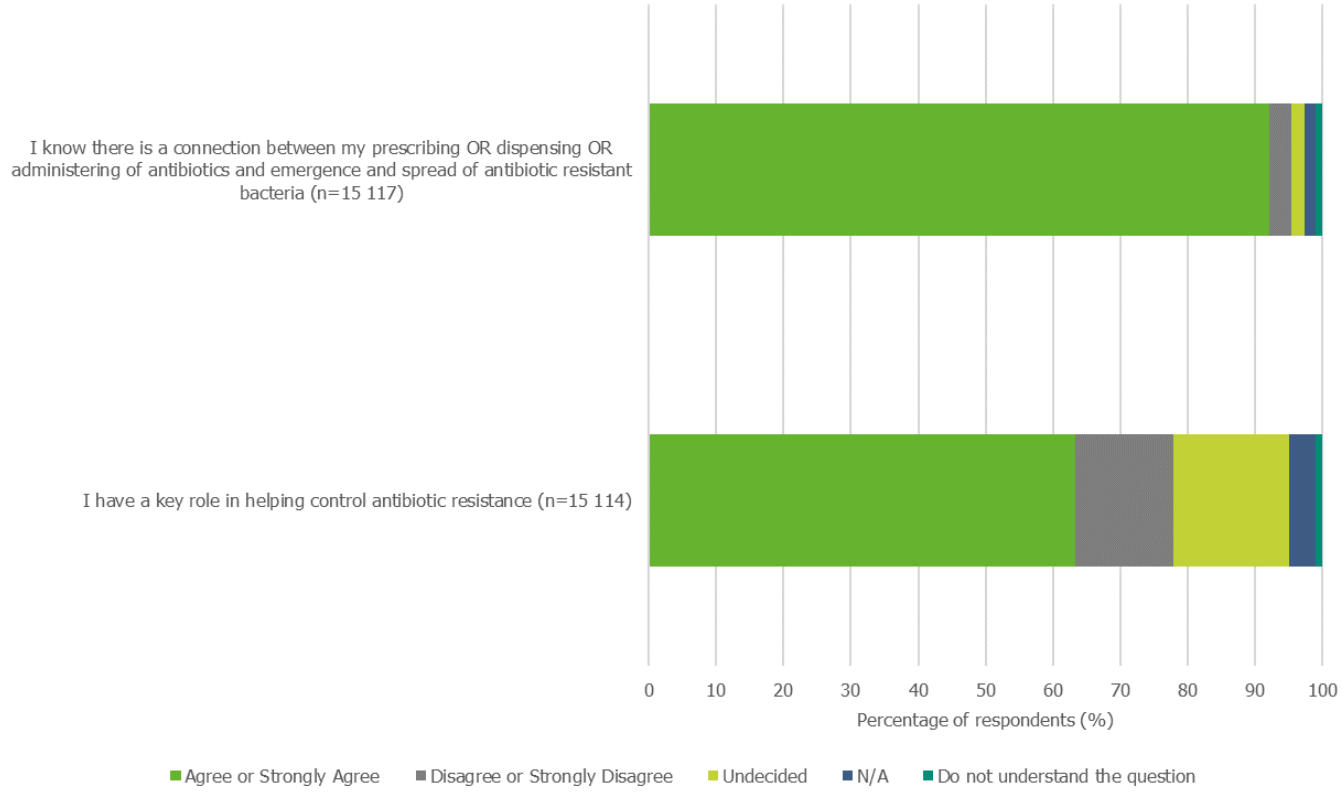


Table 15. Percentage of each profession who agree/disagree that there is a connection between their prescribing OR dispensing OR administering of antibiotics and emergence and spread of antibiotic resistant bacteria

Profession	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	N/A (%)	Do not understand the question (%)
Medical doctor (n=7 351)	94.0	3.3	1.1	1.1	0.6
Pharmacist (n=3 257)	93.0	2.3	1.8	2.2	0.6
Dentist (n=1 085)	90.8	4.9	2.9	0.2	1.3
Midwife (n=210)	86.2	2.4	3.8	6.7	1.0
Nurse (n=4 311)	84.8	3.5	3.9	5.9	1.9
Pharmacy technician (n=250)	84.4	4.0	3.6	6.4	1.6
Scientist (n=461)	77.2	2.0	0.7	19.5	0.7
Dental care professional (n=33)	75.8	0.0	9.1	12.1	3.0
Unknown (n=145)	72.4	3.4	4.1	18.6	1.4
Nursing associate/assistant (n=250)	71.6	5.2	8.4	10.4	4.4
Other healthcare worker (n=176)	71.0	1.1	6.8	18.8	2.3
Others (non-healthcare) (n=200)	64.5	2.5	4.5	28.0	0.5
Allied health professional (n=633)	60.8	3.9	2.7	30.0	2.5
All professions (n=18 362)	88.6	3.2	2.3	4.7	1.1

Table 16. Percentage of respondents that agreed or disagreed that they have a key role in controlling antibiotic resistance by profession and setting

Profession	Setting	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	N/A (%)	Do not understand the question (%)
Allied health professional (n=632)	Community (n=184)	28.8	30.4	12.5	27.2	1.1
	Hospital (n=317)	18.0	36.6	10.4	34.4	0.6
	Other settings (n=131)	16.8	39.7	11.5	32.1	0.0
Dental care professional (n=33)	Community (n=7)	42.9	14.3	14.3	28.6	0.0
	Hospital (n=8)	0.0	50.0	12.5	37.5	0.0
	Other settings (n=18)	44.4	22.2	11.1	22.2	0.0
Dentist (n=1 084)	Community (n=641)	67.6	11.4	17.2	3.0	0.9
	Hospital (n=104)	60.6	10.6	21.2	4.8	2.9
	Other settings (n=339)	60.2	12.7	20.4	5.0	1.8
Medical doctor (n=7 351)	Community (n=1 748)	74.8	7.9	13.1	3.4	0.8
	Hospital (n=3 876)	64.6	15.8	16.1	2.7	0.9
	Other settings (n=1 727)	61.4	14.5	15.9	6.5	1.6
Midwife (n=210)	Community (n=44)	43.2	18.2	22.7	15.9	0.0
	Hospital (n=128)	46.1	28.9	17.2	7.0	0.8
	Other settings (n=38)	28.9	44.7	21.1	5.3	0.0
Nurse (n=4 309)	Community (n=970)	55.4	17.1	17.0	9.2	1.3
	Hospital (n=2 584)	48.5	21.8	20.5	8.4	0.9
	Other settings (n=755)	42.8	23.2	22.0	11.0	1.1
	Community (n=38)	31.6	23.7	23.7	21.1	0.0

Profession	Setting	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Undecided (%)	N/A (%)	Do not understand the question (%)
Nursing associate/assistant (n=250)	Hospital (n=143)	21.7	28.0	21.7	25.9	2.8
	Other settings (n=69)	26.1	43.5	18.8	8.7	2.9
Other (n=200)	Community (n=28)	42.9	14.3	14.3	28.6	0.0
	Hospital (n=84)	22.6	19.0	4.8	52.4	1.2
	Other settings (n=88)	35.2	26.1	15.9	21.6	1.1
Other healthcare worker (n=176)	Community (n=30)	36.7	26.7	10.0	26.7	0.0
	Hospital (n=76)	31.6	21.1	10.5	36.8	0.0
	Other settings (n=70)	38.6	38.6	7.1	14.3	1.4
Pharmacist (n=3 257)	Community (n=214)	71.5	10.3	16.4	1.9	0.0
	Hospital (n=1 203)	68.7	12.1	17.0	1.7	0.4
	Other settings (n=1 840)	61.5	15.7	18.0	4.1	0.8
Pharmacy technician (n=250)	Community (n=40)	45.0	20.0	30.0	5.0	0.0
	Hospital (n=102)	37.3	32.4	21.6	8.8	0.0
	Other settings (n=108)	38.0	25.0	24.1	12.0	0.9
Scientist (n=461)	Community (n=8)	50.0	37.5	12.5	0.0	0.0
	Hospital (n=272)	49.3	14.0	8.5	27.2	1.1
	Other settings (n=181)	41.4	26.5	11.6	19.9	0.6
Unknown (n=144)	Community (n=30)	43.3	20.0	23.3	13.3	0.0
	Hospital (n=69)	33.3	33.3	8.7	20.3	4.3
	Other settings (n=45)	17.8	26.7	20.0	35.6	0.0
All professions (n=10 564)	Community (n=2 575)	64.7	12.6	15.3	6.6	0.9
	Hospital (n=5 029)	56.1	18.5	17.1	7.5	0.9
	Other settings (n=2 960)	54.7	18.4	17.6	8.1	1.2

When asked what level healthcare workers thought it is most effective to tackle resistance to antibiotics (up to two options could be included in each response), just over two thirds of healthcare workers (67%) indicated that action at all levels is needed; 22% of respondents selected individual level (prescribers), and 22% selected all healthcare workers (Table 17).

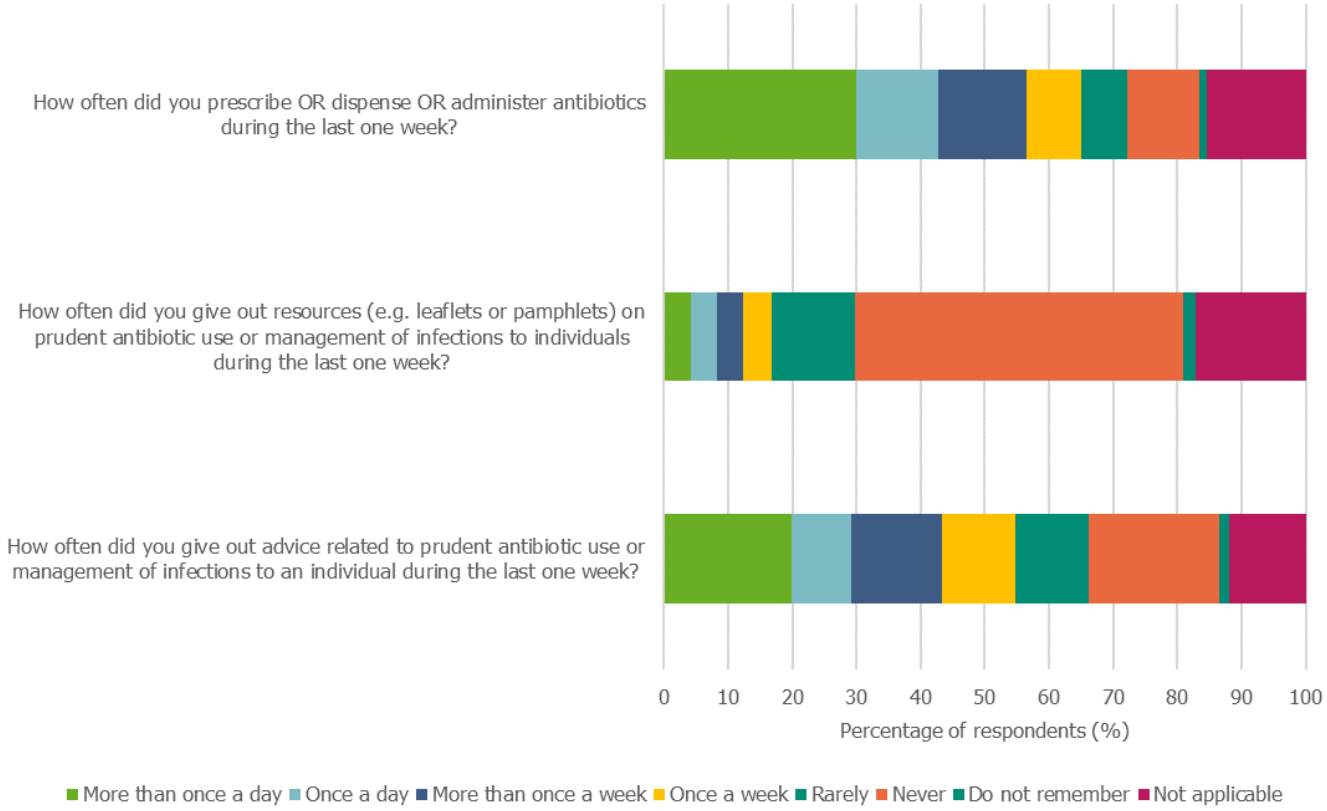
Table 17. What level healthcare workers believed it was most effective to tackle resistance to antibiotics (n=15 406)

Level to tackle resistance to antibiotics	Frequency of chosen answer (% of responses)
Action at all levels needed	10 265 (66.6)
Individual level (Prescribers)	3 438 (22.3)
Individual level (All healthcare workers)	3 299 (21.8)
Individual level (Public)	2 116 (13.7)
Environmental/Animal health	1 359 (8.8)
EU/Global	1 320 (8.6)
Regional/National	1 064 (6.9)
Do not know	182 (1.2)

Behaviour related to giving out resources and advice

When asked about the behaviour of giving out resources and advice, 65% of all the respondents reported that they prescribed or administered or dispensed antibiotics once a week or more. However, only 17% had given out resources (e.g. leaflets or pamphlets) on prudent antibiotic use or management of infections in the previous one week , while 55% had given out advice on managing infections or the prudent use of antibiotics (Figure 21). 51% and 20% respectively stated that they never did either. Pharmacies were the most frequently cited setting for each of these three activities (Table 18-20). Medical doctors were proportionately the most frequent providers of resources and/or advice on managing infections and the prudent use of antibiotics (Table 21).

Figure 21. The frequency with which respondents who have direct patient/public involvement provided antibiotics or resources related to prudent use of antibiotics (n=14 294)



Most of the respondents with direct patient/public involvement had prescribed, dispensed or administered antibiotics in the week prior to the survey; 43% carried out this duty at least once a day with another 22% carrying out one of these tasks at least once during the week (Table 18).

Table 18. The frequency with which respondents with direct patient/public involvement from each setting prescribe OR dispense OR administer antibiotics during the last one week

Setting	Number of respondents	At least one a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)	Not applicable (%)
Hospital	6 941	44.5	22.0	6.0	10.3	1.0	16.3
Community	3 216	33.2	28.2	10.0	15.3	1.4	11.9
Pharmacy	1 528	73.2	11.0	2.3	2.6	1.1	9.8
Long term care facility	873	41.6	26.1	9.6	11.7	1.3	9.7
Unknown	475	45.5	28.2	7.8	10.1	1.5	6.9
Public health institute	411	22.1	22.1	8.0	19.0	0.2	28.5
University	207	9.7	10.1	10.6	23.2	1.0	45.4
Professional body	194	29.9	26.8	11.3	13.9	1.0	17.0
Governmental organisation	183	10.4	12.6	10.4	14.2	1.6	50.8
Industry	158	25.9	19.0	12.7	12.0	1.3	29.1
Other	72	12.5	20.8	4.2	22.2	2.8	37.5
Not specified	36	33.3	27.8	11.1	8.3	0.0	19.4
All Settings	14 294	42.7	22.4	7.1	11.3	1.1	15.4

Table 19. The frequency with which respondents with direct patient/public involvement gave out resources (e.g. leaflets or pamphlets) on prudent antibiotic use or management of infections to individuals during the last one week

	Number of respondents	At least one a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)	Not applicable (%)
Hospital	6 941	7.1	8.1	12.2	52.2	1.8	18.7
Community	3 216	8.9	8.9	13.8	53.8	2.0	12.7
Pharmacy	1 528	10.1	6.6	14.9	54.2	1.7	12.4
Long term care facility	873	9.9	11.8	15.2	47.0	2.1	14.1
Unknown	475	14.1	9.5	13.7	50.1	2.1	10.5
Public health institute	411	6.6	11.2	11.2	44.5	1.5	25.1
University	207	4.8	8.2	8.2	38.6	0.5	39.6
Professional body	194	9.8	10.3	16.0	39.7	4.6	19.6
Governmental organisation	183	4.9	12.6	12.0	25.1	0.5	44.8
Industry	158	8.2	8.2	8.9	43.0	3.2	28.5
Other	72	5.6	4.2	6.9	45.8	2.8	34.7
Not specified	36	5.6	5.6	13.9	38.9	11.1	25.0
All Settings	1 4294	8.2	8.5	13.0	51.3	1.9	17.1

Table 20. The frequency with which respondents with direct patient/public involvement provided advice related to prudent antibiotic use or management of infections to an individual during the last one week

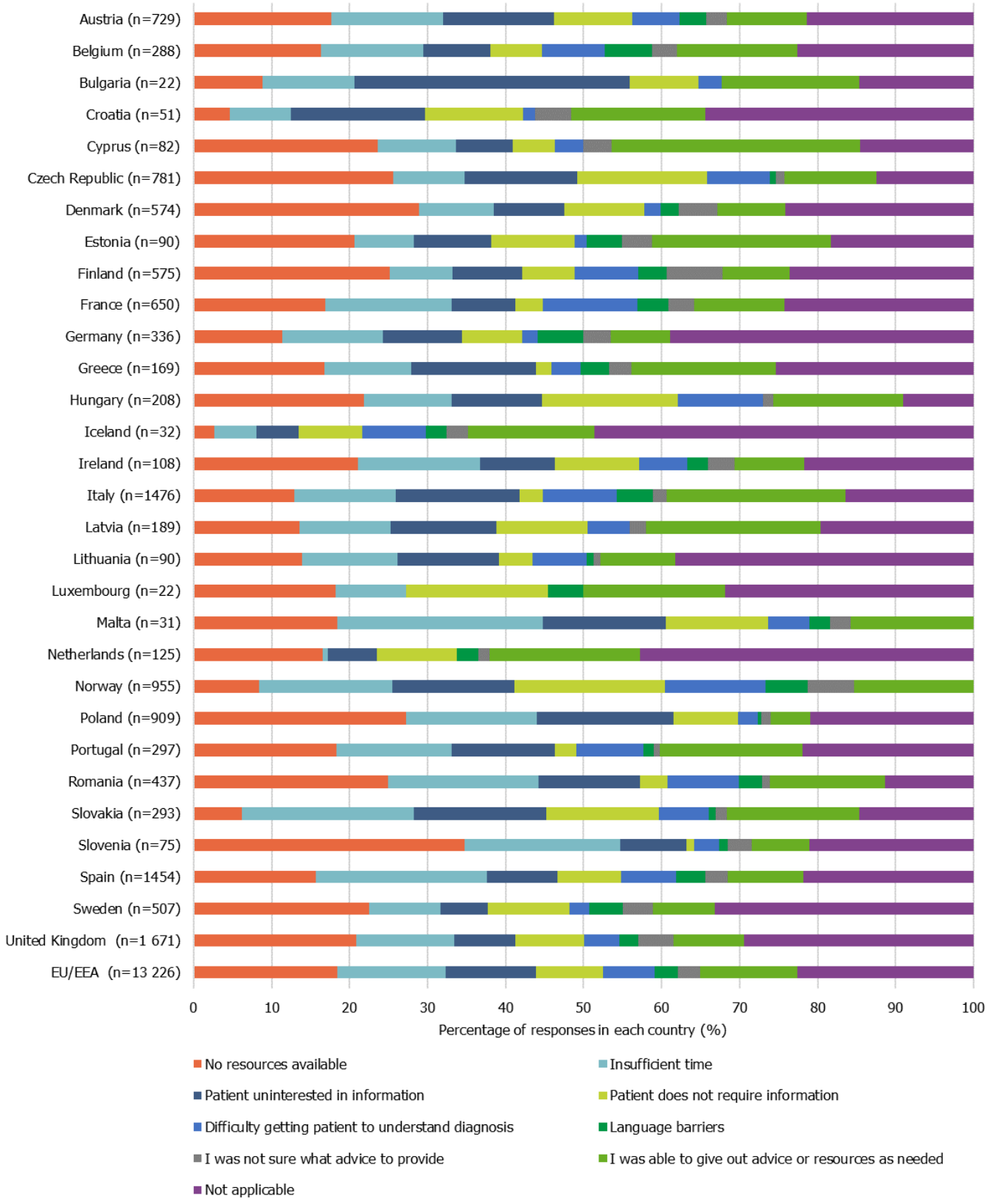
Setting	Number of respondents	At least one a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)	Not applicable (%)
Hospital	6 941	21.8	24.7	13.3	25.0	1.5	13.8
Community	3 216	37.2	30.1	9.8	14.5	1.3	7.1
Pharmacy	1 528	49.5	18.9	7.9	14.1	1.6	7.9
Long term care facility	873	32.1	25.8	10.5	20.7	1.8	9.0
Unknown	475	41.1	28.6	8.4	14.7	1.7	5.5
Public health institute	411	19.2	25.5	11.4	23.4	1.2	19.2
University	207	15.0	22.7	9.7	18.8	1.0	32.9
Professional body	194	25.8	34.5	11.9	11.3	2.1	14.4
Governmental organisation	183	14.2	28.4	13.1	9.8	0.0	34.4
Industry	158	13.9	17.1	8.2	33.5	5.7	21.5
Other	72	25.0	20.8	11.1	16.7	2.8	23.6
Not specified	36	30.6	22.2	11.1	16.7	2.8	16.7
All Settings	14 294	29.2	25.6	11.4	20.4	1.5	11.9

Table 21. Percentage of respondents who prescribed/dispensed/administered antibiotics, and those who gave out resources and/or provided advice related to prudent antibiotic use or management of infections to an individual at least once during the previous week, by profession

Profession	Number (%) of respondents who prescribed OR dispensed OR administered antibiotics at least once during the previous week	Number (%) of respondents who gave out resources (e.g. leaflets or pamphlets) on prudent antibiotic use or management of infections to an individual at least once during the previous week	Number (%) of respondents who provided advice related to prudent antibiotic use or management of infections to an individual at least once during the previous week
Medical doctor	4 917 (50.4)	1 209 (45.3)	4 249 (50.5)
Pharmacist	2 166 (22.2)	562 (21.1)	1 816 (21.6)
Nurse	1 689 (17.3)	596 (22.3)	1 395 (16.6)
Dentist	592 (6.1)	103 (3.9)	511 (6.1)
Pharmacy technician	124 (1.3)	48 (1.8)	83 (1.0)
Nursing associate/assistant	83 (0.9)	25 (0.9)	45 (0.5)
Midwife	58 (0.6)	13 (0.5)	43 (0.5)
Allied health professional	45 (0.5)	37 (1.4)	83 (1.0)
Unknown	22 (0.2)	13 (0.5)	37 (0.4)
Other healthcare worker	22 (0.2)	9 (0.3)	25 (0.3)
Scientist	15 (0.2)	40 (1.5)	78 (0.9)
Other	13 (0.1)	13 (0.5)	32 (0.4)
Dental care professional	5 (0.1)	1 (0.0)	9 (0.1)
All professions	**9 751 (100.0)**	**2 669 (100.0)**	**8 406 (100.0)**

When healthcare workers were invited to select from a list their reasons for not giving out advice or resources, the top three reasons chosen from across the EU/EEA included no resources available, insufficient time, and a lack of interest shown by patients in the information (Figure 22). Substantial differences were noted between countries in response to these questions.

Figure 22. Reasons why healthcare workers were unable to provide resources (e.g. leaflets or pamphlets) to their patients by country[4]



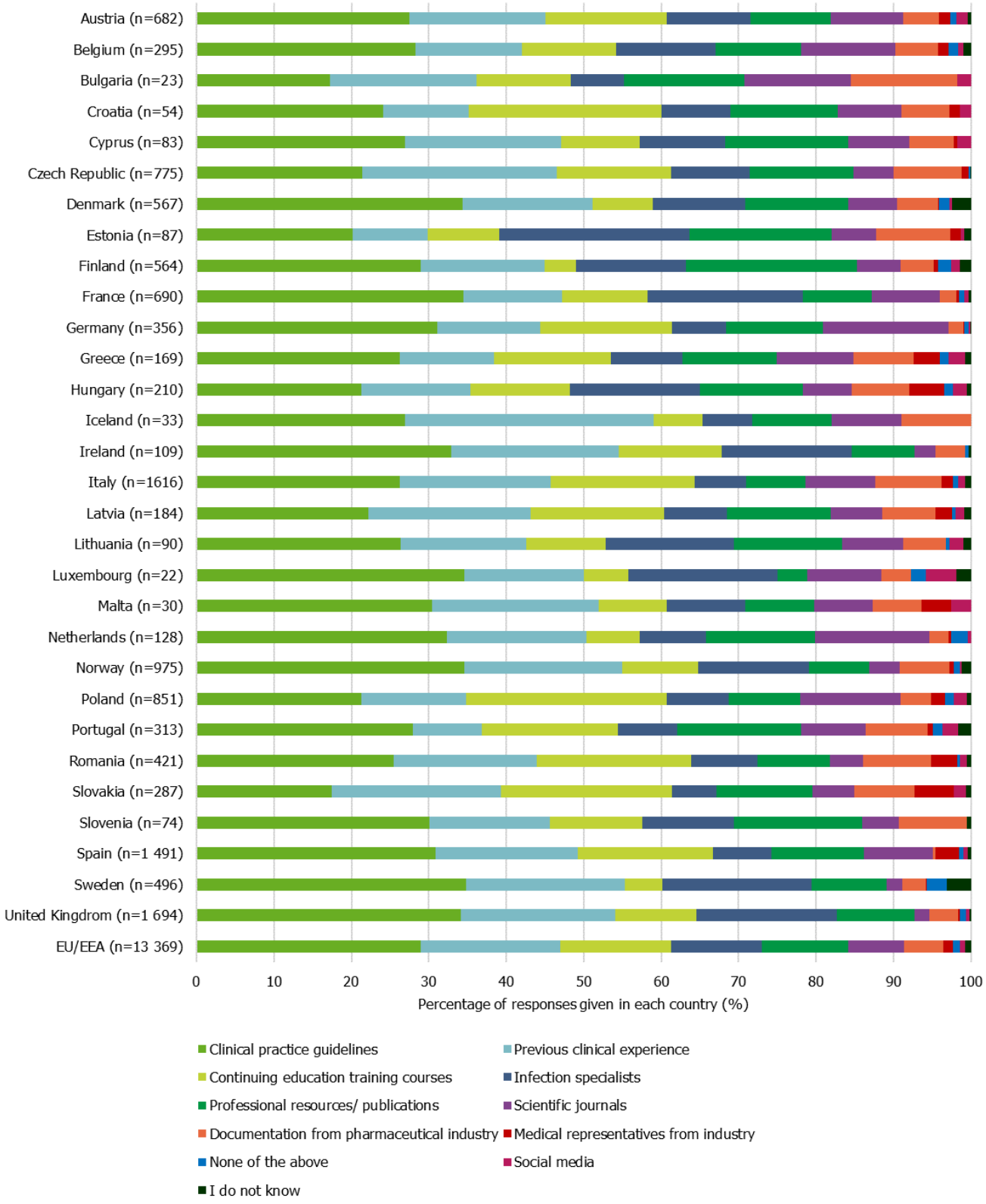
[4] Multiple responses allowed; the table presents the overall proportion of the responses given

Exploring information available to and used by healthcare workers; awareness of national and international campaigns and available training on antibiotic use and antibiotic resistance

Resources used by healthcare workers in management of infections

The type of information healthcare workers received was also assessed. In an earlier question, we asked healthcare workers if they had access to materials/resources needed to provide advice to individuals on managing infections or on prudent antibiotic use: 75% of healthcare workers who have direct patient/public involvement across the EU/EEA reported that they felt able to access guidelines on managing infections easily (Table 12). Following on from this, the survey found clinical practice guidelines to be the most frequently used resource by healthcare workers for the management of infections (29%), followed by 'previous clinical experience' (18%), and continuing education training courses (14%). Social media and the pharmaceutical industry (medical representatives or documentation) were the least cited resources from the list provided (Figure 23). This order (clinical practice guidelines, previous clinical experience, continuing education training courses) was consistent regardless of setting (Table 22). Respondents in the pharmacy setting were least likely to use clinical guidelines, but they were also the most likely to use documentation from the pharmaceutical industry (Table 22).

Figure 23. Resources most frequently used in the management of infections by healthcare workers with direct patient/public involvement, by country[5]



[5] Multiple responses allowed; the table presents the overall proportion of the responses given

Table 22. Resources most frequently used in the management of infections by all healthcare workers, by setting (multiple responses allowed)

Setting	Number of respondents	Clinical practice guidelines (%)	Previous clinical experience (%)	Continuing education training courses (%)	Infection specialists (%)	Professional resources/publications (%)	Scientific journals (%)	Documentation from the pharmaceutical industry (%)	Do not use any of these (%)	Medical representatives from the industry (%)	Do not know (%)	Social media (%)
Hospital	7 822	71.7	38.7	26.6	42.9	23.3	15.4	11.0	3.4	2.2	3.0	1.8
Community	3 536	72.1	47.7	38.4	14.9	27.7	14.7	7.4	3.5	3.5	2.3	1.7
Pharmacy	1 445	38.3	26.6	44.4	6.6	34.5	19.8	25.5	5.5	6.0	4.7	4.6
Long-term care facility	941	63.1	48.2	38.8	16.2	26.8	12.9	14.9	2.9	5.2	2.9	2.4
Public health institute	566	58.0	32.7	28.1	18.0	28.4	16.1	11.5	6.0	1.9	4.4	1.6
Unknown	523	57.9	58.1	47.6	10.9	25.8	18.7	12.8	1.9	5.0	1.1	1.7
University	313	54.6	23.3	26.5	21.4	29.4	41.2	8.6	4.5	1.3	5.8	1.0
Government organisation	281	64.1	22.8	23.5	25.3	33.1	19.9	10.0	7.8	0.7	2.5	2.5
Professional body	222	56.8	52.7	41.0	14.9	28.8	22.1	14.4	3.6	4.5	1.8	0.9
Industry	194	46.9	33.0	50.0	9.8	28.9	26.3	11.9	3.1	7.2	4.6	6.2
Other	107	45.8	31.8	26.2	23.4	38.3	18.7	12.1	2.8	4.7	7.5	0.9
Not specified	48	52.1	31.3	50.0	22.9	12.5	25.0	6.3	6.3	0.0	0.0	2.1
All	**15 998**	**66.1**	**40.1**	**33.8**	**28.2**	**26.3**	**16.5**	**11.8**	**3.7**	**3.2**	**3.1**	**2.1**

When respondents were asked whether they had received information about avoiding unnecessary prescribing or administering or dispensing of antibiotics over the past year, 60% said they had received information (Table 23). The most common sources for receiving this information were the workplace, published guidelines, and group training (Figure 24). 58% of respondents who received information on these topics said that the information did contribute to changing their views about avoiding unnecessary use prescribing or administering or dispensing of antibiotics (Table 23). Published guidelines were the most common source of information to contribute to this change in views overall for all respondents, followed by group training, and then the workplace, although there was variation across countries (Figure 25).

Forty two per cent of respondents said the information they received had changed their practice on prescribing, administering or dispensing antibiotics (Table 23). Those who did not change their practice said this was because they were already following the principles of the message (82%), they had no control over it (7%), or they found the information to be irrelevant to their current practice (5%) (Table 24).

Table 23. Number of respondents (%) who received information on avoiding unnecessary prescribing, administering or dispensing of antibiotics; and, of those, the number (%) reporting that the information contributed to changing their views or practice

	Yes n (%)	No n (%)	Unsure n (%)
In the last 12 months, do you remember receiving any information about avoiding unnecessary prescribing OR administering OR dispensing of antibiotics? (n = 16 144)	9 707 (60.1)	4 913 (30.4)	1 524 (9.4)
Did the information contribute to changing your views about avoiding unnecessary prescribing OR administering OR dispensing of antibiotics? (n = 8 701)	5 071 (58.3)	3 010 (34.6)	620 (7.1)
On the basis of the information you received, have you changed your practice on prescribing OR administering OR dispensing antibiotics? (n = 8 650)	3 641 (42.1)	3 727 (43.1)	1 282 (14.8)

Figure 24. Sources of information about avoiding unnecessary prescribing/dispensing/administering antibiotics in the last 12 months as cited by healthcare workers, by country[6].

[6] Multiple responses allowed; the table presents the overall proportion of the responses given

Figure 25. Sources of information which had the most influence on changing the respondent's views, by country[7]

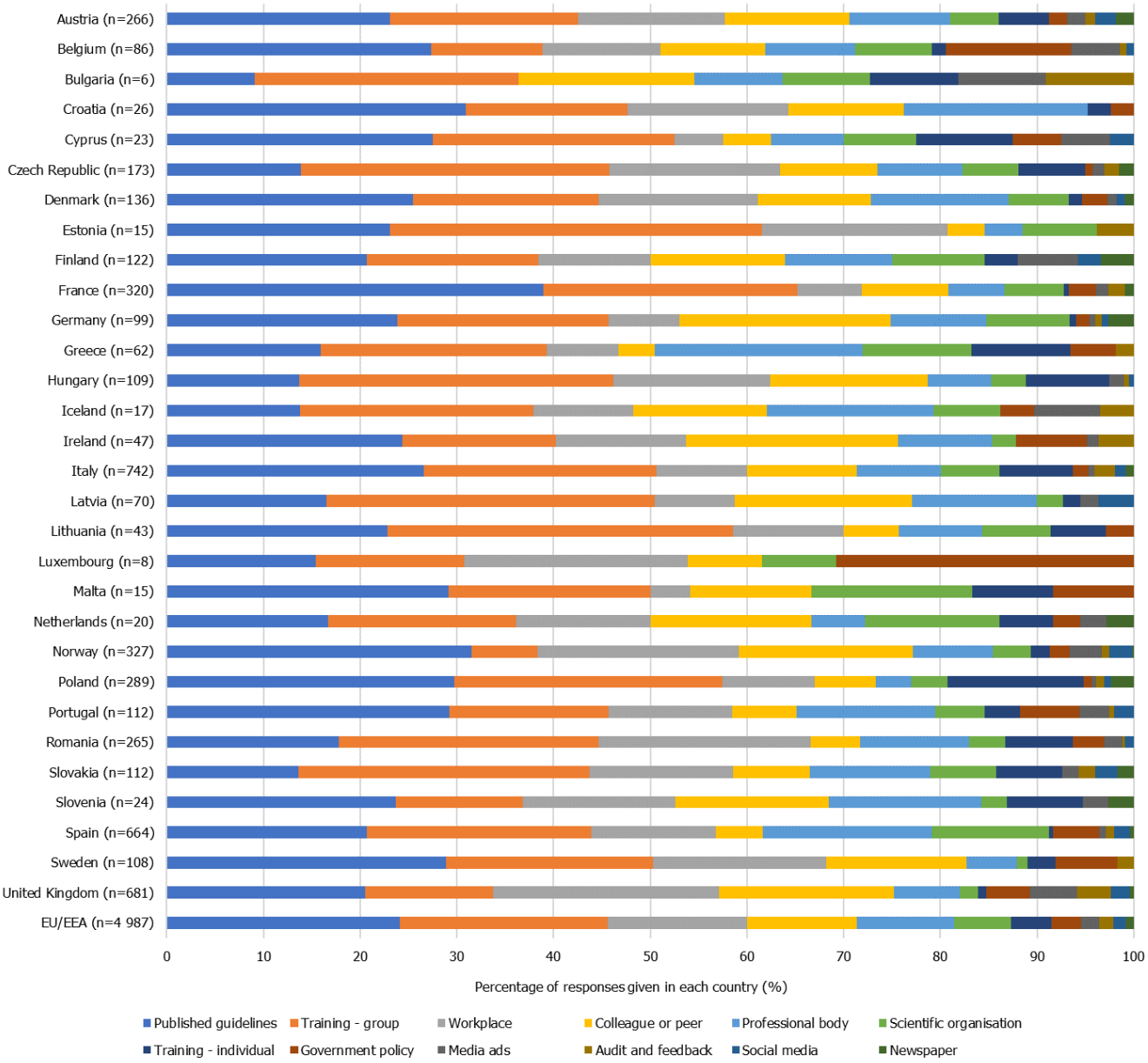
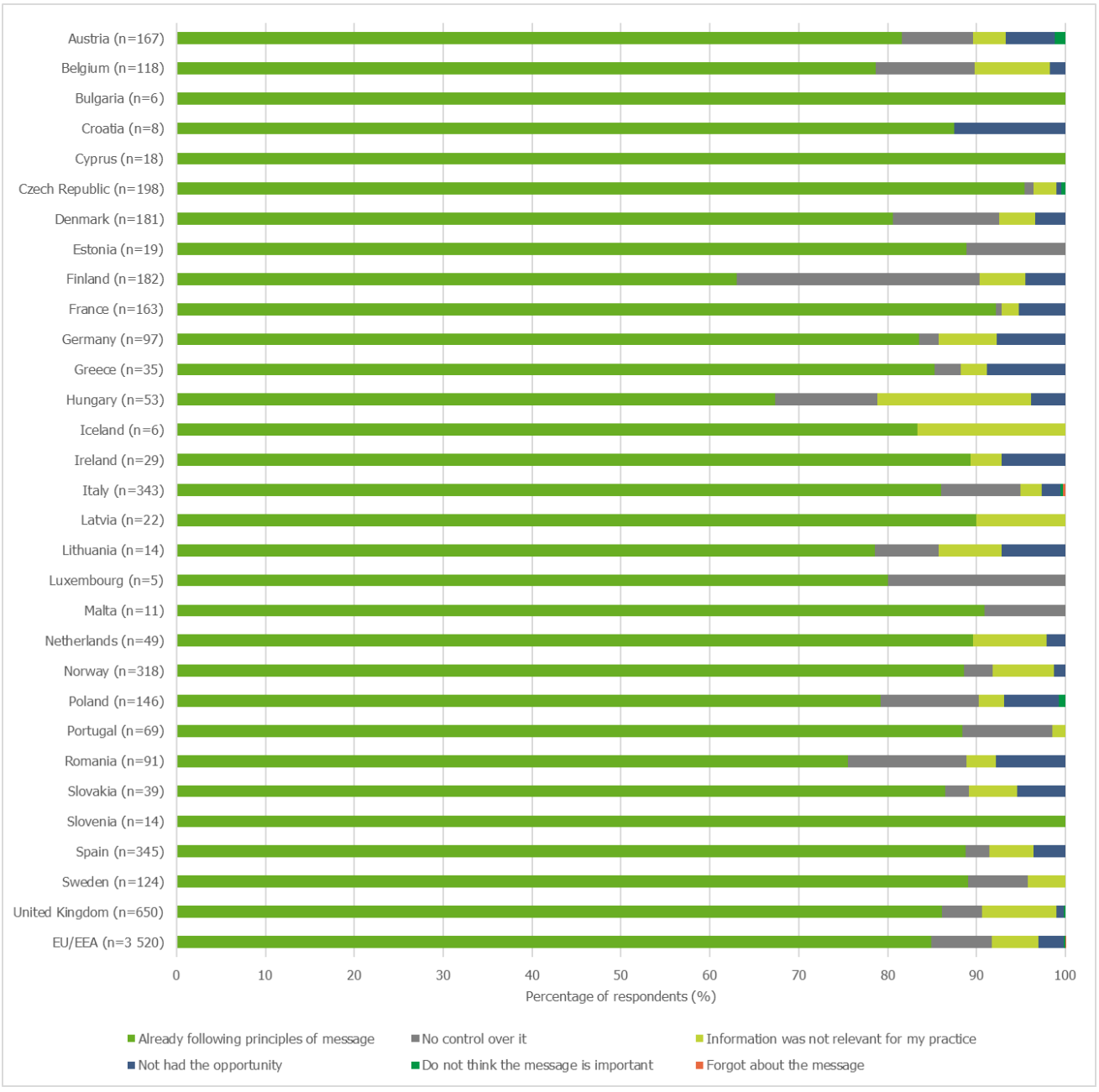


Table 24. Reasons why respondents said they did not change their practice based on the information they received (n=3 520)

Reason for not changing practice	Frequency of chosen answer (% of respondents)
Already following principles of message	2 894 (82)
No control over it	233 (7)
Information was not relevant for my practice	178 (5)
Not had the opportunity	97 (3)
Do not think the message is important	6 (0.2)
Forgot about the message	1 (0.03)

[7] Multiple responses allowed; the table presents the overall proportion of the responses given

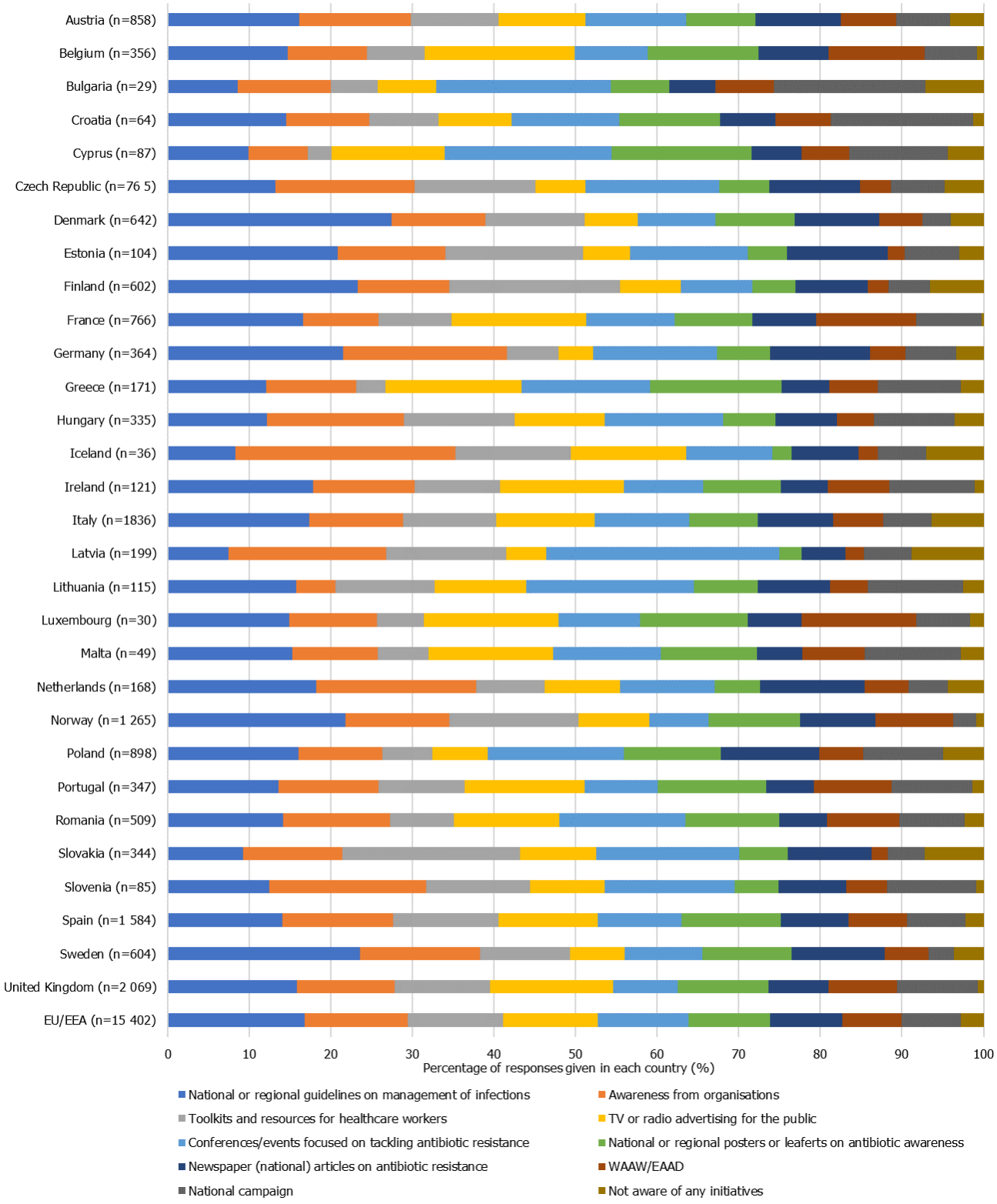
Figure 26. Reasons why respondents did not change their practice based on the information they received in the last 12 months, by country



Campaign and training

When assessing the respondents' awareness of initiatives focusing on antibiotic awareness and antibiotic resistance within their individual countries, the most commonly identified were national or regional guidelines on management of infections, awareness raising from professional organisations, toolkits and resources for healthcare workers, TV or radio advertising for the public, and conferences/events (Figure 27). Although there was a wide range of initiatives selected, 1 470 (10%) respondents said they were not aware of any initiatives within their individual countries.

Figure 27. Initiatives that respondents said they were aware of in their own countries, by country[8]



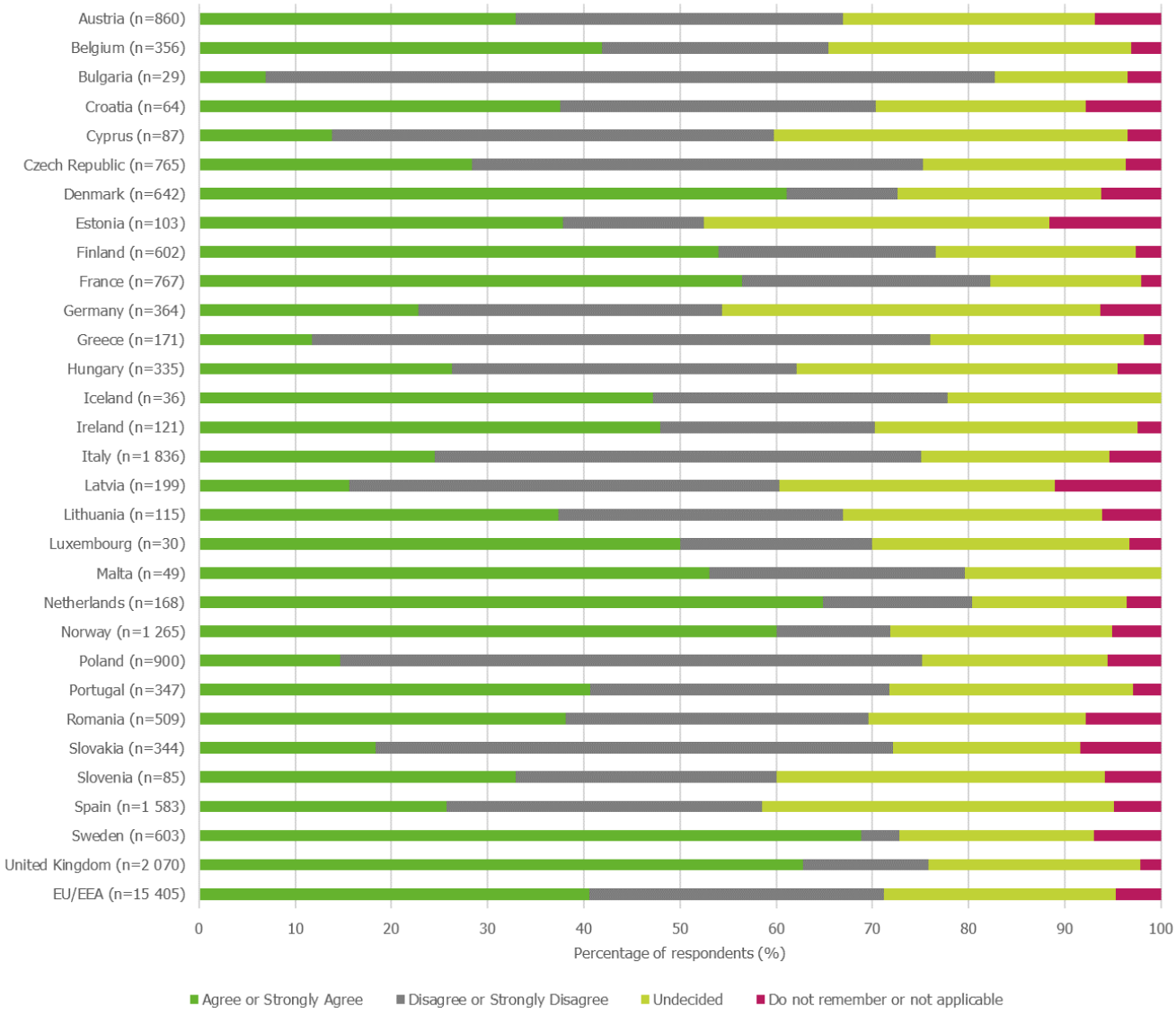
Overall, 41% of respondents agreed or strongly agreed there had been good promotion of prudent antibiotic use and information about antibiotic resistance in their country; 12 out of the 30 countries had a larger proportion of

[8] Multiple responses allowed; the table presents the overall proportion of the responses given

respondents disagree or strongly disagree than agree or strongly agree that there had been good promotion of prudent antibiotic use and information about antibiotic resistance (Figure 28).

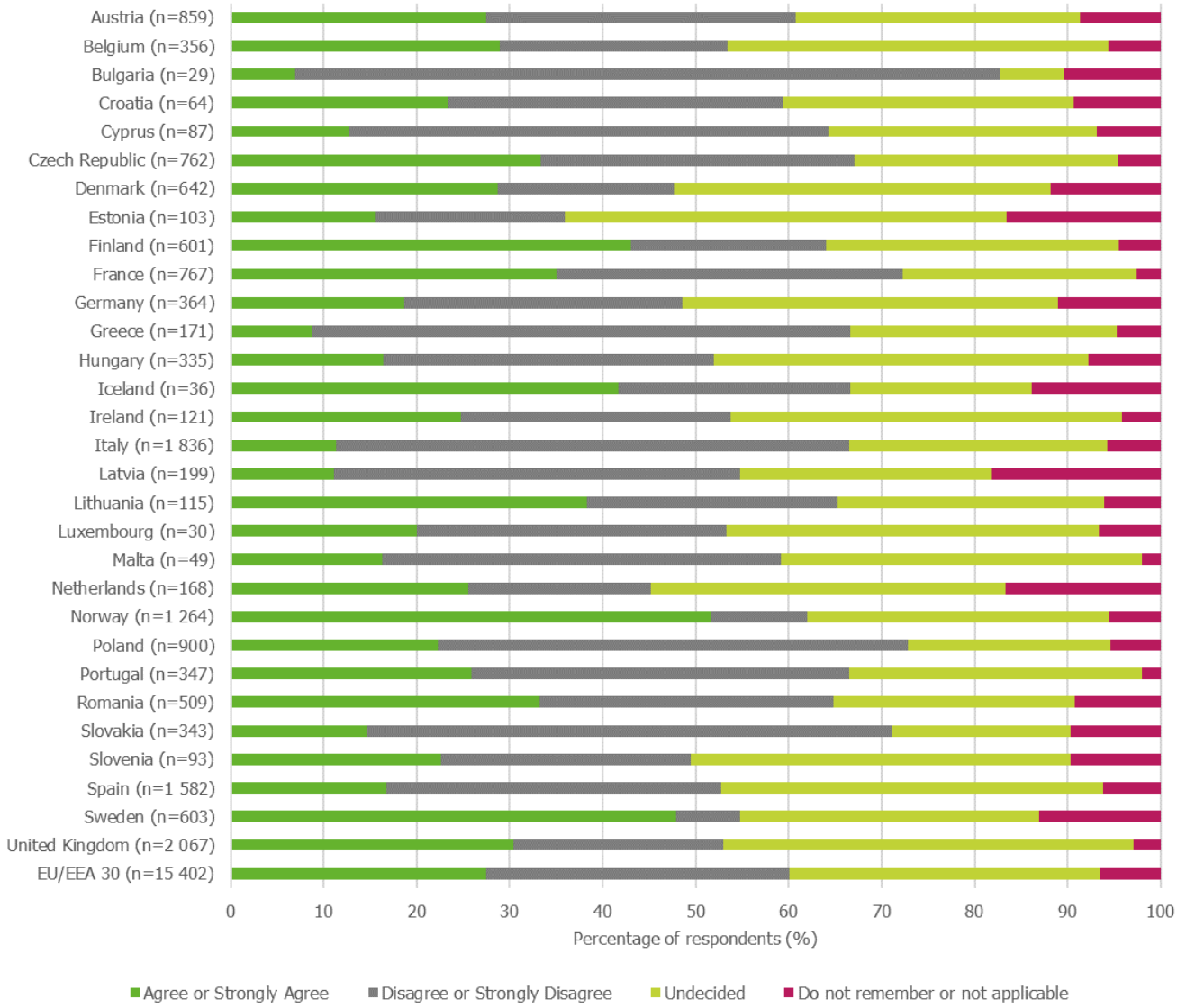
The proportion disagreeing was greater than 50% in Bulgaria (76%), Greece (64%), Poland (60%), Italy (54%), and Slovakia (54%). The countries with the highest proportions agreeing or strongly agreeing included Sweden (69%), Netherlands (65%), United Kingdom (63%) and Denmark (61%).

Figure 28. Percentage of respondents who agreed/disagreed that there had been good promotion of prudent antibiotic use and information about antibiotic resistance in their country, by country



Overall, across the 30 EU/EEA countries, only 27% of respondents agreed or strongly agreed that they believed the national campaign has been effective in reducing unnecessary antibiotic use and controlling antibiotic resistance in their country; 33% of respondents disagreed or strongly disagreed with this statement. In 20 out of the 30 countries, a larger proportion of respondents disagreed or strongly disagreed than agreed or strongly agreed that they believed the national campaign had been effective (Figure 29).

Figure 29. Percentage of respondents who agreed/disagreed that they believed the national campaign has been effective in reducing unnecessary antibiotic use and controlling antibiotic resistance in their country, by country



Awareness of national action plans, European Antibiotic Awareness Day and World Antibiotic Awareness Week

A majority of respondents across EU/EEA countries (52%) were unsure if their country had a national action plan on AMR (Figure 30) in place. Only eight countries (France, Ireland, Luxembourg, Norway, Portugal, Spain, Sweden, United Kingdom) had more than 50% of all respondents who said they knew their country had a national action plan on AMR (Figure 31). In reality, 24 of the 30 EU/EEA countries had a national action plan on AMR in 2018, while the 6 remaining EU/EEA countries had a plan under development as per country self-assessments reported to WHO . This indicates that healthcare workers' awareness of these initiatives significantly underestimates what actually exists [26].

Fewer than half of the respondents across EU/EEA countries had heard of the international antibiotic awareness campaigns EAAD and WAAW (32% and 26%, respectively) (Figure 30).

More than 50% of all respondents in eight countries had heard of EAAD, (Figure 32), while this was the case for only two countries with respect to WAAW (Figure 33).

Figure 30. Percentage of respondents who were aware/unaware of whether their country had a national action plan on AMR, who had/had not heard of European Antibiotic Awareness Day, and who had/had not heard of World Antibiotic Awareness Week

	AMR National Action Plan (%) (n=15 385)	European Antibiotic Awareness Day (%) (n=15 518)	World Antibiotic Awareness Week (%) (n=15 397)
Yes	6 739 (43.8)	5 028 (32.4)	3 942 (25.6)
No	600 (3.9)	9 047 (58.3)	9 731 (63.2)
Unsure	8 046 (52.3)	1 443 (9.3)	1 724 (11.2)

Figure 31. Percentage of respondents who know if their country has a national action plan on AMR, by country

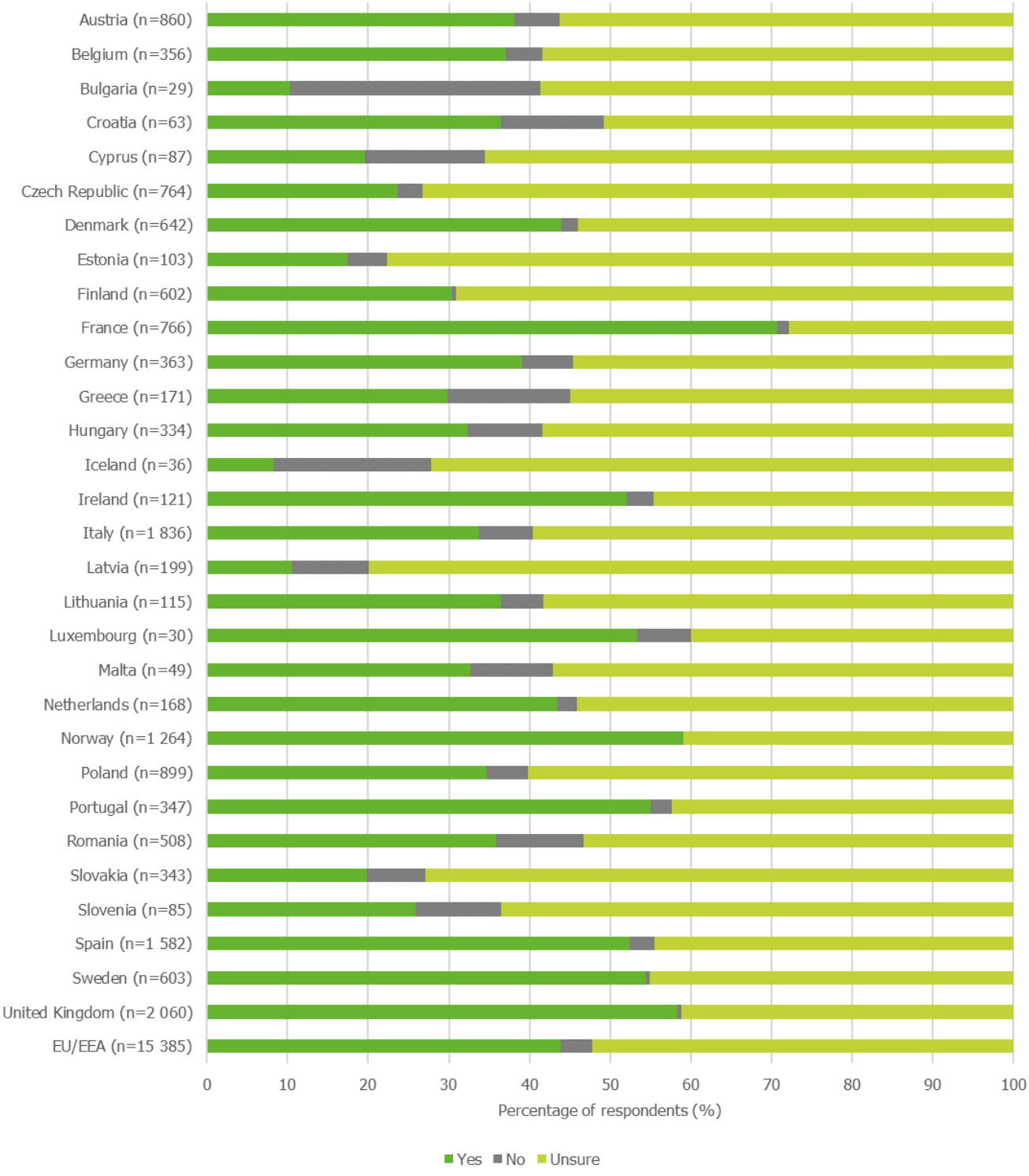


Figure 32. Percentage of respondents who have heard of European Antibiotic Awareness Day (EAAD), by country

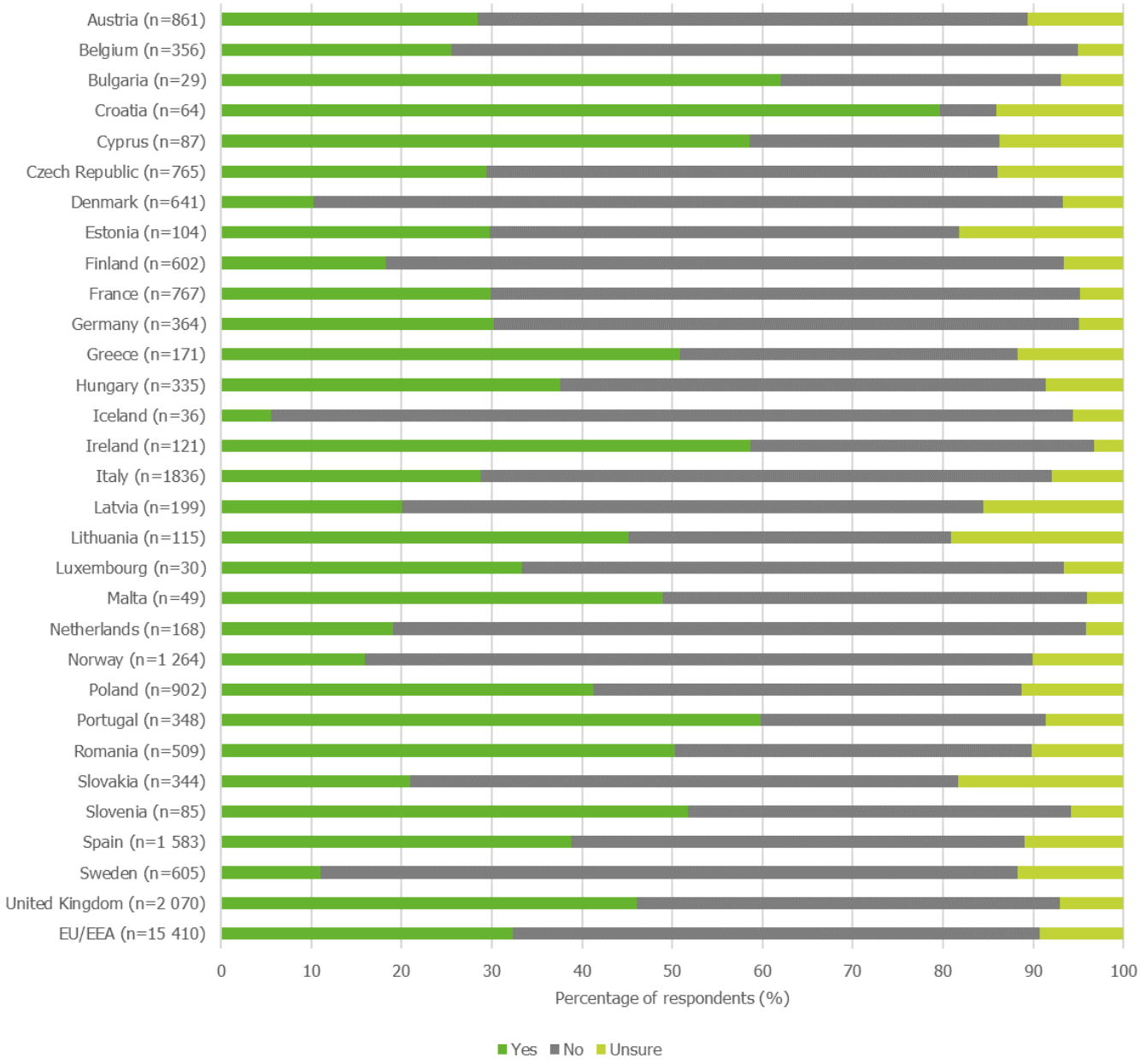
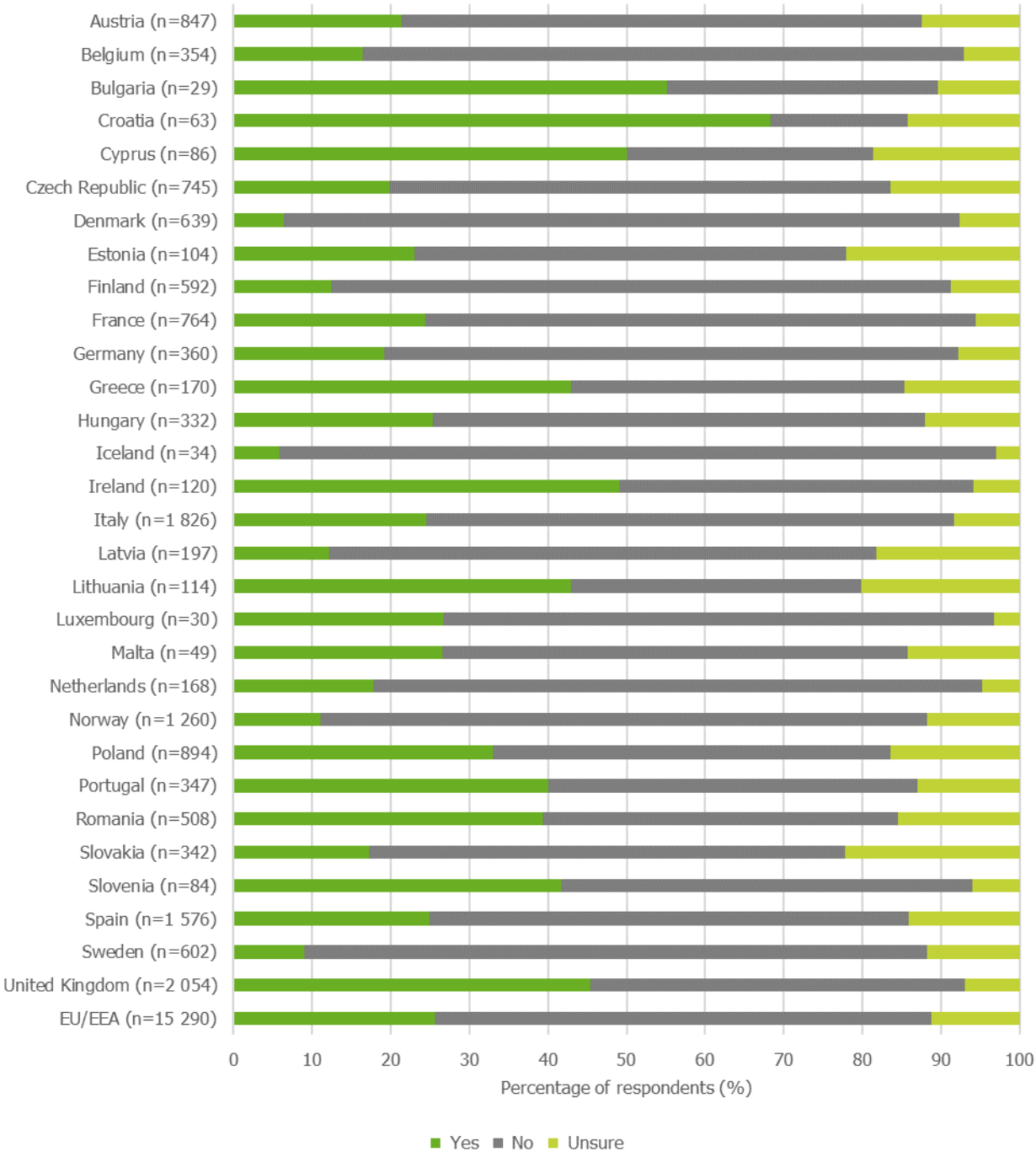


Figure 33. Percentage of respondents who have heard of World Antibiotic Awareness Week (WAAW), by country



Overall, for those who had heard of EAAD and WAAW, the majority were 'undecided' (52% and 54% respectively) on their effectiveness in raising antibiotic awareness in their country. Only 27% and 21% respectively believed EAAD and WAAW had been effective or very effective in raising antibiotic awareness in their country (Figure 34). There were wide variations in the perceived effectiveness of the campaigns in raising awareness within their country (Figure 35, Figure 36).

Figure 34. Percentage of respondents who believe EAAD and WAAW have been effective/ineffective in raising awareness about prudent use of antibiotics and antibiotic resistance in their country

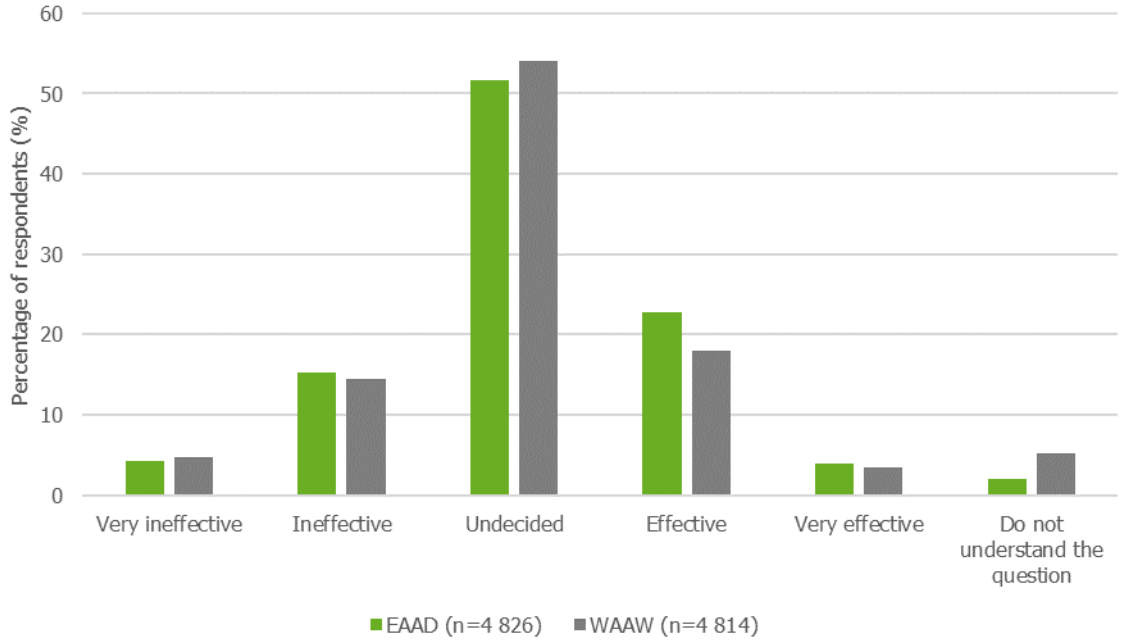


Figure 35. Percentage of respondents that believe EAAD has been effective/ineffective in raising awareness about prudent use of antibiotics and antibiotic resistance in their country, by country

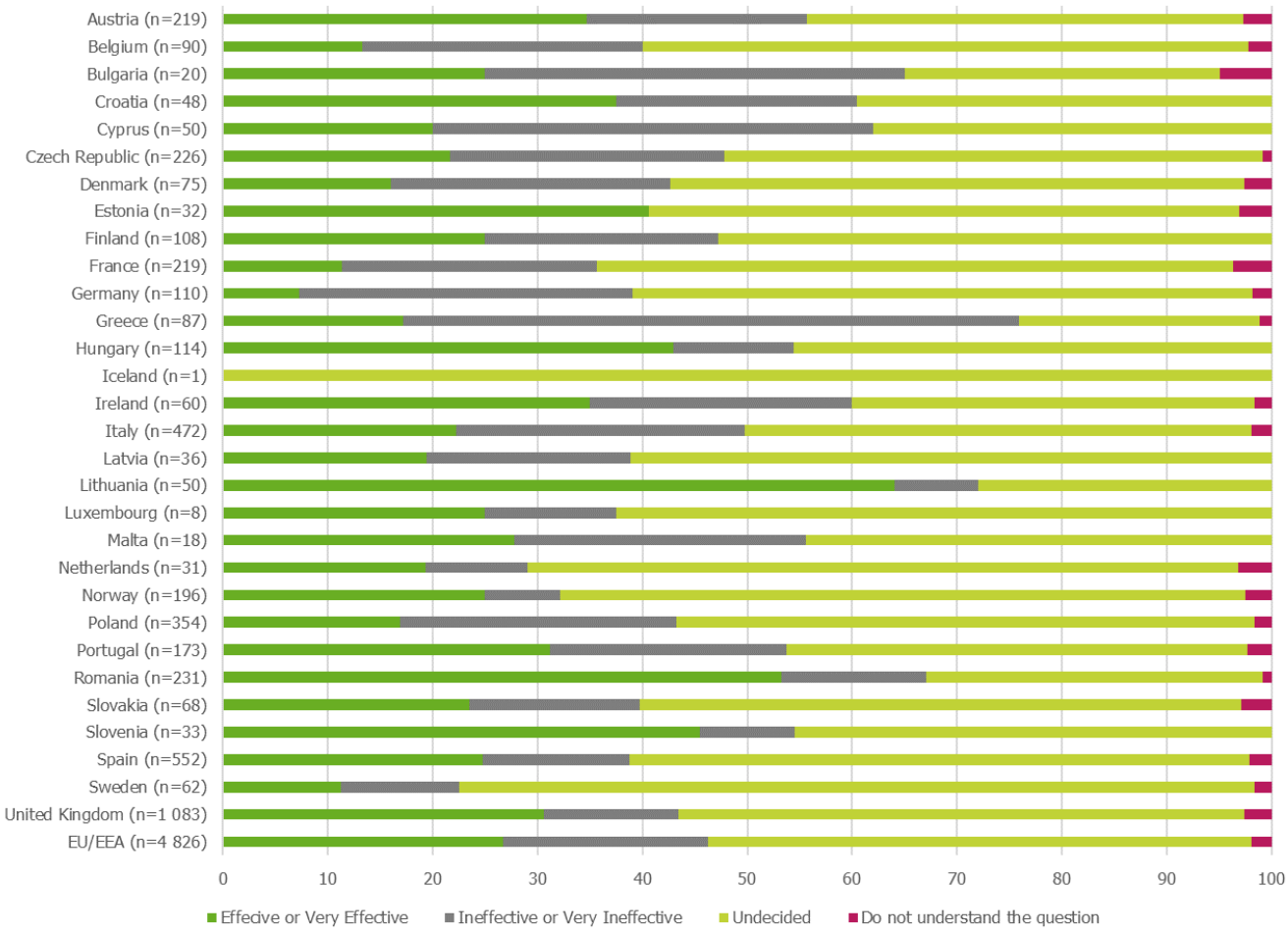
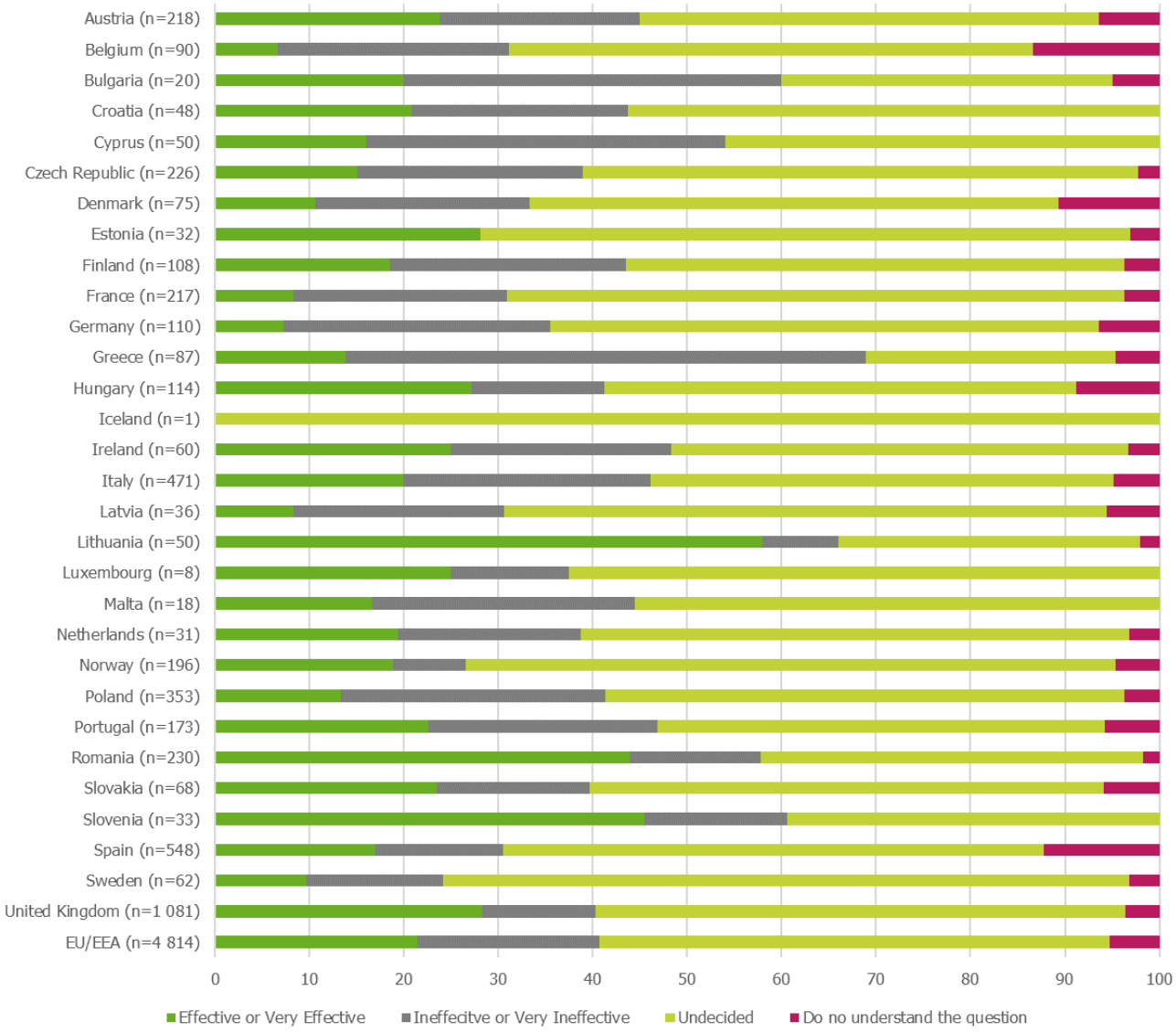


Figure 36. Percentage of respondents who believe that WAAW has been effective/ineffective in raising awareness about prudent use of antibiotics and antibiotic resistance in their country, by country



In a further analysis of data from those respondents who said they currently have a role contributing to/leading antimicrobial stewardship programmes or tackling AMR, 59% had heard of EAAD and 48% had heard of WAAW (Table 25). Most of the respondents in this group were 'undecided' on how effective the EAAD (50%) and WAAW (53%) has been in their country, with just 29% (EAAD) and 23% (WAAW) considering them to have been effective or very effective (Table 26).

Table 25. Percentage of those who have a current role in contributing to/leading antimicrobial stewardship programmes or tackling AMR and who have heard of EAAD/WAAW

Have you heard of EAAD or WAAW?	Yes (%)	No (%)	Unsure (%)
EAAD (n=4 445)	59.0	34.2	6.8
WAAW (n=4 412)	47.6	42.6	9.8

Table 26. Percentage of those who have a current role in contributing to/leading antimicrobial stewardship programmes or tackling AMR, who consider EAAD/WAAW to have ben effective/ineffective in their country

Campaign	Effective or very effective n (%)	Undecided n (%)	Ineffective or very ineffective n (%)	Do not understand the question n (%)
EAAD (n=2 484)	716 (29)	1 231 (50)	491 (20)	46 (2)
WAAW (n=2 480)	562 (23)	1 310 (53)	482 (20)	126 (5)

When respondents were asked to select from a list which topics they would like to receive more information about, resistance to antibiotics, links between health of humans, animals and environment, how to use antibiotics were the top three selected (Table 27). More than one answer was allowed.

Table 27. Topics selected by respondents on which they would like to receive more information (n=14 896)

Topic	Number of respondents (%)
Resistance to antibiotics	8 209 (55.1)
Links between the health of humans, animals and the environment	6 927 (46.5)
How to use antibiotics	6 253 (42.0)
Medical conditions for which antibiotic are used	4 691 (31.5)
Prescription of antibiotics	3 842 (25.8)
None	1 663 (11.2)

Assessing capability, opportunities, motivation and behaviour of prescribers

Demographics of prescribers

As with the WHO competencies that define the level of knowledge and the skills that each category of healthcare worker should be able to demonstrate, this survey assessed prescribers by asking questions specific to this group in order to better understand the drivers for their prescribing behaviours. Of those respondents who stated they were prescribers (6 791, or 37%), the largest group were medical doctors (80%) (Table 28), with dentists as the second largest prescribing group (12%). More than 35% of prescriber respondents stated that they prescribe antibiotics daily, with a similar proportion prescribing every week (Figure 37).

Table 28. Number (%) of respondents who stated they were prescribers, by profession

Profession	Number of respondents who stated they are prescribers (%)
Medical doctor	5 406 (79.6)
Dentist	841 (12.4)
Nurse	270 (4.0)
Pharmacist	154 (2.3)
Midwife	41(0.6)
Allied health professional	26 (0.4)
Other	13 (0.2)
Unknown	12 (0.2)
Scientist	11 (0.2)
Other healthcare worker	9 (0.1)
Nursing associate/assistant	4 (0.1)
Pharmacy technician	2 (0.0)
Dental care professional	2 (0.0)
Total	**6 791 (100.0)**

Figure 37. Frequency of antibiotic prescribing among responding prescribers

Capability, opportunities and motivation for prescribers

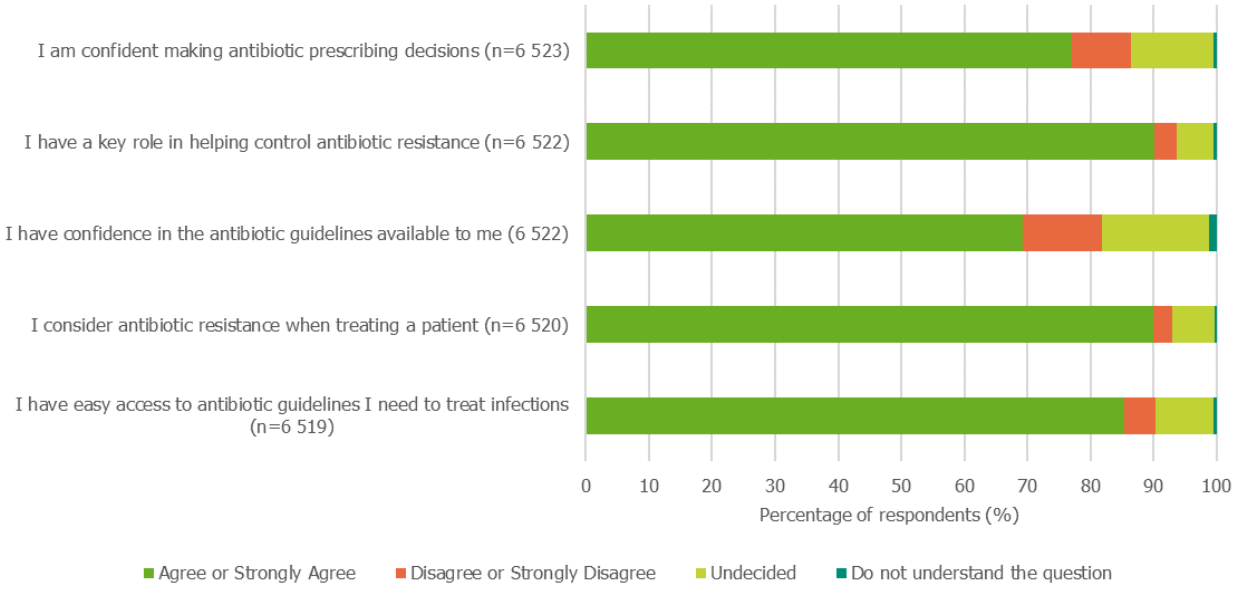
'Prescribers' are defined as those healthcare professionals who prescribe medications for patients; they are distinct from those who may, for example, administer the drugs or who otherwise have patient contact. When assessing prescribers and their decisions around antibiotics, 90% agreed or strongly agreed that they considered antibiotic resistance when treating a patient (Figure 38).

The perceived capability of prescribers was assessed through a series of statements for which they were asked to indicate to what extent they agree with each statement.

Most prescribers agreed or strongly agreed they had a key role in helping control antibiotic resistance (90%), and that they have easy access to antibiotic guidelines needed to treat infections (85%). However, fewer prescriber

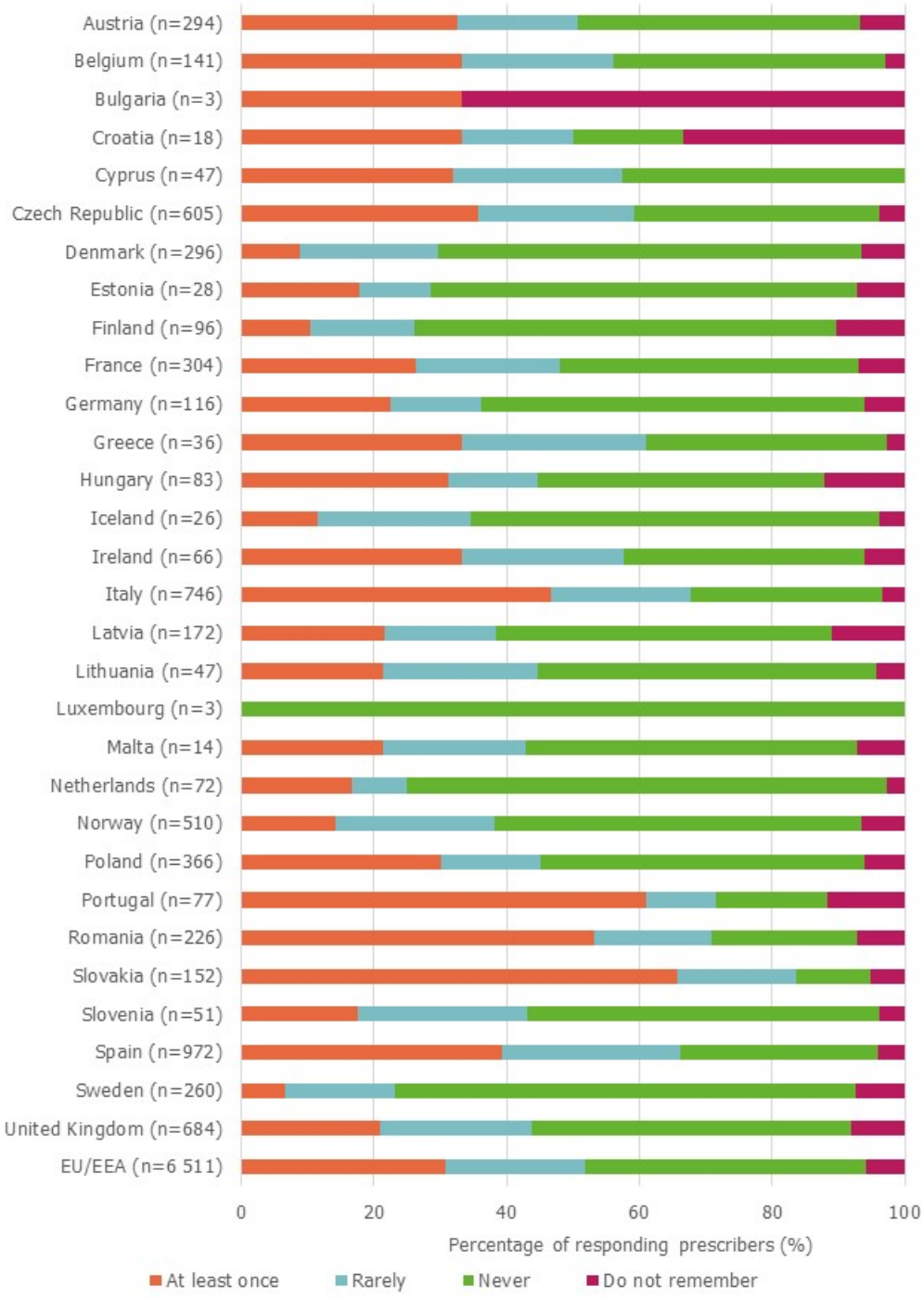
respondents agreed or strongly agreed that they were confident in making antibiotic prescribing decisions (77%), and fewer still agreed or strongly agreed that they were confident in the antibiotic guidelines available to them (69%) (Figure 38).

Figure 38. Percentage of responding prescribers who agreed/disagreed with the following statements regarding antibiotic prescribing decisions, support and accessibility to guidelines



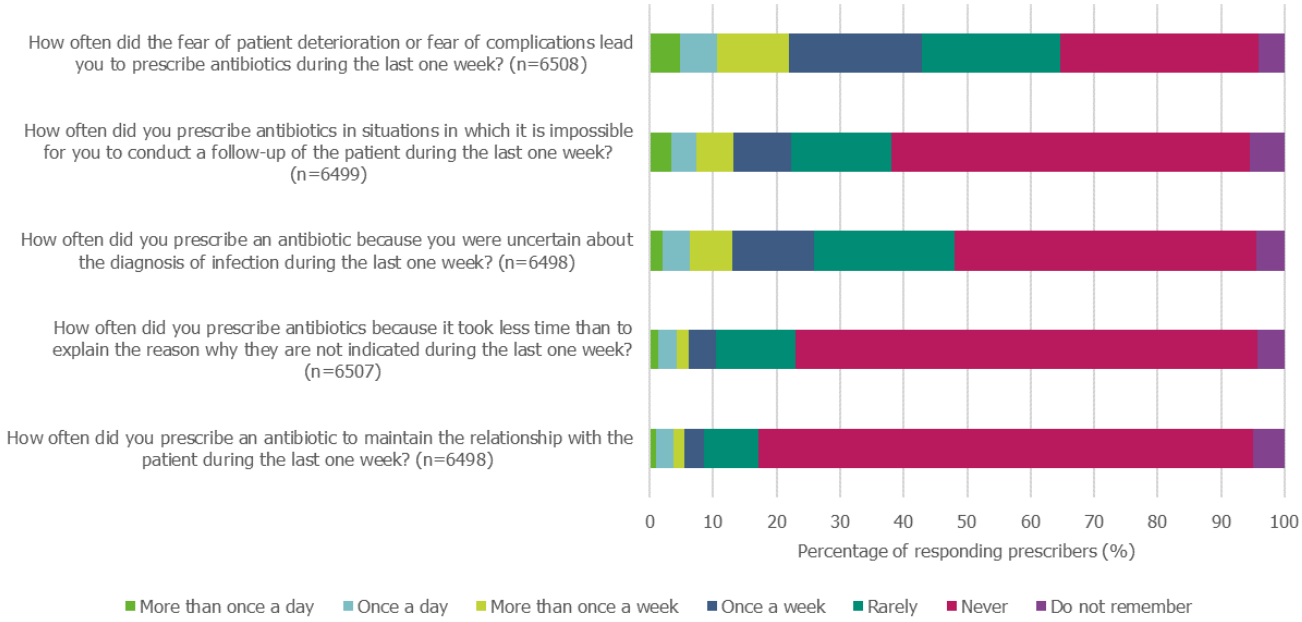
Motivation (which can be driven by, for example, incentives, intentions, and beliefs about the consequences of certain actions) can play an important role in determining whether or not a given behaviour is performed. When assessing prescribers' motivations towards and subsequent practice of initiating antibiotic prescriptions, 31% of prescribers said they would have preferred not to have prescribed an antibiotic at least once in the week prior to taking the survey (Figure 39).

Figure 39. Frequency of antibiotic prescriptions during the last one week, for which the prescriber would have preferred not to prescribe an antibiotic, by country



An important reason for prescribers prescribing an antibiotic even when they would have preferred not to was the 'fear of patient deterioration or fear of complications'. This was stated by 43% of prescribers with reference to the week prior to the survey; 11% said that they prescribe at least once a day for this reason. Uncertain diagnosis (26% during the previous week), impossible to follow up on the patient (23% during the previous week), limited time to explain why an antibiotic may not be indicated (10% during the previous week), and maintaining the patient relationship (8% during the previous week) were also stated as drivers of antibiotic prescribing, though to a lesser extent (Figure 40-45).

Figure 40. Frequency of different reasons for prescribing antibiotics, even when the prescriber would have preferred not to



The proportion of prescribers identifying 'fear of patient deterioration or fear of complications' as a driver for prescribing antibiotics was the highest in Slovakia and the lowest in the Netherlands and Sweden (Figure 41).

Figure 41. Frequency of antibiotic prescriptions due to the fear of patient deterioration or fear of complications, during the last one week, by country (n=6 508)

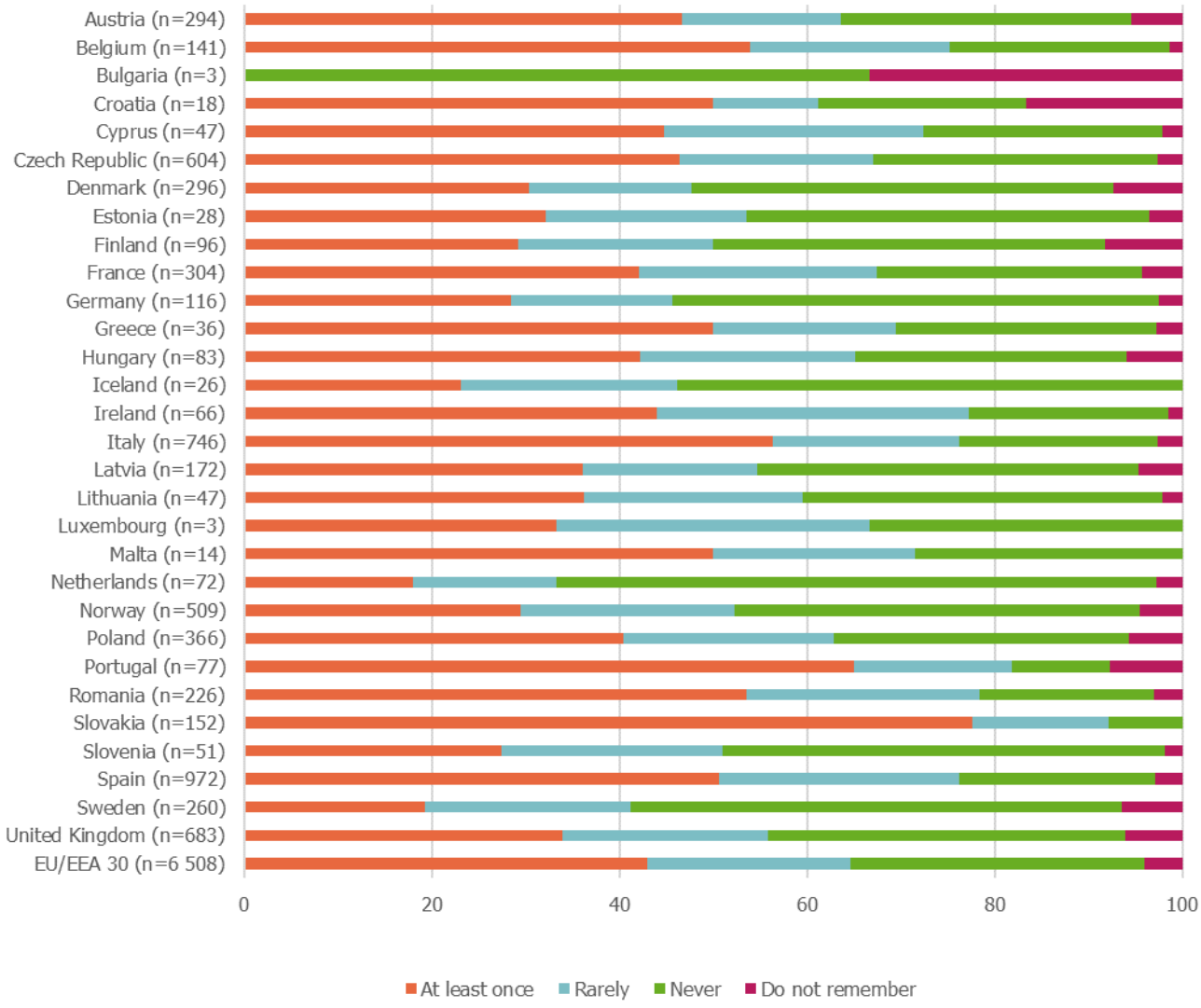


Figure 42. Frequency of antibiotic prescriptions because the prescriber was uncertain about the diagnosis of infection, during the last one week, by country (n=6 498)

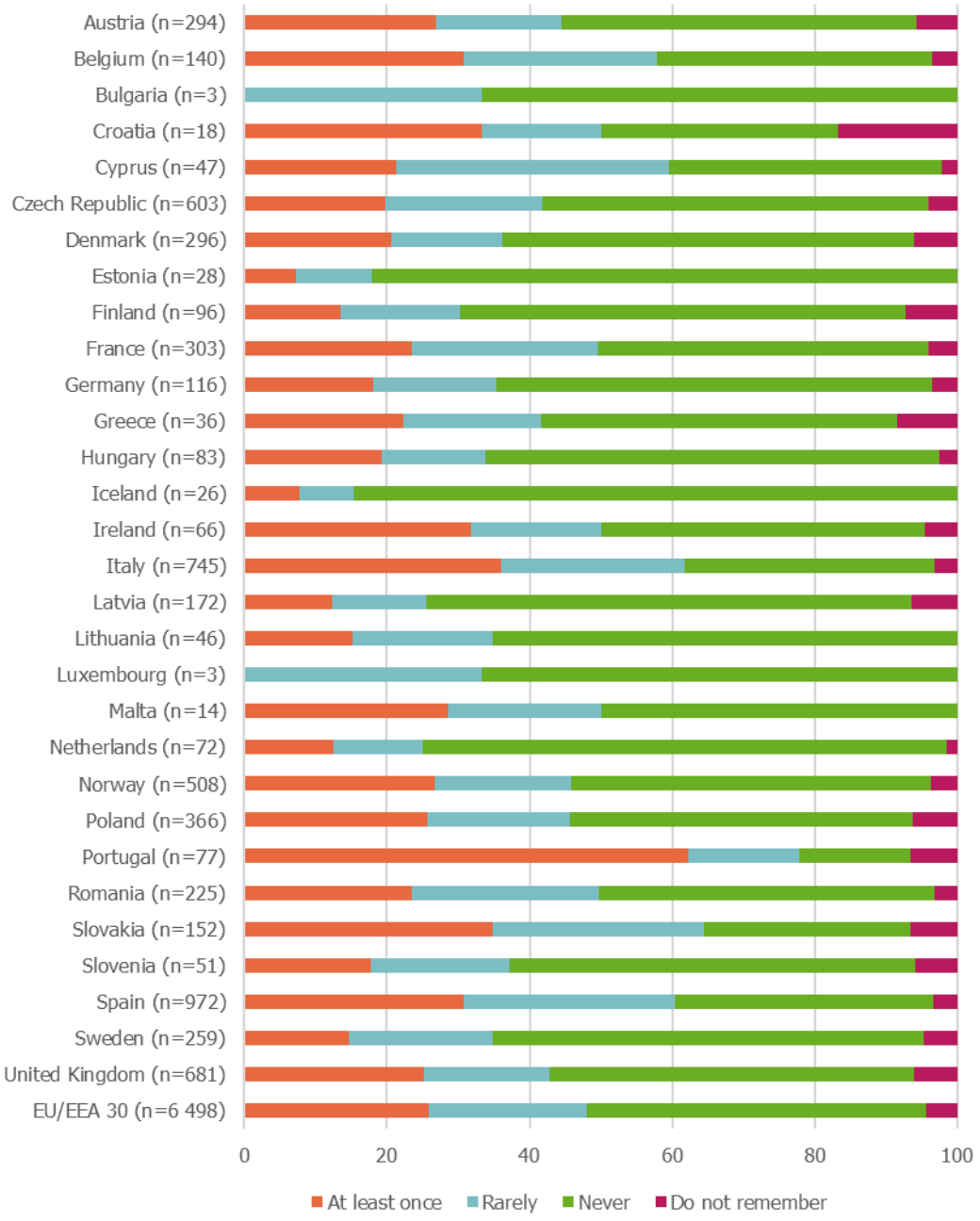


Figure 43. Frequency of antibiotic prescriptions in situations where it was impossible to follow up on the patient, during the last one week, by country

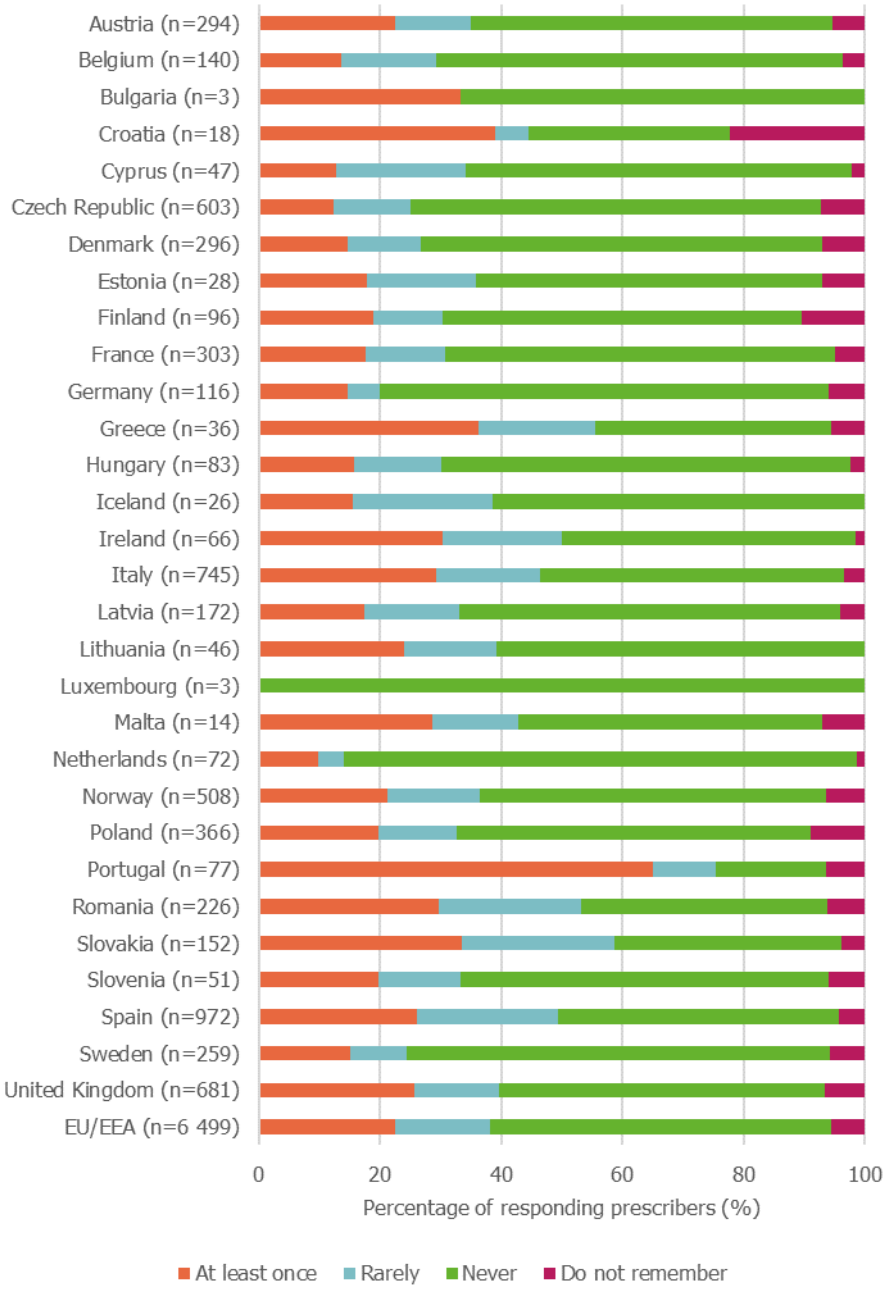


Figure 44. Frequency of antibiotic prescriptions because it took less time to prescribe than to explain the reason why they were not indicated, during the last one week, by country (n=6 507)

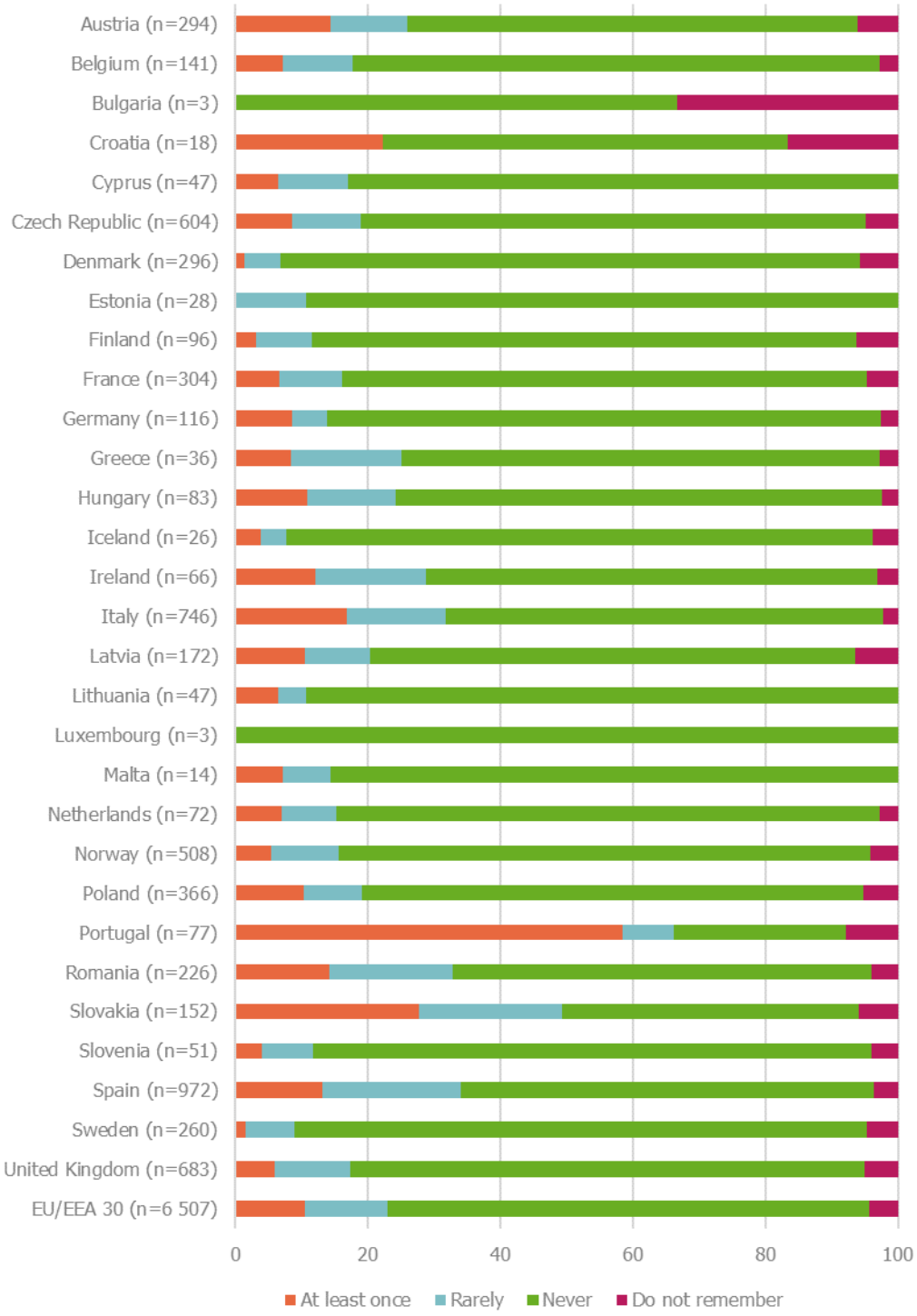
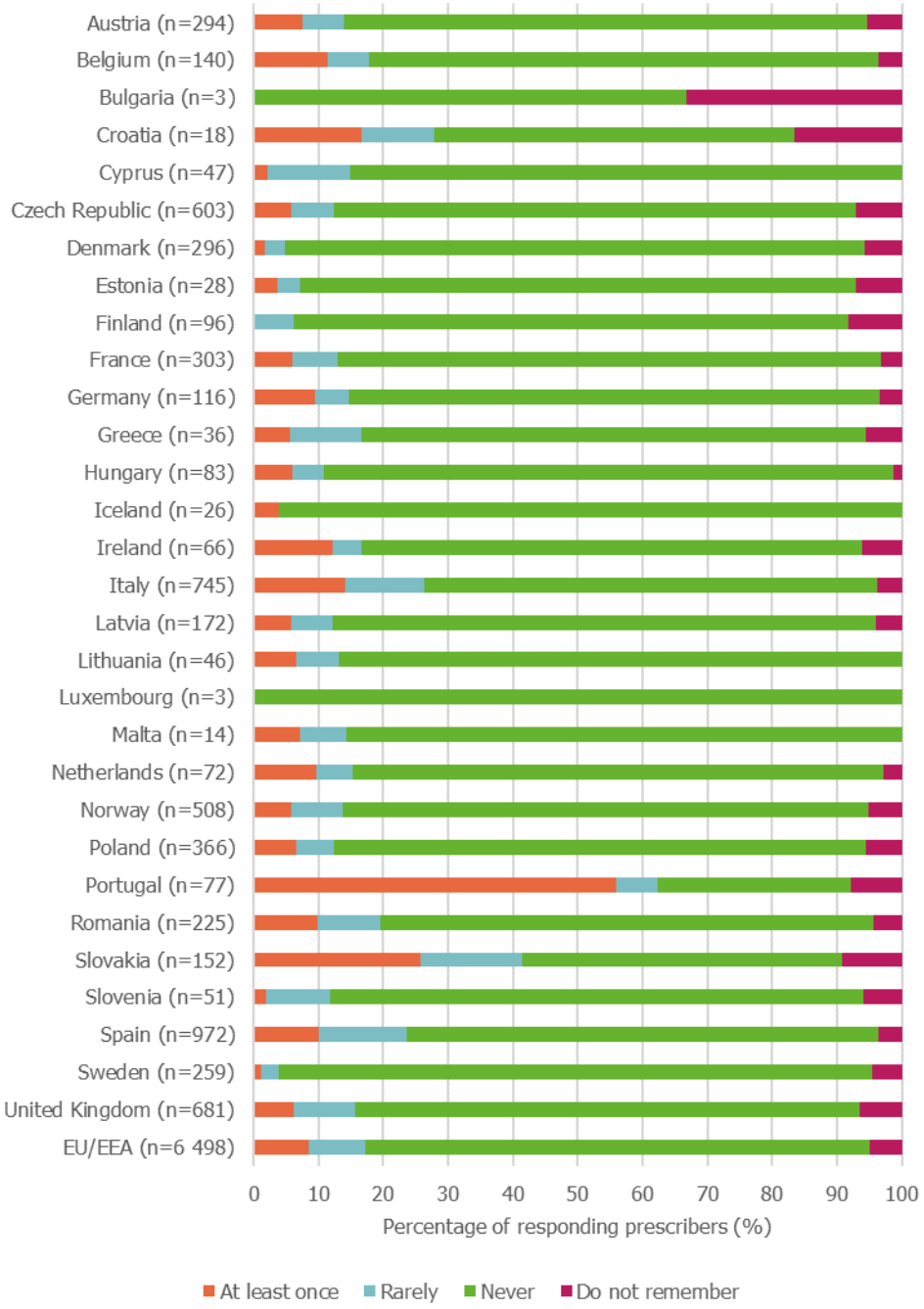


Figure 45. Frequency of antibiotic prescriptions to maintain a relationship with the patient, during the last one week, by country



Prescribers in hospitals prescribed antibiotics even when they would have preferred not to more frequently (51% of all respondents) than their peers working at community/primary healthcare level (40%) (during the week prior to the survey. Similarly, 82% of hospital prescribers prescribed antibiotics during the week prior to the survey as it took less time than to explain the reason why they would not , compared with 72% working in community/primary healthcare. However, community/primary healthcare prescribers prescribed an antibiotic during the week prior to the survey (87%) in order to maintain the relationship with the patient more often than hospital-based prescribers (72%) (Table 29).

Table 29. Comparison of prescriber behaviour on drivers for initiating prescriptions, by setting

Question	Setting	Sometimes equals at least once a week, at least once a day, more than once a day, more than once a week, rarely n (%)	Never n (%)	OR (95% CI)	P- value
How often did the fear of patient deterioration or fear of complications lead you to prescribe antibiotics during the last one week? (n=6 508)	Hospital (n=2 901)	1 869 (64.4)	1 032 (35.6)	0.80 (0.71-0.90)	0.0003
	Community (n=1 996)	1 384 (69.3)	612 (30.7)		
How often did you prescribe antibiotics in situations in which it is impossible for you to conduct a follow-up of the patient during the last one week? (n=6 499)	Hospital (n=2 866)	1 135 (39.6)	1 731 (60.4)	0.95 (0.84-1.07)	0.4062
	Community (n=1 961)	800 (40.8)	1 161 (59.2)		
How often did you prescribe an antibiotic because you were uncertain about the diagnosis of infection during the last one week? (n=6 498)	Hospital (n=2 905)	1 454 (50.1)	1 451 (49.9)	0.97 (0.86-1.08)	0.5689
	Community (n=1 987)	1 011 (50.9)	976 (49.1)		
How often would you have preferred not to prescribe an antibiotic but were not able during the last one week? (n=6 511)	Hospital (n=2 834)	1 386 (48.9)	1 448 (51.1)	0.63 (0.56-0.71)	<0.0001
	Community (n=1 967)	1 185 (60.2)	782 (39.8)		
How often did you prescribe antibiotics because it took less time than to explain the reason why they are not indicated during the last one week? (n=6 507)	Hospital (n=2 917)	530 (18.2)	2 387 (81.8)	0.58 (0.51-0.66)	<0.0001
	Community (n=1 989)	551 (27.7)	1 438 (72.3)		
How often did you prescribe an antibiotic to maintain the relationship with the patient during the last one week? (n=6 498)	Hospital (n=2 886)	365 (12.6)	2 521 (87.4)	0.51 (0.44-0.60)	<0.0001
	Community (n= 1 973)	434 (22.0)	1 539 (78.0)		

OR=Odds ratio; CI=Confidence interval

With respect to ongoing antibiotic prescriptions, the majority of respondents never 'stop an antibiotic prescription earlier than the prescribed course length', 'prescribe a shorter course of treatment compared to available guidelines', or 'discontinue early (within three days after initiation) because bacterial infection was not likely after all' (Figures 46-49). Community prescribers were more likely than hospital prescribers to 'never' prescribe a shorter course of treatment compared to recommended guidelines or to discontinue early treatment because bacterial infection was unlikely. The difference between community and hospital prescribers for these behaviours was statistically significant (Table 30).

The results for prescriber behaviour stratified by setting for each country are presented in the Annex (Tables 31-39).

Figure 46. Frequency of selected antibiotic prescribing behaviours

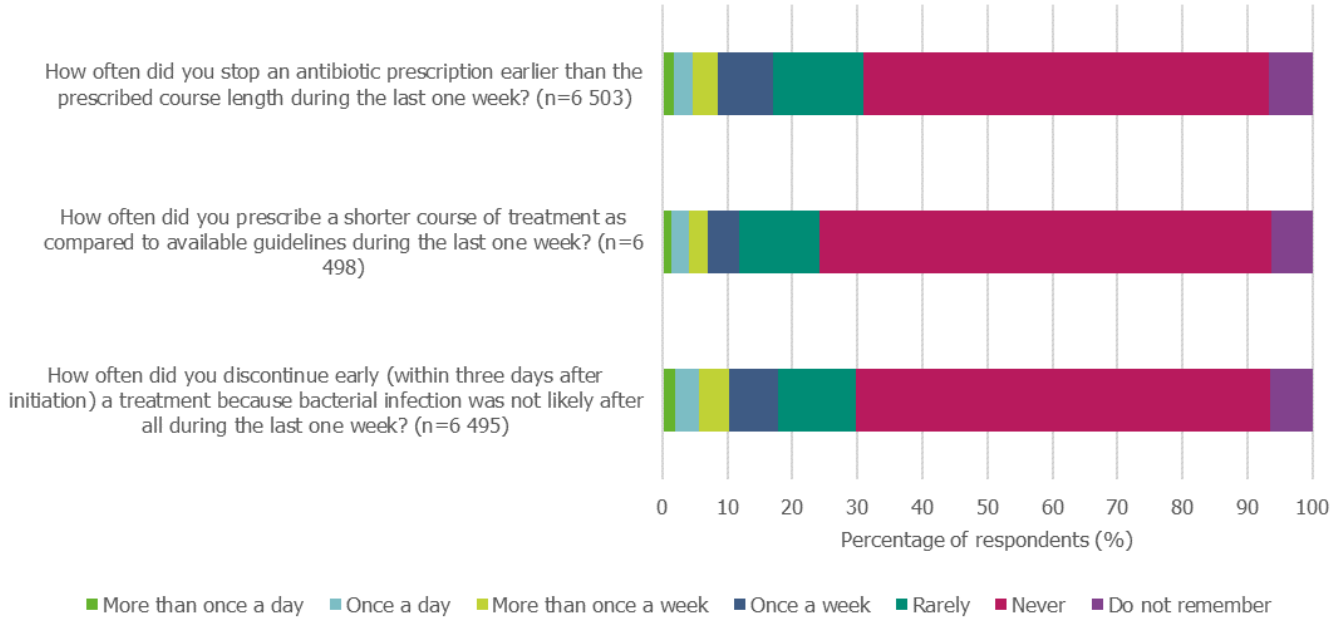


Table 30. Comparison of selected antibiotic prescribing behaviours, by setting

Question	Setting	Sometimes equals at least once a week, at least once a day, more than once a day, more than once a week, rarely n (%)	Never n (%)	OR (95% CI)	P-value
How often did you stop an antibiotic prescription earlier than the prescribed course length during the last one week? (n=6 503)	Hospital (n=2 851)	1 081 (37.9)	1 770 (62.1)	1.52 (1.34-1.73)	<0.0001
	Community (n=1 935)	553 (28.6)	1 382 (71.4)		
How often did you prescribe a shorter course of treatment as compared to available guidelines during the last one week? (n=6 498)	Hospital (n=2 852)	802 (28.1)	2 050 (71.9)	1.30 (1.14-1.48)	0.0001
	Community (n=3 998)	451 (11.3)	3 547 (88.7)		
How often did you discontinue early (within three days after initiation) a treatment because bacterial infection was not likely after all during the last one week? (n=6 495)	Hospital (n=2 847)	1 135 (39.9)	1 712 (60.1)	1.99 (1.75-2.26)	<0.0001
	Community (n=1 928)	482 (25.0)	1 446 (75.0)		

OR=Odds ratio; CI=Confidence interval

Figure 47. Frequency of stopping an antibiotic prescription earlier than the prescribed course length during the previous week, by country

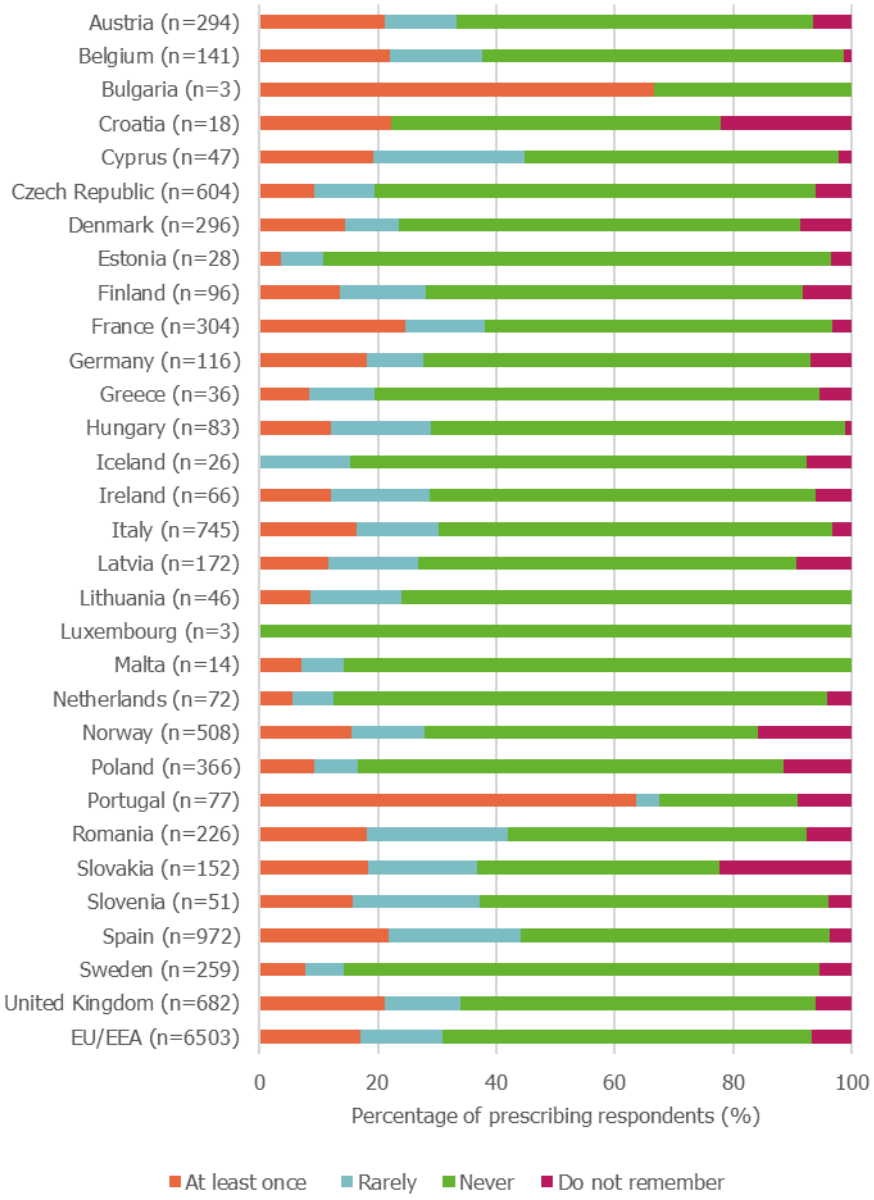


Figure 48. Frequency of prescribing a shorter treatment compared to available guidelines during the previous week, by country

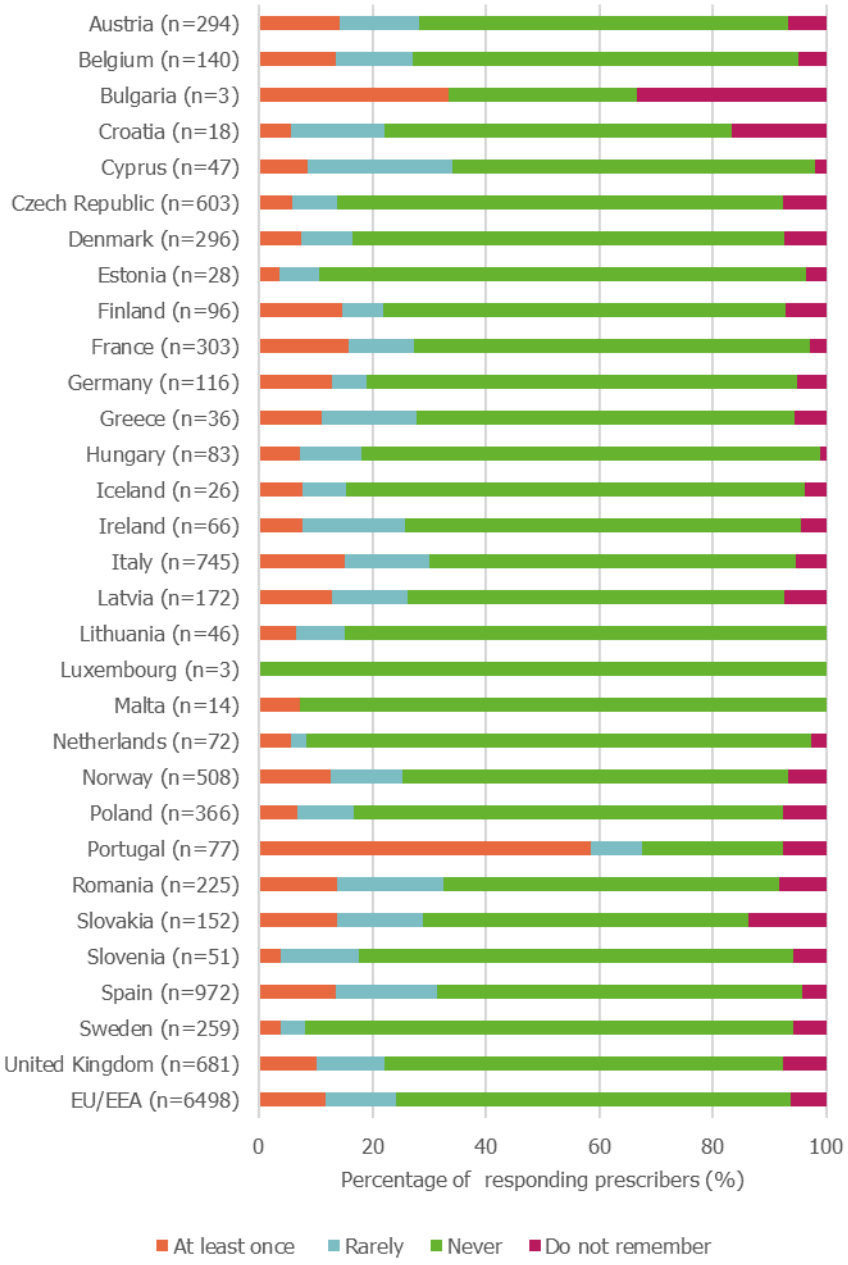
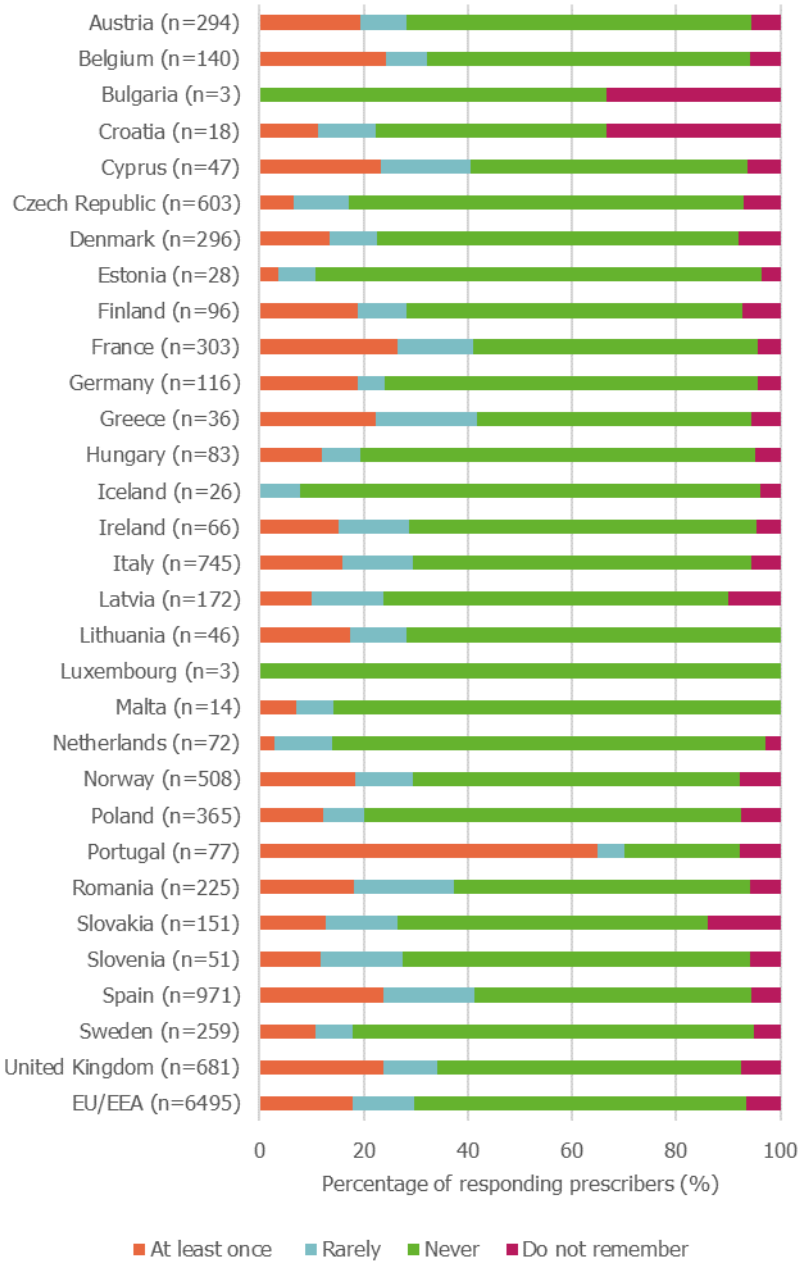
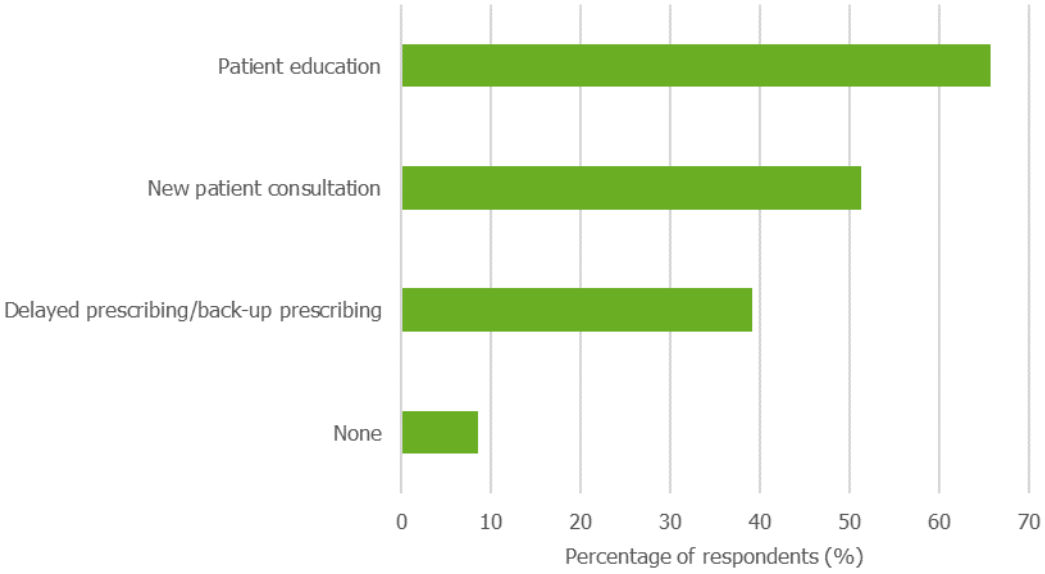


Figure 49. Frequency of early discontinuation of an antibiotic treatment because bacterial infection was not likely, during the previous week, per country



Three possible strategies to help prescribers to prescribe antibiotics prudently were given in the survey, and they were able to select all that applied to them. Sixty six per cent of respondents said they used patient education, 51% new patient consultations, and 39% delayed or back-up prescribing (Figure 50).

Figure 50. Percentage of responding prescribers that selected the following as strategies to prescribe antibiotics prudently (multiple responses allowed)



Conclusion

This survey provides collated data across EU/EEA countries and all healthcare professions about knowledge, attitudes and behaviours concerning antibiotics, antibiotic use and antibiotic resistance for the first time. Healthcare professionals play a fundamental role in reducing the emergence of antibiotic resistance, which is an important public health priority globally. The causes of antibiotic resistance are complex, with many interacting factors contributing to overuse and misuse use of antibiotics, such as prescribers' time, patient expectations, the accuracy of diagnosis, medicine legislation, economic factors, cultural factors, and social norms. Understanding the magnitude of these drivers on healthcare workers' knowledge, attitudes and behaviours is critical if effective interventions aimed at preserving antibiotic effectiveness are to be developed and implemented.

The survey showed wide variation across countries in capabilities, opportunities, and motivation as well as in the practices of healthcare workers, while also providing important information that can be used to develop generic approaches and interventions for local adaptation and use. It is clear, for example, that across EU/EEA countries, there is a need to continue with actions to maintain and raise awareness amongst healthcare workers about prudent antibiotic use and about antibiotic resistance, but it is also important to design interventions which lead to actual changes in behaviour.

Perceived knowledge about antibiotic use and antibiotic resistance was high amongst healthcare workers, with 89% of respondents acknowledging the connection between their prescribing, dispensing and administering of antibiotics and the emergence and spread of antibiotic resistance, as well as their confidence in providing advice to patients on antibiotic use and antibiotic resistance. This clearly indicates that healthcare workers are aware of the potential threat of antibiotic resistance. This perception of good knowledge amongst healthcare workers was supported by an overall average score of 6.35 out of 7 on the knowledge assessment questions. However, substantial variation was noted across the professional groups in the percentage of respondents answering all seven questions correctly. Higher knowledge may stem from a combination of factors such as the difference in education and training as well as professional responsibility for managing and treating infections between professional groups; hence medical doctors achieved the highest scores. The findings from this survey reflect previous findings which showed that a majority of clinicians had heard of antibiotic resistance, that they believed it to be a serious problem that is caused by overuse of antibiotics, and that they are aware of evidence-based approaches to mitigate against it [15].

Although 89% of all respondents knew that prescribing, dispensing or administering antibiotics can influence the emergence and spread of resistant bacteria, only 58% of respondents believed that they have a key role in helping control antibiotic resistance. The proportions were only slightly higher for respondents with direct patient/public involvement (i.e. both prescribers and those engaged more generally in patient care), indicating that further engagement with healthcare workers needs to take place on a level that not only raises awareness and increases knowledge, but which also brings about behaviour change and an understanding on how to support the wider AMR agenda within their working environment.

Responses from healthcare workers highlighted the barriers in the provision of advice and resources to patients. For example, during the week prior to completing the survey, 20% of respondents had never given advice related to prudent antibiotic use or management of infection, while over half of the respondents did not provide resources on these issues. Of those with direct patient or public involvement, 75% reported that they had easy access to guidance on infection management, and 67% have easy access to materials for advising prudent antibiotic use and antibiotic resistance. The principal reasons why healthcare workers did not provide advice and/or resources were associated with the interaction between the patient and the healthcare worker; for example, the patient reportedly did not require information, there was difficulty communicating the diagnosis to the patient, the patient was uninterested in the information, the prescriber faced resource constraints, and there was insufficient time. This highlights the range of environmental and contextual issues that need to be taken into account in order to facilitate the provision of advice to patients.

In relation to motivation for prescribing antibiotics, the survey highlighted fear of a patient's health deteriorating or fear of complications as a key reason for initiating an antibiotic prescription when the prescriber would preferred not to prescribe an antibiotic. Further analysis of prescribers' motivation showed no difference between community and hospital settings, suggesting that this problem is common to prescribers irrespective of their working context.

Based on the findings from the study, the following action points are suggested for consideration:

- Educational training and communication initiatives on antibiotics, antibiotic use and antibiotic resistance for healthcare workers in Europe should take into account the findings of this study, particularly when developing curricula, content and materials.
- Interventions for healthcare workers based on education and/or the provision of resources and guidelines should be designed and evaluated, with a focus on the promotion of prescribing, dispensing and administering behaviours that lead to prudent antibiotic use. One suggested approach is the 'Antibiotic Guardian' strategy [https://antibioticguardian.com/], which works through the principle of pledging.
- A particular attention should be paid to those groups of healthcare workers with sub-optimal knowledge, or a self perception that they do not have sufficient knowledge or skills, on how to work appropriately with antibiotics in their current practice.
- Ongoing training for healthcare workers with direct patient contact is needed, particularly to enhance communication skills and hand hygiene practices.
- Develop new and/or expand existing educational materials aimed at healthcare workers to ensure that the following topics/statements are covered: the development and spread of antibiotic resistance; 'Every person treated with antibiotics is at an increased risk of antibiotic resistant infection'; 'Antibiotic resistant bacteria can spread from person to person'; and 'Healthy people can carry antibiotic resistant bacteria'.
- Barriers to providing patients with written resources on antibiotics and antibiotic resistance should be addressed. Existing patient brochures covering topic such as 'When should I worry?' [27] and 'Treating Your Infection' [28] summarising the likely duration of self-limiting infections and offering advice on when to re-consult with a health professional along with self-care recommendations are examples of patient resources that could be promoted for use by healthcare professionals across the EU/EEA countries, or adapted as appropriate for local/national contexts.
- The effectiveness of an intervention on antibiotic prescribing depends to a large extent on the particular prescribing behaviour as well as any barriers to change that may exist within the targeted community. Multi-faceted interventions occurring on multiple levels can only be effective after addressing locally existing barriers.
- There is a need to address the factors that influence prescribers to prescribe even where they think it is not clinically necessary. Qualitative research, in particular, may improve the understanding of these factors and contribute to the development of interventions to effectively address these factors [29].
- When considering interventions to change behaviours, it would be important to evaluate their effectiveness, thereby ensuring a process of continual improvement. Countries could consider using the data from this study as a baseline for such evaluations, and use the survey tool as a means of assessing changes in the different variables that have been measures.

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Annex

Final survey

Survey questions: for all questions determining level of agreement, a 5-point Likert scale was used, as well as Not applicable/I don't know/I do not remember/I do not understand the question

Box 1. Capability - perceived and actual knowledge

To what extent do you agree or disagree with the following statements? Individual = patient or member of the public

- I know what antibiotic resistance is
- I know what information to give to individuals about prudent use of antibiotics and antibiotic resistance
- I have sufficient knowledge about how to use antibiotics appropriately for my current practice

Please answer whether you believe these statements are true or false.

- Antibiotics are effective against viruses
- Antibiotics are effective against cold and flu
- Unnecessary use of antibiotics makes them become ineffective
- Taking antibiotics has associated side effects or risks such as diarrhoea, colitis, allergy
- Every person treated with antibiotics is at an increased risk of antibiotic resistant infection
- Antibiotic resistant bacteria can spread from person to person
- Healthy people can carry antibiotic resistant bacteria

Section 2 Opportunity

To what extent do you agree or disagree with the following statements? Individual = patient or member of the public

- I have easy access to guidelines I need on managing infections
- I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance
- I have good opportunities to provide advice on prudent antibiotic use to individuals

Considering the last one week only in your clinical practice, please rate how frequently the statements apply to you. If a question is not applicable then please choose N/A.

- How often did you prescribe OR dispense OR administer antibiotics during the last one week?
- How often did you give out resources (e.g. leaflets or pamphlets) on prudent antibiotic use or management of infections to individuals during the last one week?
- How often did you give out advice related to prudent antibiotic use or management of infections to an individual during the last one week?

If you were not able to give out advice or resources as frequently as you prescribed OR dispensed OR administered antibiotics, why was this?

Section 3 Motivation

To what extent do you agree or disagree with the following statements?

- I know there is a connection between my prescribing OR dispensing OR administering of antibiotics and emergence and spread of antibiotic resistant bacteria
- I have a key role in helping control antibiotic resistance

Section 4 One Health

To what extent do you agree or disagree that the following environmental and animal health factors are important in contributing to antibiotic resistance in bacteria from humans?

- Environmental factors such as waste water in the environment
- Excessive use of antibiotics in livestock and food production

Please answer whether you believe these statements are true or false.

- The use of antibiotics to stimulate growth in farm animals is legal in the EU

Section 5 Hand Hygiene

Please state 'Yes', 'No' or 'Unsure' in regards to your knowledge on the following statements regarding hand hygiene.

- I can list the WHO's five moments of hand hygiene
- I need to perform hand hygiene (as often as recommended) if I have used gloves in contact with patients or biological material

Section 6 Information available on antibiotic use and antibiotic resistance or managing infections

- In the management of infections, which of these do you use regularly?
- In the last 12 months, do you remember receiving any information about avoiding unnecessary prescribing OR administering OR dispensing of antibiotics?
- If yes, how did you first get this information about avoiding unnecessary prescribing OR administering OR dispensing of antibiotics?
- Did the information contribute to changing your views about avoiding unnecessary prescribing OR administering OR dispensing of antibiotics?
- Which source(s) of information has had the most influence on changing your views?
- On the basis of the information you received, have you changed your practice on prescribing OR administering OR dispensing of antibiotics?
- If yes, please list what has had the most influence on changing your practice?
- If no, why not?

Section 7 Campaign and Training

- At what level do you think it is most effective to tackle resistance to antibiotics?
- What initiatives are you aware of in your country which focus on antibiotic awareness and resistance?
- To what extent do you agree or disagree with the following statements regarding the national initiatives about prudent use of antibiotics in your country?
  - There has been good promotion of prudent use of antibiotics and antibiotic resistance in my country
  - I believe the national campaign has been effective in reducing unnecessary antibiotic use and controlling antibiotic resistance
- Does your country have a national action plan on antimicrobial resistance?
- Have you heard of European Antibiotic Awareness Day (EAAD) or World Antibiotic Awareness Week (WAAW)?
- How effective do you believe EAAD and WAAW have been in raising awareness about prudent use of antibiotics and antibiotic resistance in your country?
- On which topics would you like to receive more information?

Section 8 Future Contact

- How did you find out about the survey?
- May we contact you in the future about:
  - Your survey responses
  - Other relevant AMR activities
- Please provide your name
- Please provide your email address

Section 9 Question for prescribers

- Do you currently prescribe antibiotics or are you currently an undergraduate health student?
- How often do you prescribe antibiotics?
- To what extent do you agree or disagree with the following statements?
  - I am confident making antibiotic prescribing decisions
  - I have confidence in the antibiotic guidelines available to me
  - I have a key role in helping control antibiotic resistance
  - I consider antibiotic resistance when treating a patient
  - I have easy access to antibiotic guidelines I need to treat infections
  - I feel supported to not prescribe antibiotics when they are not necessary
- Considering the last one week only:
  - How often would you have preferred not to prescribe an antibiotic but were not able during the last one week?
  - How often did the fear of patient deterioration or fear of complications lead you to prescribe antibiotics during the last one week?
  - How often did you prescribe antibiotics because it took less time than to explain the reason why they are not indicated during the last one week?
  - How often did you stop an antibiotic prescription earlier than the prescribed course length during the last one week?
  - How often did you prescribe antibiotics in situations in which it is impossible for you to conduct a follow-up of the patient during the last one week?
  - How often did you prescribe an antibiotic to maintain the relationship with the patient during the last one week?
  - How often did you prescribe an antibiotic because you were uncertain about the diagnosis of infection during the last one week?
  - How often did you prescribe a shorter course of treatment as compared to available guidelines during the last one week?
  - How often did you discontinue early (within three days after initiation) a treatment because bacterial infection was not likely after all during the last one week?
- What strategies do you employ to prescribe antibiotics prudently?

Box 10 Demographic questions for everyone asked at the beginning of the survey

- Are you involved in diagnosis, prescribing, clinical checking prescriptions, dispensing, administration, or provision of advice of antibiotics to patients or members of the public?
- In what country do you currently practice?
- Please specify which continent.
- Please specify in which country you practice.
- What is your core profession?
- What is your predominant role? (i.e.>50% of your time)
- Where do you predominantly practice? (i.e. >50% of your time)
- How many years have you been practicing in your current profession?
- What is your age?
- What gender do you most identify with?
- Which of the following social media networks do you mainly use for professional activities?
- In your current role are you contributing to/leading antimicrobial stewardship programmes or tackling AMR?

Results: prescriber behaviour stratified by setting for each country

Table 31. The frequency with which prescribers prescribed antibiotics due to fear of patient deterioration during the last one week, by country and setting

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	13.1	33.6	16.4	34.4	2.5
	Community (n=73)	19.2	32.9	12.3	32.9	2.7
Belgium	Hospital (n=65)	9.4	43.8	17.2	29.7	0.0
	Community (n=62)	14.5	43.5	24.2	16.1	1.6
Bulgaria	Hospital (n=2)	0.0	0.0	0.0	50.0	50.0
	Community (n=0)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	10.0	40.0	20.0	20.0	10.0
	Community (n=5)	20.0	60.0	0.0	20.0	0.0
Cyprus	Hospital (n=28)	10.7	25.0	32.1	32.1	0.0
	Community (n=15)	26.7	40.0	20.0	6.7	6.7
Czech Republic	Hospital (n=348)	8.6	36.6	21.9	30.8	2.0
	Community (n=45)	13.3	26.7	15.6	35.6	8.9
Denmark	Hospital (n=161)	2.5	29.2	12.4	45.3	10.6
	Community (n=102)	3.9	27.5	23.5	44.1	1.0
Estonia	Hospital (n=26)	3.8	23.1	23.1	46.2	3.8
	Community (n=1)	0.0	100.0	0.0	0.0	0.0
Finland	Hospital (n=35)	5.7	25.7	28.6	28.6	11.4
	Community (n=49)	4.1	26.5	18.4	44.9	6.1
France	Hospital (n=201)	7.0	26.4	26.9	33.8	6.0
	Community (n=80)	15.0	45.0	26.3	13.8	0.0
Germany	Hospital (n=31)	16.1	29.0	19.4	25.8	9.7
	Community (n=71)	9.9	16.9	15.5	57.7	0.0
Greece	Hospital (n=15)	6.7	60.0	6.7	26.7	0.0
	Community (n=3)	0.0	33.3	33.3	33.3	0.0
Hungary	Hospital (n=63)	6.3	34.9	22.2	28.6	7.9
	Community (n=5)	20.0	20.0	20.0	40.0	0.0
Iceland	Hospital (n=2)	0.0	50.0	0.0	50.0	0.0
	Community (n=11)	0.0	18.2	27.3	54.5	0.0
Ireland	Hospital (n=26)	12.0	36.0	40.0	12.0	0.0
	Community (n=32)	15.6	28.1	28.1	25.0	3.1
Italy	Hospital (n=240)	11.3	39.6	20.4	25.0	3.8
	Community (n=315)	14.0	45.4	18.1	21.0	1.6
Latvia	Hospital (n=64)	9.4	31.3	18.8	35.9	4.7
	Community (n=44)	6.8	36.4	15.9	36.4	4.5
Lithuania	Hospital (n=43)	7.1	28.6	23.8	38.1	2.4
	Community (n=1)	100.0	0.0	0.0	0.0	0.0
Luxembourg	Hospital (n=2)	0.0	50.0	0.0	50.0	0.0
	Community (n=1)	0.0	0.0	100.0	0.0	0.0
Malta	Hospital (n=6)	0.0	33.3	33.3	33.3	0.0
	Community (n=7)	0.0	71.4	14.3	14.3	0.0
Netherlands	Hospital (n=9)	0.0	22.2	33.3	44.4	0.0
	Community (n=43)	4.7	16.3	9.3	69.8	0.0
Norway	Hospital (n=245)	2.5	26.2	23.0	43.9	4.5
	Community (n=142)	1.4	27.5	24.6	43.7	2.8
Poland	Hospital (n=165)	4.8	27.3	22.4	37.0	8.5
	Community (n=70)	20.0	37.1	18.6	22.9	1.4
Portugal	Hospital (n=39)	33.3	28.2	17.9	15.4	5.1

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
	Community (n=25)	28.0	36.0	24.0	4.0	8.0
Romania	Hospital (n=126)	19.0	35.7	20.6	23.8	0.8
	Community (n=61)	21.7	31.7	31.7	11.7	3.3
Slovakia	Hospital (n=33)	21.2	42.4	18.2	18.2	0.0
	Community (n=22)	31.8	54.5	4.5	9.1	0.0
Slovenia	Hospital (n=35)	5.7	22.9	20.0	48.6	2.9
	Community (n=5)	0.0	40.0	40.0	20.0	0.0
Spain	Hospital (n=349)	10.9	33.0	25.3	27.6	3.2
	Community (n=413)	13.1	39.5	28.8	16.0	2.7
Sweden	Hospital (n=140)	6.5	20.1	21.6	44.6	7.2
	Community (n=114)	2.7	8.0	22.1	61.9	5.3
United Kingdom	Hospital (n=411)	6.4	25.4	23.2	39.7	5.4
	Community (n=241)	8.0	30.7	20.2	35.7	5.5
EU/EEA	Hospital (n=3 038)	3.3	2.7	6.0	83.0	5.0
	Community (n=2 056)	4.0	6.5	10.7	74.9	4.0

Table 32. The frequency with which prescribers prescribed antibiotics in situations where it was impossible to follow up on the patient during the last one week, by setting for each country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	13.9	13.1	10.7	58.2	4.1
	Community (n=73)	12.3	8.2	15.1	60.3	4.1
Belgium	Hospital (n=64)	3.1	9.4	14.1	70.3	3.1
	Community (n=62)	6.5	8.1	19.4	62.9	3.2
Bulgaria	Hospital (n=2)	0.0	50.0	0.0	50.0	0.0
	Community (n=0)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	20.0	40.0	10.0	10.0	20.0
	Community (n=5)	20.0	0.0	0.0	80.0	0.0
Cyprus	Hospital (n=28)	0.0	14.3	14.3	71.4	0.0
	Community (n=15)	6.7	6.7	33.3	46.7	6.7
Czech Republic	Hospital (n=347)	2.6	10.4	11.5	68.3	7.2
	Community (n=45)	2.2	11.1	13.3	66.7	6.7
Denmark	Hospital (n=161)	5.0	17.4	13.0	55.3	9.3
	Community (n=102)	1.0	3.9	7.8	85.3	2.0
Estonia	Hospital (n=26)	0.0	19.2	15.4	57.7	7.7
	Community (n=1)	0.0	0.0	100.0	0.0	0.0
Finland	Hospital (n=35)	8.6	8.6	20.0	48.6	14.3
	Community (n=49)	4.1	14.3	6.1	67.3	8.2
France	Hospital (n=201)	4.5	13.9	11.4	66.2	4.0
	Community (n=80)	2.5	13.8	18.8	56.3	8.8
Germany	Hospital (n=31)	12.9	6.5	0.0	64.5	16.1
	Community (n=71)	4.2	8.5	7.0	77.5	2.8
Greece	Hospital (n=15)	13.3	46.7	13.3	20.0	6.7
	Community (n=3)	0.0	33.3	66.7	0.0	0.0
Hungary	Hospital (n=63)	6.3	14.3	14.3	61.9	3.2
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	9.1	27.3	63.6	0.0
Ireland	Hospital (n=26)	0.0	28.0	28.0	44.0	0.0
	Community (n=32)	18.8	15.6	18.8	43.8	3.1

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Italy	Hospital (n=240)	10.8	19.2	15.8	50.4	3.8
	Community (n=315)	7.6	21.6	15.9	51.1	3.8
Latvia	Hospital (n=64)	6.3	15.6	14.1	59.4	4.7
	Community (n=44)	0.0	13.6	20.5	63.6	2.3
Lithuania	Hospital (n=42)	4.8	19.0	14.3	61.9	0.0
	Community (n=1)	0.0	100.0	0.0	0.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	16.7	16.7	16.7	50.0	0.0
	Community (n=7)	14.3	0.0	14.3	57.1	14.3
Netherlands	Hospital (n=9)	0.0	11.1	0.0	88.9	0.0
	Community (n=43)	2.3	4.7	2.3	90.7	0.0
Norway	Hospital (n=245)	5.3	19.7	14.8	53.3	7.0
	Community (n=142)	0.7	12.0	16.9	64.8	5.6
Poland	Hospital (n=165)	3.6	10.9	13.3	63.6	8.5
	Community (n=70)	7.1	18.6	15.7	52.9	5.7
Portugal	Hospital (n=39)	41.0	20.5	7.7	25.6	5.1
	Community (n=25)	44.0	24.0	20.0	4.0	8.0
Romania	Hospital (n=126)	10.3	16.7	24.6	45.2	3.2
	Community (n=61)	11.7	21.7	25.0	36.7	5.0
Slovakia	Hospital (n=33)	9.1	15.2	18.2	54.5	3.0
	Community (n=22)	9.1	27.3	31.8	31.8	0.0
Slovenia	Hospital (n=35)	8.6	20.0	5.7	60.0	5.7
	Community (n=5)	0.0	0.0	40.0	60.0	0.0
Spain	Hospital (n=349)	9.5	20.1	17.0	49.4	4.0
	Community (n=413)	5.8	18.2	28.1	44.1	3.9
Sweden	Hospital (n=140)	7.9	10.1	9.4	67.6	5.0
	Community (n=113)	1.8	10.6	8.8	71.7	7.1
United Kingdom	Hospital (n=410)	11.3	16.5	12.8	53.2	6.2
	Community (n=240)	10.5	13.0	15.1	55.9	5.5
EU/EEA	Hospital (n=3038)	7.8	15.8	13.8	57.0	5.7
	Community (n=2056)	6.5	14.7	17.7	56.5	4.6

Table 33. The frequency with which prescribers prescribed antibiotics during the last one week because they were uncertain about diagnosis, by setting for each country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	9.8	24.6	17.2	45.1	3.3
	Community (n=73)	15.1	16.4	13.7	50.7	4.1
Belgium	Hospital (n=64)	10.9	23.4	26.6	37.5	1.6
	Community (n=62)	4.8	24.2	24.2	41.9	4.8
Bulgaria	Hospital (n=2)	0.0	0.0	50.0	50.0	0.0
	Community (n=0)	6.7	33.3	20.0	33.3	6.7
Croatia	Hospital (n=10)	0.0	30.0	30.0	30.0	10.0
	Community (n=5)	20.0	40.0	0.0	40.0	0.0
Cyprus	Hospital (n=28)	3.6	17.9	35.7	42.9	0.0
	Community (n=15)	6.7	20.0	40.0	26.7	6.7
Czech Republic	Hospital (n=347)	2.6	18.2	22.2	53.3	3.7
	Community (n=45)	8.9	8.9	11.1	66.7	4.4
Denmark	Hospital (n=161)	4.3	26.7	15.5	45.3	8.1
	Community (n=102)	0.0	6.9	14.7	77.5	1.0
Estonia	Hospital (n=26)	0.0	7.7	7.7	84.6	0.0
	Community (n=1)	0.0	0.0	100.0	0.0	0.0
Finland	Hospital (n=35)	5.7	14.3	14.3	57.1	8.6
	Community (n=49)	2.0	6.1	20.4	65.3	6.1
France	Hospital (n=201)	5.0	16.9	25.4	48.3	4.5
	Community (n=80)	6.3	23.8	27.5	38.8	3.8
Germany	Hospital (n=31)	9.7	22.6	22.6	32.3	12.9
	Community (n=71)	5.6	9.9	18.3	66.2	0.0
Greece	Hospital (n=15)	13.3	26.7	13.3	40.0	6.7
	Community (n=3)	0.0	0.0	66.7	33.3	0.0
Hungary	Hospital (n=63)	4.8	12.7	15.9	63.5	3.2
	Community (n=5)	0.0	20.0	0.0	80.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	0.0	18.2	81.8	0.0
Ireland	Hospital (n=26)	12.0	36.0	24.0	24.0	4.0
	Community (n=32)	3.1	18.8	18.8	53.1	6.3
Italy	Hospital (n=240)	9.2	22.5	21.7	42.5	4.2
	Community (n=315)	7.3	30.2	30.8	29.5	2.2

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Latvia	Hospital (n=64)	1.6	14.1	10.9	67.2	6.3
	Community (n=44)	2.3	9.1	15.9	68.2	4.5
Lithuania	Hospital (n=42)	0.0	16.7	16.7	66.7	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	50.0	50.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	16.7	33.3	50.0	0.0
	Community (n=7)	0.0	42.9	14.3	42.9	0.0
Netherlands	Hospital (n=9)	0.0	33.3	11.1	55.6	0.0
	Community (n=43)	2.3	7.0	7.0	83.7	0.0
Norway	Hospital (n=245)	1.6	25.4	17.6	52.0	3.3
	Community (n=142)	0.7	24.6	23.2	48.6	2.8
Poland	Hospital (n=165)	4.8	16.4	23.6	49.1	6.1
	Community (n=70)	8.6	28.6	18.6	40.0	4.3
Portugal	Hospital (n=39)	30.8	25.6	12.8	25.6	5.1
	Community (n=25)	48.0	28.0	20.0	0.0	4.0
Romania	Hospital (n=126)	6.3	17.5	29.4	46.0	0.8
	Community (n=61)	11.7	15.0	16.7	51.7	5.0
Slovakia	Hospital (n=33)	6.1	15.2	36.4	42.4	0.0
	Community (n=22)	4.5	45.5	22.7	18.2	9.1
Slovenia	Hospital (n=35)	2.9	20.0	20.0	48.6	8.6
	Community (n=5)	0.0	20.0	20.0	60.0	0.0
Spain	Hospital (n=349)	8.6	24.1	28.7	35.1	3.4
	Community (n=413)	6.5	21.8	31.5	37.8	2.4
Sweden	Hospital (n=140)	5.0	10.8	20.1	59.0	5.0
	Community (n=113)	0.0	12.4	21.2	61.9	4.4
United Kingdom	Hospital (n=410)	8.1	21.9	15.8	48.8	5.4
	Community (n=240)	5.0	13.4	21.0	55.5	5.0
EU/EEA	Hospital (n=3038)	6.2	20.6	21.1	47.8	4.4
	Community (n=2056)	6.0	19.6	23.6	47.5	3.4

Table 34. The frequency with which prescribers prescribed even when they would have preferred not to during the last one week, by setting per country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember
Austria	Hospital (n=122)	9.8	19.7	18.0	46.7	5.7
	Community (n=73)	19.2	21.9	12.3	42.5	4.1
Belgium	Hospital (n=65)	10.9	12.5	23.4	50.0	3.1
	Community (n=62)	8.1	33.9	19.4	35.5	3.2
Bulgaria	Hospital (n=2)	0.0	0.0	0.0	0.0	100.0
	Community (n=)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	0.0	40.0	20.0	20.0	20.0
	Community (n=5)	0.0	40.0	20.0	0.0	40.0
Cyprus	Hospital (n=28)	7.1	25.0	17.9	50.0	0.0
	Community (n=15)	26.7	6.7	46.7	20.0	0.0
Czech Republic	Hospital (n=349)	6.0	23.6	23.9	42.0	4.6
	Community (n=45)	11.1	35.6	20.0	28.9	4.4
Denmark	Hospital (n=161)	0.6	9.3	22.4	59.0	8.7
	Community (n=102)	0.0	7.8	18.6	71.6	2.0
Estonia	Hospital (n=26)	0.0	11.5	11.5	69.2	7.7
	Community (n=1)	0.0	100.0	0.0	0.0	0.0
Finland	Hospital (n=35)	2.9	11.4	22.9	48.6	14.3
	Community (n=49)	6.1	4.1	12.2	69.4	8.2
France	Hospital (n=201)	7.0	12.9	19.9	52.2	8.0
	Community (n=80)	11.3	30.0	28.8	27.5	2.5
Germany (n=102)	Hospital (n=31)	19.4	12.9	16.1	35.5	16.1
	Community (n=71)	8.5	14.1	14.1	63.4	0.0
Greece	Hospital (n=15)	13.3	33.3	33.3	20.0	0.0
	Community (n=3)	0.0	33.3	33.3	33.3	0.0
Hungary	Hospital (n=63)	9.5	20.6	14.3	41.3	14.3
	Community (n=5)	0.0	20.0	20.0	60.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	9.1	27.3	54.5	9.1
Ireland	Hospital (n=26)	8.0	28.0	20.0	36.0	8.0
	Community (n=32)	18.8	18.8	25.0	31.3	6.3
Italy	Hospital (n=240)	9.6	30.4	19.6	35.0	5.4
	Community (n=315)	14.9	35.9	21.9	25.1	2.2
Latvia	Hospital (n=64)	10.9	10.9	17.2	50.0	10.9
	Community (n=44)	9.1	13.6	15.9	47.7	13.6
Lithuania	Hospital (n=43)	0.0	21.4	23.8	50.0	4.8
	Community (n=1)	100.0	0.0	0.0	0.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	16.7	33.3	50.0	0.0
	Community (n=7)	0.0	28.6	14.3	42.9	14.3
Netherlands	Hospital (n=9)	0.0	22.2	11.1	66.7	0.0
	Community (n=43)	4.7	11.6	7.0	76.7	0.0
Norway	Hospital (n=246)	1.2	9.8	22.5	59.0	7.4
	Community (n=142)	1.4	15.5	28.2	50.0	4.9
Poland	Hospital (n=165)	4.8	17.6	14.5	54.5	8.5
	Community (n=70)	22.9	24.3	14.3	35.7	2.9
Portugal	Hospital (n=39)	43.6	12.8	10.3	23.1	10.3
	Community (n=25)	40.0	28.0	16.0	4.0	12.0
Romania	Hospital (n=126)	18.3	30.2	17.5	27.0	7.1
	Community (n=61)	21.7	38.3	20.0	15.0	5.0

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember
Slovakia	Hospital (n=33)	30.3	21.2	18.2	21.2	9.1
	Community (n=22)	45.5	27.3	13.6	9.1	4.5
Slovenia	Hospital (n=35)	2.9	11.4	25.7	54.3	5.7
	Community (n=5)	0.0	20.0	20.0	60.0	0.0
Spain	Hospital (n=349)	8.3	19.0	27.6	41.1	4.0
	Community (n=413)	12.8	32.2	29.1	22.5	3.4
Sweden	Hospital (n=140)	2.9	5.0	14.4	70.5	7.2
	Community (n=114)	0.0	4.4	20.4	68.1	7.1
United Kingdom	Hospital (n=412)	5.7	11.6	22.7	53.0	7.1
	Community (n=241)	6.7	20.2	24.4	42.0	6.7
EU/EEA	Hospital (n=3045)	7.3	17.2	21.1	47.6	6.9
	Community (n=2058)	11.0	24.2	22.4	38.0	4.4

Table 35. The frequency with which prescribers prescribed antibiotics because it took less time than to explain the reasons why they are not indicated during the last one week, by country and setting

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	7.4	6.6	9.8	74.6	1.6
	Community (n=73)	6.8	11.0	12.3	63.0	6.8
Belgium	Hospital (n=65)	3.1	1.6	6.3	84.4	4.7
	Community (n=62)	4.8	4.8	14.5	74.2	1.6
Bulgaria	Hospital (n=2)	0.0	0.0	0.0	50.0	50.0
	Community (n=)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	10.0	20.0	0.0	70.0	0.0
	Community (n=5)	20.0	0.0	0.0	60.0	20.0
Cyprus	Hospital (n=28)	0.0	3.6	10.7	85.7	0.0
	Community (n=15)	6.7	6.7	13.3	73.3	0.0
Czech Republic	Hospital (n=348)	0.0	5.8	10.1	80.1	4.0
	Community (n=45)	4.4	11.1	8.9	66.7	8.9
Denmark	Hospital (n=161)	0.0	1.9	4.3	86.3	7.5
	Community (n=102)	0.0	0.0	6.9	92.2	1.0
Estonia	Hospital (n=26)	0.0	0.0	3.8	96.2	0.0
	Community (n=1)	0.0	0.0	100.0	0.0	0.0
Finland	Hospital (n=35)	0.0	2.9	8.6	82.9	5.7
	Community (n=49)	2.0	2.0	8.2	81.6	6.1
France	Hospital (n=201)	2.0	3.0	6.5	83.6	5.0
	Community (n=80)	2.5	7.5	20.0	67.5	2.5
Germany	Hospital (n=31)	3.2	0.0	9.7	77.4	9.7
	Community (n=71)	4.2	8.5	2.8	84.5	0.0
Greece	Hospital (n=15)	0.0	13.3	20.0	66.7	0.0
	Community (n=3)	0.0	0.0	33.3	66.7	0.0
Hungary	Hospital (n=63)	4.8	6.3	12.7	73.0	3.2
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	0.0	9.1	81.8	9.1
Ireland	Hospital (n=26)	0.0	4.0	24.0	68.0	4.0
	Community (n=32)	12.5	6.3	12.5	65.6	3.1
Italy	Hospital (n=240)	7.1	6.7	11.3	71.3	3.8
	Community (n=315)	7.3	10.5	14.9	66.7	0.6
Latvia	Hospital (n=64)	1.6	7.8	12.5	70.3	7.8
	Community (n=44)	0.0	9.1	4.5	81.8	4.5
Lithuania	Hospital (n=43)	0.0	4.8	4.8	90.5	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	0.0	0.0	100.0	0.0
	Community (n=7)	0.0	14.3	14.3	71.4	0.0
Netherlands	Hospital (n=9)	0.0	11.1	0.0	77.8	11.1
	Community (n=43)	2.3	7.0	4.7	86.0	0.0
Norway	Hospital (n=245)	1.2	0.8	7.8	86.1	4.1
	Community (n=142)	2.8	2.8	15.5	76.1	2.8
Poland	Hospital (n=165)	1.8	3.0	10.3	80.0	4.8
	Community (n=70)	2.9	12.9	8.6	71.4	4.3
Portugal	Hospital (n=39)	46.2	2.6	2.6	41.0	7.7
	Community (n=25)	56.0	20.0	12.0	8.0	4.0
Romania	Hospital (n=126)	4.0	7.1	18.3	69.8	0.8
	Community (n=61)	8.3	10.0	13.3	61.7	6.7

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Slovakia	Hospital (n=33)	12.1	9.1	15.2	60.6	3.0
	Community (n=22)	4.5	27.3	18.2	40.9	9.1
Slovenia	Hospital (n=35)	2.9	2.9	5.7	85.7	2.9
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Spain	Hospital (n=349)	6.3	6.6	15.5	68.7	2.9
	Community (n=413)	5.1	6.5	24.0	60.8	3.6
Sweden	Hospital (n=140)	1.4	0.7	4.3	89.2	4.3
	Community (n=114)	0.9	0.0	11.5	83.2	4.4
United Kingdom	Hospital (n=411)	1.2	3.4	8.6	82.0	4.7
	Community (n=241)	1.3	6.7	16.4	72.3	3.4
EU/EEA (n=6507)	Hospital (n=3042)	3.3	4.3	9.8	78.5	4.1
	Community (n=2058)	4.8	7.1	14.9	69.9	3.4

Table 36. The frequency with which prescribers prescribed an antibiotic to maintain a relationship during the last one week, by setting for each country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	4.1	2.5	3.3	85.2	4.9
	Community (n=73)	5.5	6.8	8.2	75.3	4.1
Belgium	Hospital (n=64)	3.1	4.7	4.7	84.4	3.1
	Community (n=62)	4.8	9.7	8.1	74.2	3.2
Bulgaria	Hospital (n=2)	0.0	0.0	0.0	50.0	50.0
	Community (n=0)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	0.0	20.0	10.0	60.0	10.0
	Community (n=5)	0.0	20.0	20.0	60.0	0.0
Cyprus	Hospital (n=28)	0.0	3.6	7.1	89.3	0.0
	Community (n=15)	0.0	0.0	26.7	73.3	0.0
Czech Republic	Hospital (n=347)	0.3	2.9	5.8	85.0	6.1
	Community (n=45)	2.2	8.9	4.4	75.6	8.9
Denmark	Hospital (n=161)	1.2	1.2	1.2	88.8	7.5
	Community (n=102)	0.0	0.0	4.9	94.1	1.0
Estonia	Hospital (n=26)	0.0	3.8	3.8	88.5	3.8
	Community (n=1)	0.0	0.0	0.0	0.0	100.0
Finland	Hospital (n=35)	0.0	0.0	11.4	77.1	11.4
	Community (n=49)	0.0	0.0	2.0	91.8	6.1
France	Hospital (n=201)	2.5	2.5	5.5	85.6	4.0
	Community (n=80)	1.3	7.5	10.0	78.8	2.5
Germany	Hospital (n=31)	6.5	0.0	3.2	77.4	12.9
	Community (n=71)	2.8	8.5	7.0	81.7	0.0
Greece	Hospital (n=15)	0.0	13.3	20.0	66.7	0.0
	Community (n=3)	0.0	0.0	33.3	66.7	0.0
Hungary	Hospital (n=63)	4.8	1.6	3.2	88.9	1.6
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	0.0	0.0	100.0	0.0
Ireland	Hospital (n=26)	0.0	8.0	0.0	84.0	8.0
	Community (n=32)	9.4	9.4	9.4	65.6	6.3
Italy	Hospital (n=240)	5.8	5.0	9.2	75.0	5.0
	Community (n=315)	5.4	11.1	11.4	69.2	2.9
Latvia	Hospital (n=64)	0.0	3.1	7.8	84.4	4.7
	Community (n=44)	0.0	2.3	4.5	88.6	4.5
Lithuania	Hospital (n=42)	2.4	4.8	4.8	88.1	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	0.0	0.0	100.0	0.0
	Community (n=7)	0.0	14.3	14.3	71.4	0.0
Netherlands	Hospital (n=9)	0.0	11.1	0.0	77.8	11.1
	Community (n=43)	4.7	9.3	2.3	83.7	0.0
Norway	Hospital (n=245)	1.2	1.2	4.5	88.5	4.5
	Community (n=142)	0.0	5.6	13.4	75.4	5.6
Poland	Hospital (n=165)	1.2	1.2	7.3	83.6	6.7
	Community (n=70)	5.7	5.7	4.3	82.9	1.4
Portugal	Hospital (n=39)	46.2	0.0	2.6	43.6	7.7
	Community (n=25)	60.0	12.0	12.0	12.0	4.0
Romania	Hospital (n=126)	3.2	3.2	6.3	85.7	1.6
	Community (n=61)	11.7	3.3	15.0	63.3	6.7

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Slovakia	Hospital (n=33)	9.1	6.1	9.1	69.7	6.1
	Community (n=22)	9.1	31.8	18.2	31.8	9.1
Slovenia	Hospital (n=35)	2.9	0.0	2.9	88.6	5.7
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Spain	Hospital (n=349)	6.3	4.9	8.3	77.0	3.4
	Community (n=413)	2.9	5.1	15.5	72.9	3.6
Sweden	Hospital (n=140)	0.7	0.0	2.9	92.1	4.3
	Community (n=113)	0.9	0.9	2.7	90.3	5.3
United Kingdom	Hospital (n=410)	2.5	1.5	7.6	82.8	5.7
	Community (n=240)	3.4	6.3	13.0	71.0	6.3
EU/EEA	Hospital (n=3038)	3.3	2.7	6.0	83.0	5.0
	Community (n=2056)	4.0	6.5	10.7	74.9	4.0

Table 37. The frequency with which prescribers stopped an antibiotic earlier than the prescribed course length, by setting for each country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	9.8	13.9	14.8	57.4	4.1
	Community (n=73)	5.5	19.2	9.6	61.6	4.1
Belgium	Hospital (n=65)	6.3	21.9	14.1	56.3	1.6
	Community (n=62)	8.1	9.7	17.7	62.9	1.6
Bulgaria	Hospital (n=2)	0.0	100.0	0.0	0.0	0.0
	Community (n=0)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	10.0	30.0	0.0	40.0	20.0
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Cyprus	Hospital (n=28)	3.6	17.9	21.4	57.1	0.0
	Community (n=15)	13.3	0.0	40.0	40.0	6.7
Czech Republic	Hospital (n=348)	1.2	9.2	13.0	70.6	6.1
	Community (n=45)	0.0	8.9	8.9	77.8	4.4
Denmark	Hospital (n=161)	1.2	22.4	11.8	53.4	11.2
	Community (n=102)	2.0	2.0	5.9	86.3	3.9
Estonia	Hospital (n=26)	0.0	0.0	7.7	88.5	3.8
	Community (n=1)	100.0	0.0	0.0	0.0	0.0
Finland	Hospital (n=35)	5.7	17.1	14.3	51.4	11.4
	Community (n=49)	2.0	8.2	14.3	69.4	6.1
France	Hospital (n=201)	7.0	21.9	13.9	54.7	2.5
	Community (n=80)	1.3	16.3	11.3	67.5	3.8
Germany	Hospital (n=31)	12.9	32.3	9.7	32.3	12.9
	Community (n=71)	4.2	2.8	9.9	77.5	5.6
Greece	Hospital (n=15)	0.0	6.7	20.0	73.3	0.0
	Community (n=3)	0.0	0.0	0.0	100.0	0.0
Hungary	Hospital (n=63)	6.3	9.5	15.9	66.7	1.6
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	0.0	18.2	72.7	9.1
Ireland	Hospital (n=26)	8.0	12.0	8.0	68.0	4.0
	Community (n=32)	3.1	3.1	28.1	59.4	6.3
Italy	Hospital (n=240)	7.9	15.0	14.2	58.8	4.2
	Community (n=315)	4.8	6.0	14.6	71.7	2.9
Latvia	Hospital (n=64)	1.6	15.6	15.6	62.5	4.7
	Community (n=44)	0.0	2.3	11.4	70.5	15.9
Lithuania	Hospital (n=42)	0.0	9.5	14.3	76.2	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	0.0	0.0	100.0	0.0
	Community (n=7)	0.0	14.3	14.3	71.4	0.0
Netherlands	Hospital (n=9)	0.0	22.2	11.1	66.7	0.0
	Community (n=43)	2.3	2.3	4.7	88.4	2.3
Norway	Hospital (n=245)	0.8	18.4	12.7	54.1	13.9
	Community (n=142)	1.4	9.9	12.0	59.9	16.9
Poland	Hospital (n=165)	1.2	4.8	9.7	72.1	12.1
	Community (n=70)	2.9	10.0	10.0	65.7	11.4
Portugal	Hospital (n=39)	41.0	17.9	5.1	25.6	10.3
	Community (n=25)	60.0	12.0	4.0	20.0	4.0
Romania	Hospital (n=126)	3.2	21.4	22.2	48.4	4.8
	Community (n=61)	5.0	5.0	28.3	55.0	6.7

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Slovakia	Hospital (n=33)	3.0	6.1	15.2	51.5	24.2
	Community (n=22)	9.1	13.6	9.1	50.0	18.2
Slovenia	Hospital (n=35)	2.9	20.0	17.1	54.3	5.7
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Spain	Hospital (n=349)	7.8	19.8	21.0	48.0	3.4
	Community (n=413)	3.1	15.5	21.5	56.2	3.6
Sweden	Hospital (n=140)	4.3	7.9	7.2	75.5	5.0
	Community (n=113)	0.9	0.9	5.3	86.7	6.2
United Kingdom	Hospital (n=411)	6.7	22.4	12.6	53.4	4.9
	Community (n=240)	1.3	6.7	13.9	71.8	6.3
EU/EEA	Hospital (n=3041)	5.1	16.5	13.9	58.2	6.3
	Community (n=2056)	3.8	8.8	14.4	67.2	5.9

Table 38. The frequency with which prescribers prescribed a shorter treatment of antibiotics compared to available guidelines during the last one week, by setting for each country

Country	Setting	At least once a day	At least once a week	Rarely	Never	Do not remember
Austria	Hospital (n=122)	11.5	7.4	12.3	64.8	4.1
	Community (n=73)	6.8	5.5	17.8	65.8	4.1
Belgium	Hospital (n=64)	4.7	14.1	15.6	64.1	1.6
	Community (n=62)	4.8	4.8	9.7	72.6	8.1
Bulgaria	Hospital (n=2)	0.0	50.0	0.0	0.0	50.0
	Community (n=)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	0.0	10.0	10.0	70.0	10.0
	Community (n=5)	0.0	0.0	40.0	60.0	0.0
Cyprus	Hospital (n=28)	0.0	7.1	25.0	64.3	3.6
	Community (n=15)	0.0	6.7	33.3	60.0	0.0
Czech Republic	Hospital (n=347)	1.2	7.8	9.8	74.9	6.3
	Community (n=45)	0.0	2.2	11.1	80.0	6.7
Denmark	Hospital (n=161)	1.2	9.3	12.4	66.5	10.6
	Community (n=102)	2.0	2.0	4.9	90.2	1.0
Estonia	Hospital (n=26)	0.0	3.8	7.7	84.6	3.8
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Finland	Hospital (n=35)	0.0	22.9	8.6	60.0	8.6
	Community (n=49)	2.0	10.2	6.1	75.5	6.1
France	Hospital (n=201)	4.5	13.4	13.4	65.2	3.5
	Community (n=80)	3.8	5.0	7.5	81.3	2.5
Germany	Hospital (n=31)	6.5	22.6	9.7	45.2	16.1
	Community (n=71)	4.2	2.8	5.6	85.9	1.4
Greece	Hospital (n=15)	6.7	13.3	13.3	66.7	0.0
	Community (n=3)	0.0	0.0	0.0	100.0	0.0
Hungary	Hospital (n=63)	3.2	6.3	9.5	79.4	1.6
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	9.1	9.1	72.7	9.1
Ireland	Hospital (n=26)	4.0	8.0	24.0	60.0	4.0
	Community (n=32)	3.1	0.0	15.6	75.0	6.3
Italy	Hospital (n=240)	6.7	10.8	15.4	61.7	5.4
	Community (n=315)	5.1	7.3	16.2	66.0	5.4
Latvia	Hospital (n=64)	6.3	10.9	10.9	64.1	7.8
	Community (n=44)	0.0	6.8	9.1	75.0	9.1
Lithuania	Hospital (n=42)	4.8	2.4	7.1	85.7	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	0.0	0.0	100.0	0.0
	Community (n=7)	0.0	14.3	0.0	85.7	0.0
Netherlands	Hospital (n=9)	0.0	11.1	0.0	88.9	0.0
	Community (n=43)	7.0	0.0	2.3	90.7	0.0
Norway	Hospital (n=245)	2.0	9.0	14.8	65.6	8.6
	Community (n=142)	0.7	11.3	10.6	72.5	4.9
Poland	Hospital (n=165)	1.2	4.8	12.1	73.3	8.5
	Community (n=70)	4.3	2.9	11.4	78.6	2.9
Portugal	Hospital (n=39)	51.3	2.6	7.7	33.3	5.1
	Community (n=25)	60.0	8.0	16.0	8.0	8.0
Romania	Hospital (n=126)	2.4	10.3	21.4	59.5	6.3
	Community (n=61)	5.0	15.0	16.7	55.0	8.3
Slovakia	Hospital (n=33)	0.0	6.1	9.1	72.7	12.1

Country	Setting	At least once a day	At least once a week	Rarely	Never	Do not remember
	Community (n=22)	4.5	9.1	22.7	45.5	18.2
Slovenia	Hospital (n=35)	2.9	2.9	8.6	80.0	5.7
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Spain	Hospital (n=349)	7.2	12.4	14.7	62.4	3.4
	Community (n=413)	1.7	7.3	18.2	67.8	5.1
Sweden	Hospital (n=140)	0.7	5.0	4.3	83.5	6.5
	Community (n=113)	0.9	0.0	4.4	89.4	5.3
United Kingdom	Hospital (n=410)	4.4	8.9	12.6	67.0	7.1
	Community (n=240)	2.5	2.5	10.9	76.9	7.1
EU/EEA	Hospital (n=3038)	4.4	9.4	12.6	67.5	6.1
	Community (n=2056)	3.7	5.7	12.6	72.8	5.3

Table 39. The frequency with which prescribers prescribed a shorter course of antibiotic compared to available guidelines, by setting for each country

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Austria	Hospital (n=122)	9.8	19.7	7.4	59.8	3.3
	Community (n=73)	8.2	6.8	9.6	69.9	5.5
Belgium	Hospital (n=64)	10.9	29.7	12.5	43.8	3.1
	Community (n=62)	4.8	4.8	3.2	79.0	8.1
Bulgaria	Hospital (n=2)	0.0	0.0	0.0	50.0	50.0
	Community (n=)	0.0	0.0	0.0	0.0	0.0
Croatia	Hospital (n=10)	0.0	20.0	10.0	30.0	40.0
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Cyprus	Hospital (n=28)	7.1	21.4	14.3	50.0	7.1
	Community (n=15)	6.7	13.3	26.7	46.7	6.7
Czech Republic	Hospital (n=347)	1.2	7.2	13.3	72.3	6.1
	Community (n=45)	2.2	2.2	8.9	80.0	6.7
Denmark	Hospital (n=161)	2.5	19.9	9.9	56.5	11.2
	Community (n=102)	2.0	1.0	6.9	88.2	2.0
Estonia	Hospital (n=26)	0.0	3.8	7.7	84.6	3.8
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Finland	Hospital (n=35)	2.9	31.4	11.4	45.7	8.6
	Community (n=49)	0.0	10.2	8.2	75.5	6.1
France	Hospital (n=201)	10.0	23.4	13.4	49.3	4.0
	Community (n=80)	1.3	10.0	20.0	65.0	3.8
Germany	Hospital (n=31)	22.6	22.6	0.0	41.9	12.9
	Community (n=71)	4.2	5.6	8.5	80.3	1.4
Greece	Hospital (n=15)	0.0	13.3	26.7	53.3	6.7
	Community (n=3)	0.0	66.7	0.0	33.3	0.0
Hungary	Hospital (n=63)	6.3	9.5	7.9	69.8	6.3
	Community (n=5)	0.0	0.0	0.0	100.0	0.0
Iceland	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=11)	0.0	0.0	18.2	72.7	9.1
Ireland	Hospital (n=26)	8.0	24.0	20.0	40.0	8.0
	Community (n=32)	3.1	3.1	12.5	78.1	3.1
Italy	Hospital (n=240)	9.2	16.3	17.1	52.9	4.6
	Community (n=315)	3.8	5.4	12.1	72.4	6.3
Latvia	Hospital (n=64)	4.7	14.1	17.2	56.3	7.8
	Community (n=44)	0.0	2.3	6.8	75.0	15.9
Lithuania	Hospital (n=42)	4.8	14.3	9.5	71.4	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Luxembourg	Hospital (n=2)	0.0	0.0	0.0	100.0	0.0
	Community (n=1)	0.0	0.0	0.0	100.0	0.0
Malta	Hospital (n=6)	0.0	0.0	16.7	83.3	0.0
	Community (n=7)	0.0	14.3	0.0	85.7	0.0
Netherlands	Hospital (n=9)	0.0	11.1	22.2	66.7	0.0
	Community (n=43)	2.3	0.0	7.0	90.7	0.0
Norway	Hospital (n=245)	2.5	21.3	10.7	57.0	8.6
	Community (n=142)	1.4	10.6	11.3	70.4	6.3
Poland	Hospital (n=164)	3.0	9.8	9.8	67.7	9.8
	Community (n=70)	10.0	5.7	8.6	71.4	4.3
Portugal	Hospital (n=39)	38.5	23.1	7.7	23.1	7.7
	Community (n=25)	68.0	4.0	4.0	20.0	4.0
Romania	Hospital (n=126)	10.3	12.7	21.4	53.2	2.4
	Community (n=61)	1.7	10.0	18.3	61.7	8.3

Country	Setting	At least once a day (%)	At least once a week (%)	Rarely (%)	Never (%)	Do not remember (%)
Slovakia	Hospital (n=33)	0.0	12.1	9.1	66.7	12.1
	Community (n=22)	0.0	13.6	18.2	50.0	18.2
Slovenia	Hospital (n=35)	2.9	14.3	17.1	57.1	8.6
	Community (n=5)	0.0	0.0	20.0	80.0	0.0
Spain	Hospital (n=348)	10.3	25.6	15.2	44.8	4.0
	Community (n=413)	3.6	12.3	18.6	58.4	7.0
Sweden	Hospital (n=140)	4.3	11.5	8.6	69.8	5.8
	Community (n=113)	0.9	3.5	5.3	85.8	4.4
United Kingdom	Hospital (n=410)	10.6	23.4	8.9	50.7	6.4
	Community (n=240)	2.5	5.5	12.6	71.4	8.0
EU/EEA	Hospital (n=3036)	7.1	18.0	12.3	56.4	6.2
	Community (n=2056)	3.9	7.2	12.3	70.3	6.2

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