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Key priorities in the prevention and control of healthcare-associated infection: a survey of European and other international infection prevention experts

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Abstract

Purpose Prevention and control of healthcare-associated infection (HCAI) are important within and beyond Europe. However, it is unclear which areas are considered important by HCAI prevention and control professionals. This study assesses the priorities in the prevention and control of HCAI as judged by experts in the field.

Methods A survey was conducted by the European Society of Clinical Microbiology and Infectious Diseases focussing on seven topics using SurveyMonkey®. Through a newsletter distributed by email, about 5000 individuals were targeted throughout the world in February and March 2013. Participants were asked to rate the importance of particular topics from one (low importance) to ten (extraordinary importance), and there was no restriction on giving equal importance to more than one topic.

Results A total of 589 experts from 86 countries participated including 462 from Europe (response rate: 11.8 %). Physicians accounted for 60 % of participants, and 57 % had ten or more years' experience in this area. Microbial epidemiology/resistance achieved the highest priority scoring with 8.9, followed by surveillance 8.2, and decolonisation/disinfection/antiseptics with 7.9. Under epidemiology/resistance, highly resistant Gram-negative bacilli scored highest (9.0–9.2). The provision of computerised healthcare information systems for the early detection of outbreaks was accorded the top priority under surveillance. The prevention of surgical site and central line infections ranked highest under the category of specific HCAI and HCAI in certain settings. Differences between regions are described.

Conclusion These findings reflect the concerns of experts in HCAI prevention and control. The results from this survey should inform national and international agencies on future action and research priorities.

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Introduction

Healthcare-associated infections (HCAI) are increasingly important as a public health issue, and these infections are of concern to healthcare workers, patients and the public [1–3]. According to the World Health Organisation (WHO), the prevalence of HCAI in developed countries ranges between 3.5 and 12.0 % [2]. In a 2011–2012 survey of over 1000 hospitals in 13 countries, 6.0 % of patients in European hospitals had an HCAI, increasing fourfold to 19.5 % of patients in intensive care units, and one in three patients received an antimicrobial agent on any given day [4]. Whilst HCAIs are multifactorial and include the underlying complexity of the patient's condition, e.g., cancer, it is acknowledged that many HCAIs are preventable and that significant cost savings could be made by the more rigorous application of established best practice.

In addition to the need to prevent HCAI, there is increasing concern about multidrug-resistant bacteria and the lack of alternatives to currently available agents. It has been suggested that there needs to be more international cooperation to facilitate the development, evaluation and introduction of novel antimicrobial drugs and technologies, as well as infection prevention and control strategies [5, 6]. Amongst the most challenging issues are resistant Gram-negative bacilli, where there is international spread between countries with many challenges in prevention and control because of the multiple resistance mechanisms and the many potential reservoirs [7, 8].

Many efforts are underway locally, nationally and internationally to prevent and control HCAIs and antimicrobial resistance. Earlier diagnosis and the more appropriate use of antimicrobial agents are important, and the European Union (EU) has funded research projects on these topics, such as the European network for mastering hospital antimicrobial resistance (MOSAR) [9]. Also, in many countries, there has been (and still is) particular emphasis on improving compliance with hand hygiene recommendations, a process supported by international experts, most governments and the WHO [10]. However, it is not clear what professionals in the area of HCAI prevention and control believe should be the key priorities. There is a danger that, in the absence of a clear focus and a defined strategy, efforts and time may be wasted in not tackling HCAI appropriately if these important stakeholders are not considered.

Here, we report the priorities for HCAI prevention and control judged by experts in the area, as revealed in an international survey that was carried out in early 2013.

Methods

The survey was organised by the European society of clinical microbiology and infectious diseases (ESCMID) Study Group for Nosocomial Infections (ESGNI). The survey was piloted amongst the members of the ESGNI Co-ordinating Study Group and focussed on seven topics that were felt to be of particular importance, i.e., surveillance, economics/mathematical models, microbial epidemiology and resistance, organisational and behavioural change, healthcare delivery factors, specific HCAI and settings, and decolonisation/disinfection/antiseptics (details available in supplementary material). Antimicrobial stewardship was not included as it is the subject of another ESCMID study group and has been addressed elsewhere.

On 1st February 2013, the survey achieved approval of the ESCMID Scientific Affairs Officer (Murat Akova). Following this, it was transformed into SurveyMonkey® [11] and (after pretesting) put on the ESCMID homepage. An e-mail message was distributed from the ESCMID Executive Office (H.S.) to international experts in infection prevention and control through use of the ESGNI/ESCMID Newsletter, thus targeting about 5000 individuals. Participants were able to complete the survey between 13th February and 28th March 2013. For each question, the participant was asked to give a rating from one (very low importance) to ten (of extraordinary importance) for the seven topics as well as for each component of the topic or subtopic. There was no restriction on the participant giving equal importance to more than one topic or subtopic. The survey was open to all infection prevention and control practitioners in the EU and beyond.

Results

During the survey period, 589 participants from 86 countries (from five continents and 16 subcontinents) completed the survey (response rate: 11.8 %). The highest number of participants, i.e., 462, were from Europe, with Western Europe (151), Southeastern Europe (125) and Southwestern Europe (107) being the most commonly represented. There were 63 participants from Asia, 33 from the Americas, 21 from Africa and 10 from Oceania. Figure 1 illustrates the distribution of respondents in Europe.

Physicians accounted for over 60 % of the participants followed by scientists (20 %) and others at 14 %. The highest medical group represented amongst physicians were

Fig. 1 Distribution of participants from European countries (with ≥5 participants)
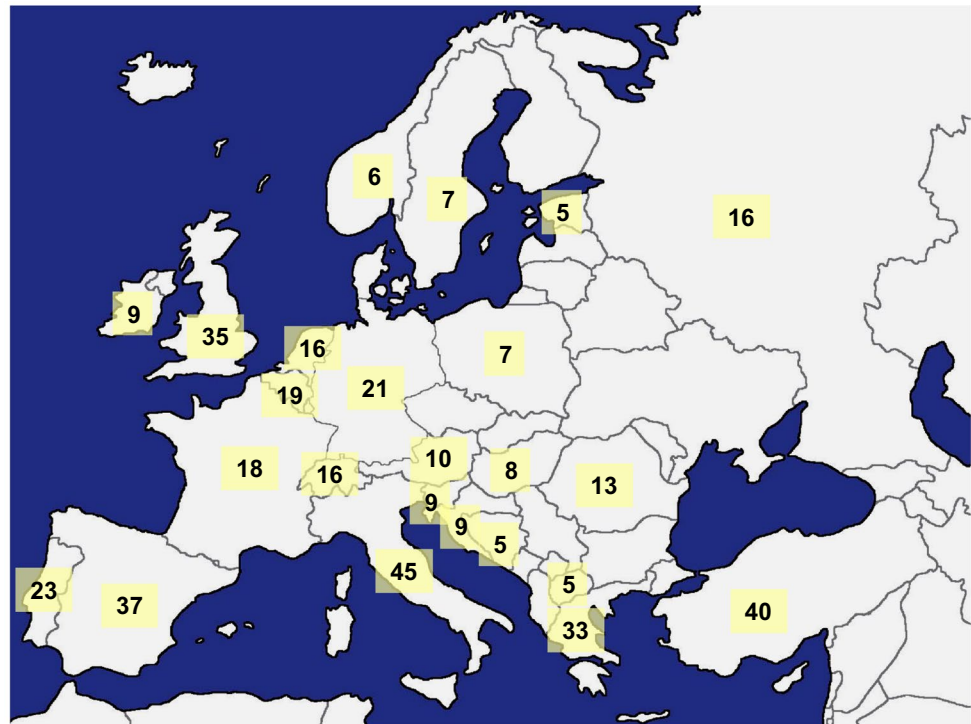
medical/clinical microbiologists at 47 %, followed by infectious disease physicians at 33 % and internal medicine practitioners at 17 %. Over 50 % of the respondents had appointments in academic hospitals, and 57 % had experience of ten years or more in the area of infection prevention and control.

The overall ranking of topics is outlined in Table 1. Microbial epidemiology/resistance was considered the highest priority, achieving a mean score of 8.9. This was followed by surveillance, 8.2, decolonisation/disinfection/antiseptics, 8.1 and organisational and behavioural change as well as specific HCAIs and settings at 7.9. The distribution of the scores for the specific key topics from Europe and beyond Europe is shown in Table 2. Interestingly, there was consensus across all continents that microbial resistance was the most important topic.

Under the heading of microbial epidemiology/resistance, the control of highly resistant Gram-negative pathogens including those producing extended-spectrum β-lactamase enzymes had the highest score at 9.0—9.2. This was followed by multiresistant Gram-positive bacteria (8.4) and *Clostridium difficile* infection (7.9). Also under microbial epidemiology/resistance, the development of reliable, affordable and accessible rapid laboratory detection methods had a score of 8.8.

Under surveillance, the evaluation of computerised healthcare information systems for the early detection of outbreaks of HCAI, including multidrug-resistant pathogens was the top priority with a score of 8.3 followed

Table 1 Order and ranking score for key topics in infection prevention and control

Rank	Topic	Mean score
1	Microbial epidemiology/resistance	8.9
2	Surveillance	8.2
3	Decolonisation/disinfection/antiseptics	8.1
4	Organisational and behavioural change	7.9
5	Specific HCAI and settings	7.9
6	Healthcare delivery factors	7.5
7	Economics/mathematical models	6.9

by the standardisation of surveillance, including definitions at 8.1. Research on the effects of decolonisation of patients harbouring multidrug-resistant bacteria on infection rates was the top priority in the category of decolonisation/disinfection/antiseptics, with a score of 8.1. This was followed by studies on the effect of surface disinfectants (7.9) and investigations into the clinical effectiveness of antiseptic compounds (7.8). Regarding specific HCAI and certain settings, two areas achieved equal high priority, i.e., the development of protocols/checklists and new technologies to improve the prevention of surgical site infections and to prevent central line infections, both of which scored 7.9. These were followed by the development of scoring systems and new technologies to improve the diagnosis of ventilator-associated pneumonia.

Table 2 Scores for specific key topics—Europe and World regions other than Europe

Region	Respondents	Variable (according to overall ranking)	Mean score	Lower 95 % CI	Upper 95 % CI
Eastern Europe	62	1. Microbial epidemiology/resistance	8.8	8.3	9.3
		2. Surveillance	8.2	7.7	8.7
		3. Decolonisation/disinfection/antiseptics	7.8	7.3	8.4
		4. Organisational and behavioural change	7.2	6.6	7.8
		5. Specific HCAI and settings	7.7	7.1	8.2
		6. Healthcare delivery factors	7.0	6.4	7.6
		7. Economics/mathematical models	6.8	6.1	7.4
Northern Europe	18	1. Microbial epidemiology/resistance	8.0	7.2	8.8
		2. Surveillance	7.3	6.0	8.5
		3. Decolonisation/disinfection/antiseptics	6.9	5.6	8.2
		4. Organisational and behavioural change	7.9	6.9	9.0
		5. Specific HCAI and settings	7.0	6.0	8.0
		6. Healthcare delivery factors	6.8	5.5	8.1
		7. Economics/mathematical models	6.1	5.0	7.3
Southeast Europe	125	1. Microbial epidemiology/resistance	9.2	8.9	9.5
		2. Surveillance	8.5	8.1	8.8
		3. Decolonisation/disinfection/antiseptics	8.4	8.0	8.7
		4. Organisational and behavioural change	8.3	7.9	8.7
		5. Specific HCAI and settings	8.4	8.1	8.8
		6. Healthcare delivery factors	7.9	7.5	8.3
		7. Economics/mathematical models	7.1	6.7	7.5
Southwest Europe	107	1. Microbial epidemiology/resistance	9.1	8.9	9.3
		2. Surveillance	8.5	8.2	8.8
		3. Decolonisation/disinfection/antiseptics	8.2	7.8	8.5
		4. Organisational and behavioural change	7.9	7.6	8.2
		5. Specific HCAI and settings	8.0	7.7	8.3
		6. Healthcare delivery factors	7.6	7.3	7.9
		7. Economics/mathematical models	7.2	6.9	7.5
Western Europe	151	1. Microbial epidemiology/resistance	8.7	8.5	8.9
		2. Surveillance	7.8	7.5	8.1
		3. Decolonisation/disinfection/antiseptics	7.8	7.6	8.1
		4. Organisational and behavioural change	7.8	7.6	8.1
		5. Specific HCAI and settings	7.4	7.1	7.7
		6. Healthcare delivery factors	7.0	6.7	7.3
		7. Economics/mathematical models	6.9	6.6	7.2
Non-Europe	126	1. Microbial epidemiology/resistance	8.8	8.5	9.1
		2. Surveillance	8.4	8.1	8.7
		3. Decolonisation/disinfection/antiseptics	8.3	7.9	8.6
		4. Organisational and behavioural change	7.9	7.6	8.3
		5. Specific HCAI and settings	8.2	7.9	8.6
		6. Healthcare delivery factors	7.7	7.3	8.0
		7. Economics/mathematical models	6.8	6.3	7.2

In addition to scoring and prioritising key topics, participants were also invited to provide free comments, which ranged from remarks about the survey itself and about specific HCAI issues. The 49 comments included the need for support for infection prevention and control programmes in lower income countries, the role of the

Table 3 Test for differences (Wilcoxon rank sum test) between Europe versus other regions and within Europe

Variable	*p* value
Europe versus other regions	
1. Microbial epidemiology/resistance	0.6740
2. Surveillance	0.2594
3. Decolonisation/disinfection/antiseptics	0.0805
4. Organisational and behavioural change	0.5385
5. Specific HCAI and settings	0.0173
6. Healthcare delivery factors	0.0906
7. Economics/mathematical models	0.3914
Within Europe: north–west versus southeast–west, east	
1. Microbial epidemiology/resistance	<0.0001
2. Surveillance	<0.0001
3. Decolonisation/disinfection/antiseptics	0.0007
4. Organisational and behavioural change	0.4130
5. Specific HCAI and settings	<0.0001
6. Healthcare delivery factors	0.0002
7. Economics/mathematical models	0.0759

colonised healthcare worker in the spread of multidrug-resistant organisms and the need for protocols and interpretative guidelines for routine environmental sampling in preventing HCAI.

Differences existed when the scores are subdivided by European and non-European regions (Tables 2 and 3). For example, healthcare delivery factors scored significantly higher in Southeastern as compared to Northern Europe.

Discussion

Associated with the increased public awareness and burden on modern healthcare systems, efforts are underway locally, nationally and internationally to support the prevention and control of HCAIs and antimicrobial resistance. Increased numbers of scientific publications describing relevant clinical studies reflect this evolution [12, 13].

In this study of approximately 600 participants across five continents, microbial epidemiology and the control of multidrug-resistant bacteria, especially Gram-negative bacteria, had the highest priority for intervention, followed by better surveillance systems (early detection of outbreaks). Interestingly, scientific and practical issues regarding decolonisation/disinfection and antiseptic compounds are considered of high relevance today, which is in some contrast to their role a decade ago. These findings are helpful in highlighting what the consensus is amongst infection prevention and control practitioners on the key areas that need to be addressed in terms of informing key

healthcare and political decision makers at local, national and international level. Also, differences between different regions within Europe and between Europe and other continents should specifically inform national and regional priority setting. This information may be helpful to further develop special programmes for HCAI control, keeping in mind that 'one fits all' solutions will not be a realistic approach [6].

Whilst the results from this survey are of interest, there are limitations to the study. As this was a voluntary survey and the participants were self-selected, we cannot validate how representative those who participated were, and whether or not they truly reflect the views and opinions of infection prevention experts and practitioners in their respective countries or disciplines. The relatively low response rate may add to this limitation. Also, we did not verify the qualifications or experience of the participants, and it may be that the results reflect the most enthusiastic individuals rather than key opinion leaders who did not allocate time to fill out the survey during the designated period. Whilst we did allow participants to enter free comments to highlight other important areas, the ESGNI Coordinating Study Group predetermined the topics and the subtopics. However, we felt that this was necessary to enable us to analyse the data in a practical and meaningful way. Whilst hand hygiene was not specifically addressed as a topic in its own right, its importance was underlined in comments. Infection control nurses were not specifically addressed, because they are not regular members of ESCMID.

In summary, the highest score was reached by the topic "microbial epidemiology/resistance", followed by "surveillance" and "decolonisation/disinfection/antiseptic compounds". Also, relevant insights were gained through individual comments. Altogether, well-organised and effective initiatives and measures in infection prevention and antimicrobial resistance control are required, and the commitment of resources may be guided to some extent by our findings. Finally, this survey represents a useful resource when discussions take place on determining priorities and the allocation of resources nationally and at European level, and the survey should probably be repeated at least every decade to assist in any review of those priorities.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Allegranzi B, Bagheri Nejad S, Combescure C, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. Lancet. 2011;377:228–41.

2. World Health Organisation (WHO). Report on the burden of endemic health care-associated infection worldwide. Geneva: WHO; 2011.

3. Martin M, Zingg W, Hansen S, et al. PROHIBIT study group. Public reporting of healthcare-associated infection data in Europe. What are the views of infection prevention opinion leaders? J Hosp Infect. 2013;83:94–8.

4. Surveillance Report. Point prevalence survey of healthcare-associated infections and antimicrobial use in European hospitals 2011-2012. Stockholm: European Centre for Disease Prevention and Control; 2013.

5. Theuretzbacher U. Accelerating resistance, inadequate antibacterial drug pipelines and international responses. Int J Antimicrob Agent. 2012;39:295–9.

6. Dettenkofer M, Ammon A, Astagneau P, et al. Infection control–a European research perspective for the next decade. J Hosp Infect. 2011;77:7–10.

7. Struelens MJ, Monnet DL, Magiorakos AP, O'Connor S, Giesecken J. New Delhi metallo-beta-lactamase 1-producing Enterobacteriaceae: emergence and response in Europe. EuroSurveillance. 2010;15:19716.

8. Khan AS, Dancer SJ, Humphreys H. Priorities in the prevention and control of multidrug-resistant Enterobacteriaceae in hospitals. J Hosp Infect. 2012;82:85–93.

9. http://www.mosar-sic.org/mosar/en-gb/index. Accessed 24 Apr 2014.

10. Magiorakos AP, Leens E, Drouvot V, et al. Pathways to clean hands: highlights of successful hand hygiene implementation strategies in Europe. EuroSurveillance. 2010;15:19560.

11. Ebersman D et al. https://www.surveymonkey.com/ (2014). Accessed 24 Apr 2014.

12. Huang SS, Septimus E, Kleinman K, et al. Targeted versus universal decolonization to prevent ICU infection. New Engl J Med. 2013;368:2255–65.

13. Derde LP, Cooper BS, Goossens H, et al. Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomised trial. Lancet Infect Dis. 2014;14:31–9.