

RESEARCH ARTICLES

Training infection control and hospital hygiene professionals in Europe, 2010: agreed core competencies among 33 European countries

S Brusaferrero¹, B Cookson², S Kalenic³, T Cooper⁴, J Fabry⁵, R Gallagher⁶, P Hartemann⁷, K Mannerquist⁸, W Popp⁹, G Privitera¹⁰, C Ruef¹¹, P Viale¹², F Coiz¹³, E Fabbro (elisa.fabbro@uniud.it)¹, C Suetens¹³, C Varela Santos¹⁴, National representatives of the Training in Infection Control in Europe (TRICE) project¹⁵

1. Department of Medical and Biological Sciences, University of Udine, Udine, Italy
2. Division of Infection and Immunity, University College London, London, United Kingdom
3. Department of Medical Microbiology, University of Zagreb, Zagreb, Croatia
4. Infection Prevention Society, London, United Kingdom
5. University Claude Bernard, Lyon, France
6. Nurse Advisor Infection Prevention and Control, Royal College of Nursing, London, United Kingdom
7. Hospital Hygiene Service, Chu De Nancy and Desp Seres Faculty of Medicine, Vandoeuvre-Nancy, France
8. Swedish Institute for Infectious Disease Control, Stockholm, Sweden
9. Hospital Hygiene, University Clinics Essen, Essen, Germany
10. Department of Translational Research and New Technology in Medicine and Surgery, University of Pisa, Pisa, Italy
11. ESCMID representative-Division of Infectious Diseases and Hospital Epidemiology, Hirslanden Hospital and Medical Center, Zurich, Switzerland
12. Infectious Disease Unit, Teaching Hospital S. Orsola-Malpighi, Alma Mater Studiorum University of Bologna
13. Surveillance and Response Support Unit, European Centre for Disease Prevention and Control, Stockholm, Sweden
14. Public Health Training section, European Centre for Disease Prevention and Control, Stockholm, Sweden
15. The members of the project are listed at the end of the article

Citation style for this article:

Brusaferrero S, Cookson B, Kalenic S, Cooper T, Fabry J, Gallagher R, Hartemann P, Mannerquist K, Popp W, Privitera G, Ruef C, Viale P, Coiz F, Fabbro E, Suetens C, Varela Santos C, National representatives of the Training in Infection Control in Europe (TRICE) project. Training infection control and hospital hygiene professionals in Europe, 2010: agreed core competencies among 33 European countries. *Euro Surveill.* 2014;19(49):pii=20985. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20985>

Article submitted on 19 November 2013 / published on 11 December 2014

The harmonisation of training programmes for infection control and hospital hygiene (IC/HH) professionals in Europe is a requirement of the Council recommendation on patient safety. The European Centre for Disease Prevention and Control commissioned the 'Training Infection Control in Europe' project to develop a consensus on core competencies for IC/HH professionals in the European Union (EU). Core competencies were drafted on the basis of the Improving Patient Safety in Europe (IPSE) project's core curriculum (CC), evaluated by questionnaire and approved by National Representatives (NRs) for IC/HH training. NRs also re-assessed the status of IC/HH training in European countries in 2010 in comparison with the situation before the IPSE CC in 2006. The IPSE CC had been used to develop or update 28 of 51 IC/HH courses. Only 10 of 33 countries offered training and qualification for IC/HH doctors and nurses. The proposed core competencies are structured in four areas and 16 professional tasks at junior and senior level. They form a reference for standardisation of IC/HH professional competencies and support recognition of training initiatives.

Introduction

There has been an increase in prevention and control activities in the field of infection control and hospital hygiene (IC/HH) in recent years owing to an increased awareness of patient safety and the considerable

burden of healthcare-associated infections (HAIs) [1]. While this strengthens the role of IC/HH professionals [2], the process has not always been accompanied by a commensurate increase in the resources for IC/HH prevention and control [3]. Many reports have documented a shortage of qualified IC/HH doctors and IC/HH nurses [4-7], and there are large differences among European countries in the qualifications required to work as an IC/HH professional [8]. The need to guarantee healthcare quality standards throughout Europe, including for IC/HH, has been further stressed by the approval of the European Union (EU) directive on cross-border patient mobility [9]. In addition, topics such as patient safety, quality improvement, continuing professional development and risk management have become increasingly important and should be part of the content of contemporary IC/HH training programmes [2,10-12].

In 2006, a European survey organised by the Improving Patient Safety in Europe (IPSE) project [8] indicated a lack of national IC/HH training programmes and of professional profiles for IC/HH practitioners in many European countries. Experts from the IPSE project and representatives of the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) subsequently developed a European core curriculum for training of IC/HH professionals across Europe [8].

In July 2008, at the end of the IPSE project, its activities were transferred to the European Centre for Disease Prevention and Control (ECDC) in Stockholm. In 2009, considering the importance of continued support to national IC/HH training programmes and the opportunity to build further on the outputs of IPSE, ECDC issued an open call for tender (i) to evaluate the use of the European core curriculum developed by IPSE in European countries and reassess the needs for IC/HH training in these countries, (ii) to set up a network for IC/HH training, and (iii) to propose a strategy for further support to IC/HH training in EU/EEA Member States (publication reference OJ/2009/06/16-PROC/2009/027).

The contract was awarded to the Training in Infection Control in Europe (TRICE) project under the coordination of the University of Udine, Italy. The TRICE project explored the state of the art of training IC/HH professionals in Europe, evaluated the European core curriculum together with experts from participating countries, and proposed an agreed list of core competencies to guide the standardisation of training of European IC/HH professionals [13].

The aim of this paper is to report the evolution of the status of European IC/HH activities and practitioners between 2006 and 2010 and the finalisation of the agreed European IC/HH core competencies.

Methods

The TRICE project was carried out between January and September 2010 and had two stages: a questionnaire-based survey, followed by a face-to-face consultation. Member States of the EU, the European Economic Area (EEA) and EU candidate countries were invited by ECDC to participate and were asked to designate a national representative (NR) specifically for the project.

The NR who responded to the questionnaire were nominated by the governments of each country. They were either doctors or nurses and chosen according to a profile defined by ECDC, as part of the project. In this profile it was clearly explained that the NRs had to contribute to the survey reporting the national state of the art on the topic and that they were to interact with all relevant infection control leads and other appropriate professionals in their country.

The 30 countries (33 respondents) included all EU Member States (Austria, Belgium, Bulgaria, Croatia (at the time a candidate country), Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom (UK) (England, Northern Ireland, Scotland and Wales provided separate answers), one EEA country (Norway) and one EU candidate countries (Turkey). The IPSE 2006 survey lacked the participation of Cyprus, Greece, and Romania.

NRs had to be national experts on IC/HH, as they were required to document their national situations, collect data, complete questionnaires, and comment upon and approve TRICE documents. However, only nine of the 33 respondents were the same person as the one who had completed the IPSE 2006 questionnaire. For this reason, NRs were asked to validate data with other professionals in their country before returning the completed TRICE questionnaire. To facilitate this process, answers to the 2006 IPSE questionnaire were sent to the NRs together with the TRICE questionnaire. NRs were asked to contact, in case of need, IC/HH training coordinators in their country to ensure that replies were representative for the country.

Development of the core competencies for IC/HH professionals in the EU comprised the following activities:

- Re-assessment by questionnaire of the existence of national programmes and courses for IC/HH training and of the current status and profile of IC/HH professionals. Countries were asked, where possible, to compare their situation in 2010 with that in 2006 (as evaluated by the IPSE project);
- Submission to the NRs of the European core curriculum for training of IC/HH practitioners developed by IPSE, together with a proposal for stratifying the core competencies in the curriculum into different levels of expertise (essential, intermediate and advanced level);
- Discussion through working groups and final general consensus of results and views at a meeting of NRs on 21 to 22 June 2010 in Udine (Italy); validation and approval by all the NRs and meeting participants of a draft of these results and views;
- Development of a final document on these core competencies, approved by the NRs.

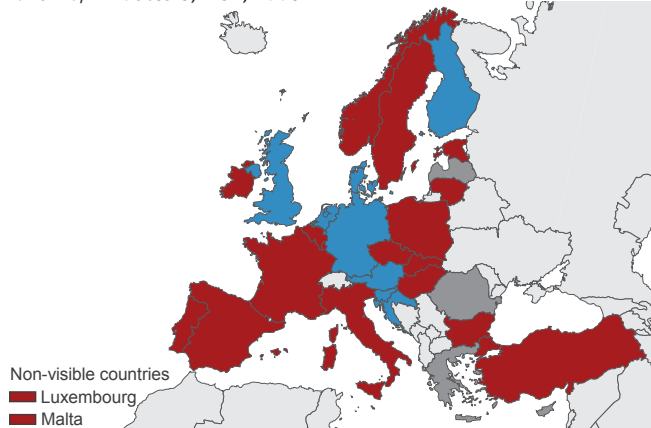
As European countries have several different definitions, interpretations and reference frameworks relevant to competencies, the term 'competency', agreed by NRs, was defined as: 'the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development' [14].

The questionnaire was based on the previous IPSE project. It included instructions on how to fill in the responses, definitions of terms and relevant references to the IPSE project. Possible misinterpretations of the questions were addressed during data validation at a meeting of the NRs in June 2010. A pilot study was performed before launching the questionnaire. All data were individually validated by NRs twice before finalising the analysis, first to confirm that the questionnaire had been filled in and the answers had been discussed at the workshop meeting and again for the draft of the final report including tables and figures.

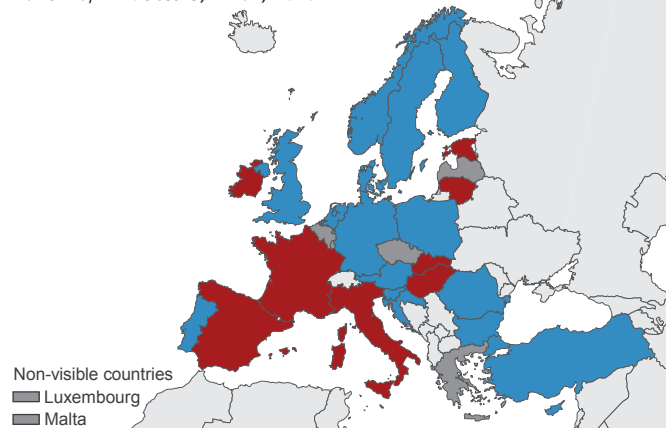
FIGURE 1

Presence of a national curriculum or programme for training of infection control and hospital hygiene doctors and nurses in European countries, 2006 (IPSE; 31 countries) and 2010 (TRICE; 33 countries)

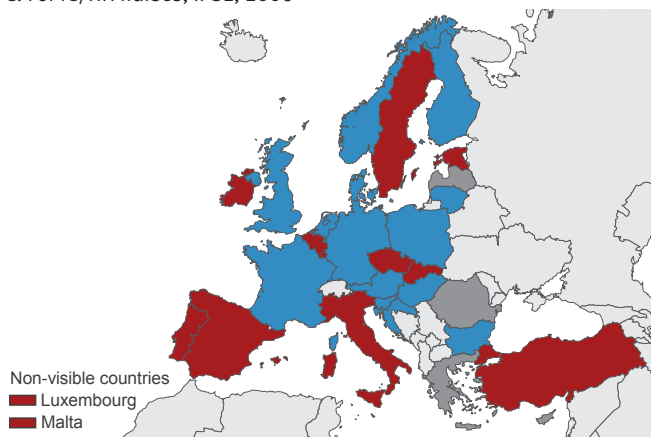
A. For IC/HH doctors, IPSE, 2006



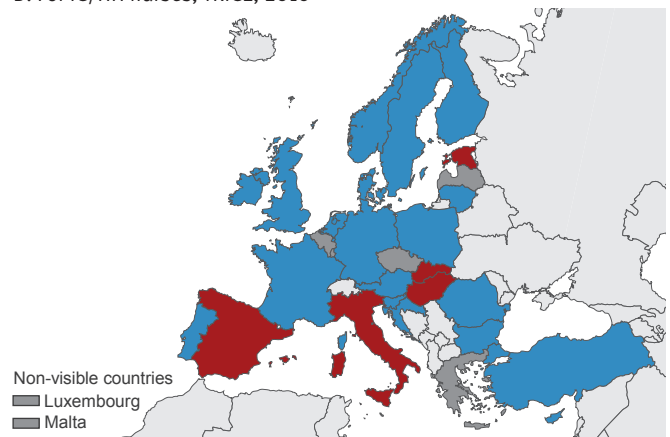
B. For IC/HH doctors, TRICE, 2010



C. For IC/HH nurses, IPSE, 2006



D. For IC/HH nurses, TRICE, 2010



■ Yes (at national or professional level) ■ Not answered
■ No ■ Not included in the survey

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

Data from the IPSE 2006 and the TRICE 2010 surveys were entered in a database and analysed with SPSS version 11 (IBM SPSS Statistics New York, United States). Data were compared with the chi-squared test accepting a value of $p \leq 0.05$ as statistical significant. To compare the ranking of the tasks performed by IC/HH professionals between the two surveys by degree of responsibility (responsible or contributor), we calculated the Spearman's rank correlation coefficient.

Results

From 2006 to 2010, the number of countries with a national curriculum or programme for IC/HH training of doctors and nurses increased from 10 of 31 responding countries to 19 of 33 responding countries for doctors (Figure 1A and B), and from 17 of 31 to 21 of 33 countries for nurses (Figure 1C and D).

For IC/HH nurses, continuous training by professional bodies was required in 11 of 33 countries, a university degree in eight countries and IC/HH specialty was required in 10 countries for nurses to play a leading role in IC/HH. From 2006 to 2010, there was a slight increase in the number of universities taking a leading role in IC/HH training both for doctors and nurses (Table 1).

More than two thirds (22/30) of European countries reported that at least one training course was available for IC/HH professionals, with 51 courses reported in total. Twenty-three of the 51 courses were run every year, six were run every second year, and for the remaining courses the frequency was not reported.

Courses provided a post-graduate diploma (where the country recognises this title for professionals) for 25 of

TABLE 1

Type of degree or learning leading to infection control/hospital hygiene qualification for doctors and for nurses in European countries, 2006 (IPSE; 31 countries) and 2010 (TRICE; 33 countries)

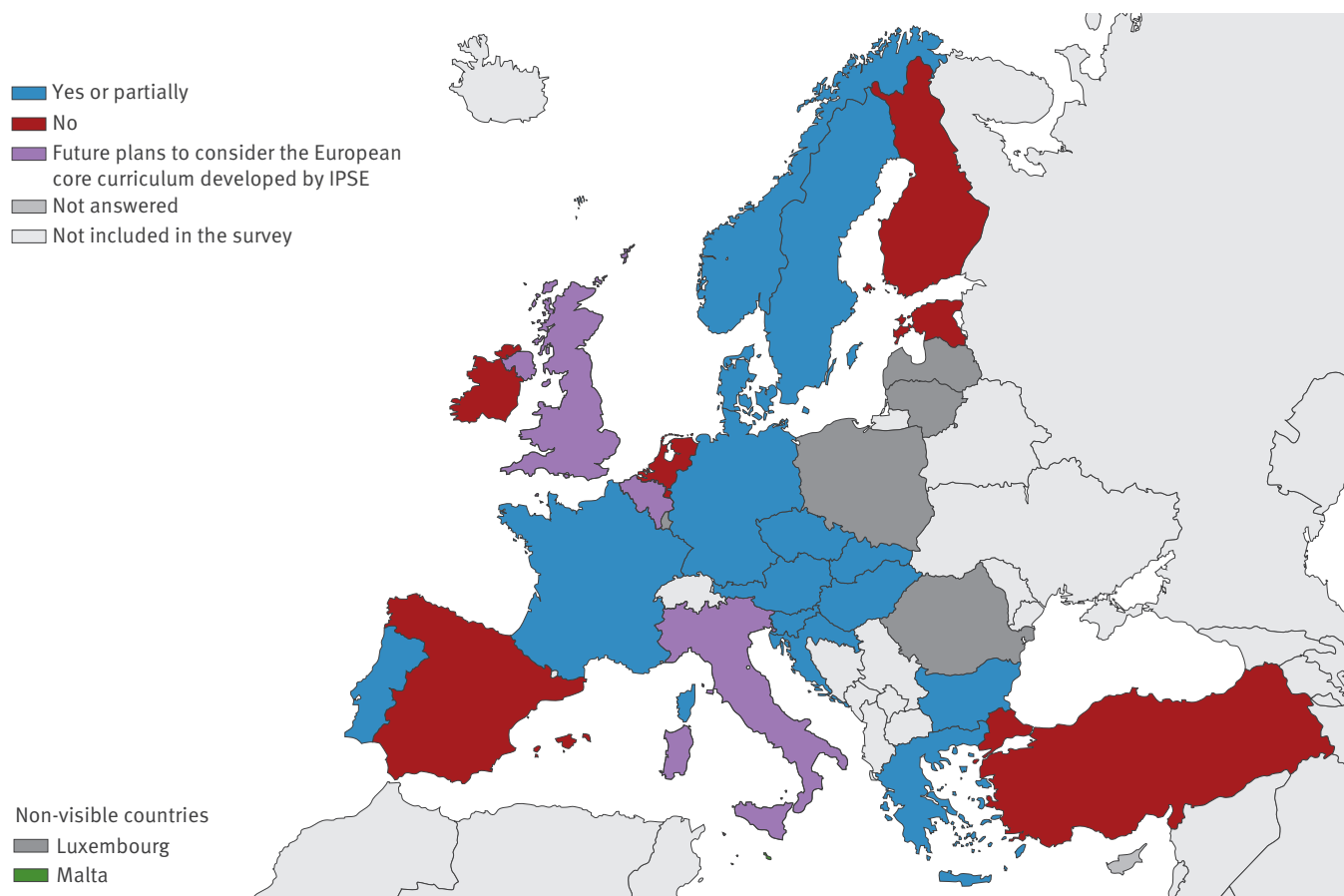
Type of degree or learning leading to IC/HH qualification ^a	Number (percentage) of countries with characteristics for			
	Doctors		Nurses	
	2006 (n=31)	2010 (n=33)	2006 (n=31)	2010 (n=33)
IC/HH specialty	4 (13%)	4 (12%)	10 (32%)	10 (30%)
IC/HH sub-specialty	2 (6%)	5 (15%)	1 (3%)	0 (0%)
Continuous training (government)	3 (10%)	5 (15%)	3 (10%)	4 (12%)
Continuous training (professional bodies)	12 (39%)	10 (30%)	11 (35%)	11 (33%)
Board certification	3 (10%)	3 (9%)	3 (10%)	3 (9%)
University degree	6 (19%)	9 (27%)	5 (16%)	8 (24%)
Other	NA	1 (3%)	NA	1 (3%)
Question not answered	12 (39%)	10 (30%)	8 (26%)	8 (24%)

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; NA: not available; TRICE: Training needs assessment in Infection Control in Europe.

^a More than one answer allowed.

FIGURE 2

Existing infection control and hospital hygiene training courses based on the European core curriculum developed by IPSE in 2006, as assessed by TRICE survey in 2010



IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

TABLE 2

Characteristics of the professional status (job description, professional profile and official recognition) of infection control/hospital hygiene doctors and nurses in European countries, 2006 (IPSE; 31 countries) and 2010 (TRICE; 33 countries)

Characteristics of professional status	Number (percentage) of countries with characteristics for			
	IC/HH doctors		IC/HH nurses	
	2006 (n=31)	2010 (n=33)	2006 (n=31)	2010 (n=33)
Presence of job description	11 (36%)	17 (52%)	19 (61%)	23 (70%)
Presence of a professional profile definition	18 (58%)	28 (85%)	22 (71%)	27 (82%)
Presence of official recognition by the degree of IC/HH for doctors and nurses (any) ^a	13 (42%)	16 (49%)	20 (65%)	19 (58%)
Official recognition by health care authorities	10 (32%)	11 (33%)	18 (58%)	14 (42%)
Official recognition by universities	2 (7%)	4 (12%)	3 (10%)	5 (15%)
Official recognition by professional bodies	4 (13%)	8 (24%)	7 (23%)	8 (24%)

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

Considered in the Table are only 30 countries that answered both surveys (2006 and 2010) in 2010.

^a More than one answer allowed.

the 51 courses, and a post-graduation certification (in those countries where there is no formal recognition of the IC/HH profession) for 13 courses. Thirteen courses did not report a formal recognition. Nineteen of the 51 courses were recognised by the Ministry of Health and/or a State Agency, 23 by universities, and four by professional chambers (this list includes eight courses that are recognised by two institutions). The duration of the training was 100 hours or less in eight courses; 101 to 200 hours in six courses, 201 to 300 hours in 15 courses, 300 hours or more in eight courses, and one or more years in 13 courses, one course did not report the duration. Remarkably, 28 training courses reported in 2010 that they had considered the European core curriculum developed by the IPSE project and three of these courses provided distance learning programmes (Figure 2).

The questionnaire also explored the professional status of IC/HH doctors and IC/HH nurses (Table 2) with respect to the presence of a job description, professional profile definition and official recognition of an IC/HH degree. For IC/HH doctors, there was a slight increase in the percentage of countries reporting a job description (from 11 of 31 in 2006 to 17 of 33 countries in 2010 ($p=0.20$) and a significant increase in the percentage of countries that provided a professional profile definition from 18 of 31 countries in 2006 to 28 of 33 countries in 2010 ($p<0.05$). However, the official recognition of the IC/HH degree did not increase between 2006 and 2010 and remained low at 16 of 33 countries for doctors and 19 of 33 for nurses (Table 2).

IC/HH teams were defined within a national programme or regulation in 27 of 33 countries in 2010, compared with 21 of 31 countries in 2006. IC/HH doctors and IC/HH nurses were confirmed as the most represented professionals in the IC/HH team (Table 3).

The initial specialisation (educational background) of IC/HH doctors was mostly microbiology, reported by 28 of 33 countries in 2010, followed by infectious diseases in 17, epidemiology in 11, public health in nine and hygiene in seven of the 33 countries.

The most frequently reported initial specialisation for registered nurses before IC/HH specialisation for nurses was graduated/certified nurse in 28 of 33 countries, followed by intensive care nurse in six, operating theatre nurse in six, anaesthesiology nurse in three and other specialised nursing background in five countries. The level of seniority required to become an IC/HH nurse was a minimum of three year of experience after qualification in 22 of the 33 countries, followed by being a senior head nurse in 10 countries.

TABLE 3

Healthcare professionals included in the infection control and hospital hygiene team in European countries, 2006 (IPSE, 21 countries) and 2010 (TRICE, 27 countries)

Healthcare professionals ^a	Number (percentage) of countries with characteristics for	
	2006 (n=21)	2010 (n=27)
IC/HH doctors	21 (100%)	27 (100%)
IC/HH nurses	20 (95%)	26 (96%)
Laboratory technicians	4 (19%)	6 (22%)
Environmental technicians	1 (5%)	3 (9%)
Data managers	2 (10%)	1 (3%)
Administrative support	10 (48%)	9 (33%)
Other	0 (0%)	6 (22%)

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

^a More than one answer allowed.

The TRICE project also reassessed the tasks for which IC/HH doctors are responsible or to which they contribute in their day-to-day practice. The most frequently reported tasks or areas of responsibility for IC/HH doctors in 2010 were: outbreak identification and investigation, analysis and feedback of IC/HH data and the development of an IC/HH programme and work plan (Table 4).

The most frequently reported tasks or areas of responsibility for IC/HH nurses in 2010 were: training of hospital employees in IC/HH and the elaboration and implementation of IC/HH procedures (Table 5). Although some significant differences in the individual tasks existed between 2006 and 2010, there was a strong correlation of the ranking of tasks by degree of responsibility (responsible or contributor) between the two surveys (Spearman's correlation coefficient 0.78, $p < 0.001$).

Besides the traditionally recognised tasks for IC/HH doctors and nurses, it appeared that the discipline of

IC/HH was expanding, with the inclusion of new components such as quality and risk management.

Evaluation and finalisation of the core competencies

The results of the evaluation of the IPSE core competencies were discussed at a meeting of the NRs in June 2010. During this meeting, some changes to the IPSE core competencies were agreed and it was decided to recommend only two categories because the intermediate-level category (see Methods) was used by the NRs less frequently than the two other categories when evaluating individual competencies and was considered too complex. Hence, two main levels of practice for IC/HH training and professional development were agreed as follows:

Introductory level (junior specialist): newly appointed IC/HH staff member with little or no previous experience;

Expert level (senior specialist): IC/HH professionals who are confident and experienced, who use reasoning,

TABLE 4

Tasks for which infection control/hospital hygiene doctors played a role as responsible persons and or as contributors, European countries, 2006 (IPSE, 31 countries) and 2010 (TRICE, 33 countries)

Grade of responsibility	Task	Number (percentage) of countries reporting task	
		2006 (n=31)	2010 (n=33)
Responsible	Identification and investigation of outbreaks	21 (68%)	30 (91%)
	Analysis and feedback of IC/HH data	21 (68%)	25 (76%)
	Elaboration of an IC/HH programme, workplan and projects	19 (61%)	24 (73%)
	Management (implementation, follow-up, evaluation) of an IC/HH programme, workplan and projects	20 (65%)	23 (70%)
	Design of a surveillance system	15 (48%)	22 (67%)
	Elaboration of IC/HH procedures	16 (52%)	22 (67%)
	Management (implementation, follow-up, evaluation) of HAI surveillance	15 (48%)	21 (64%)
	Providing expertise in IC/HH policy	16 (52%)	21 (64%)
	Training of hospital employees in IC/HH	15 (48%)	20 (61%)
	Audits and performance evaluation of organisations and parts of them	15 (48%)	19 (58%)
	Research	13 (42%)	17 (52%)
	Implementation of IC/HH procedures	12 (39%)	17 (52%)
	Antibiotics policy	14 (45%)	17 (52%)
Contributor	Quality management	21 (68%)	25 (76%)
	Elaboration of healthcare procedures	18 (58%)	23 (70%)
	Risk management	21 (65%)	23 (70%)
	Clinical management of infected or at-risk patients	12 (39%)	22 (67%)
	Contributing to building renovation plans	NA	21 (64%)
	Contribution to construction and design of healthcare buildings	NA	20 (61%)
	Prescription of antibiotics	12 (39%)	19 (58%)
	Employee health	15 (48%)	19 (58%)
	Implementation of healthcare procedures	17 (55%)	19 (58%)
Selection of supplies or products used in the hospital	NA	19 (58%)	

HAI: healthcare-associated infections; IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; NA: not available; TRICE: Training needs assessment in Infection Control in Europe.

Only the tasks reported by at least 50% of countries in 2010 are mentioned.

TABLE 5

Tasks for which infection control/hospital hygiene nurses played a role as responsible persons or as contributors, European countries, 2006 (IPSE, 31 countries) and 2010 (TRICE, 33 countries)

Grade of responsibility	Task	Number (percentage) of countries reporting task	
		2006 (n=31)	2010 (n=33)
Responsible	Training of hospital employees in IC/HH	18 (58%)	24 (73%)
	Elaboration of IC/HH procedures	18 (58%)	23 (70%)
	Implementation of IC/HH procedures	18 (58%)	21 (64%)
	Procedures for disinfection of medical devices	13 (42%)	21 (64%)
	Management (implementation, follow-up, evaluation) of an IC/HH programme, workplan and projects	14 (45%)	19 (58%)
	Audits and performance evaluation of organisations and parts of them	14 (45%)	18 (55%)
	Identification and investigation of outbreaks	13 (42%)	18 (52%)
Contributor	Risk management	22 (71%)	17 (52%)
	Quality management	22 (71%)	23 (70%)
	Design of a surveillance system	18 (58%)	23 (70%)
	Employee health	14 (45%)	21 (64%)
	Elaboration of healthcare procedures	20 (65%)	21 (64%)
	Research	17 (55%)	20 (61%)
	Implementation of healthcare procedures	17 (55%)	19 (58%)
	Clinical management of infected or at risk patients	14 (45%)	18 (55%)
	Providing expertise in IC/HH policy	14 (45%)	17 (52%)
	Work organisation in clinical units	10 (32%)	17 (52%)

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

Only the tasks reported by at least 50% of countries in 2010 are mentioned.

critical thinking, reflection and analysis to inform their assessment and decision making and are able to develop and implement new solutions to problems.

The final agreed 'core competencies for infection control and hospital hygiene professionals in the European Union' are available from the ECDC website [13] and are organised in four areas (programme management, quality improvement, surveillance and investigation of HAI, and IC/HH activities) and 16 domains, each with core competencies for a junior and a senior specialist. Table 6 summarises the structure of the document.

In this context it is necessary to stress that the specification was for IC/HH specialists in acute care hospitals and that the core competencies were similar for IC/HH nurses and IC/HH doctors, including those competencies relating to antimicrobial stewardship because of the increasing numbers of prescribing nurses in European countries and their greater strategic involvement.

Discussion

The TRICE project has provided data for a comprehensive overview of the characteristics, training for professionals, tasks and related core competencies for European IC/HH professionals in 2010. It will also

inform future trend analyses, as almost all countries have reported their current situation. The decision to use the questionnaire on core competencies that was used by the IPSE project in 2006, enabled us to evaluate the progress of European countries between 2006 and 2010. In particular, our results showed that IPSE initiatives and the European core curriculum developed by the project IPSE already had an impact on the creation of new national curricula for IC/HH training, on the definition of professional profiles, in particular for IC/HH doctors, and on the development or adaptation of the content of new or existing courses in European countries. Nevertheless, well-defined qualifications, standardised training pathways and agreed competencies for IC/HH professionals were still lacking in 2010. A critical point is that, in 2010, almost half of the countries still did not have an official recognition of qualifications for an IC/HH doctor or an IC/HH nurse.

The professional backgrounds of IC/HH doctors and IC/HH nurses in European countries were homogeneous, which should make the process of harmonisation of training programmes achievable. IC/HH doctors were most commonly trained in microbiology, followed by infectious diseases, hygiene and public health. In 28 of 33 countries, IC/HH nurses had a minimum of three years of experience as a graduated/certified nurse.

More than 80% of the respondents reported that a definition of the Infection Control Team existed in national programmes or regulations. The professionals most frequently included were doctors and nurses that were the focus of the survey. In future projects it would be useful to explore more in detail also the role of other professionals engaged in the infection control team.

The type of degree or learning to become an IC/HH specialist remained heterogeneous among European countries. This reinforces the need for common standards for the training of IC/HH professionals. In this context, our proposal for European core competencies for IC/HH professionals in the European Union [13] is expected to promote the standardisation of the competencies of IC/HH professionals in Europe and the design and implementation of training courses according to different national contexts and to facilitate the mutual recognition of competencies across Europe. It further serves as an opportunity for IC/HH professionals to review their own performance and plan their professional development and for healthcare institutions and organisations to evaluate their needs in terms of professional human resources and to evaluate the performance of the existing IC/HH professionals.

European core competencies are useful for countries without a national curriculum or programme to promote new training initiatives for IC/HH professionals

according to European standards. For other countries, European core competencies represent an opportunity to identify gaps in their curricula and to organise IC/HH according to the different levels of expertise. These European core competencies will thus act as a point of reference for the development of IC/HH training initiatives and harmonisation of these courses and qualifications.

Professional competency grows in a continuum, where the speed and the completeness depend on several parameters. Under certain circumstances, these competencies will have to be developed very quickly. This will depend on many variables such as the expectation that IC/HH doctors or nurses will chair an IC/HH committee at an agreed time after appointment, on how long there have been IC/HH doctors or nurses in a country, on whether adequate resources are available (e.g. administrative support), on the presence and need to interact with audit/patient safety departments, and on IC/HH team members' aptitudes, preferences and previous experiences. For example, some new IC/HH professionals may have acquired considerable management experience and transferable skills from previous positions in other specialties before embarking upon their IC/HH career.

The proposed core competencies for IC/HH professionals in the European Union were developed in 2010. Since this date, the North American Certification Board

TABLE 6

Core competencies for infection control and hospital hygiene professionals in the European Union, by area and domain, 2010

Area	Domain	Number of competencies
Programme management	Elaborating and advocating an infection control programme	7
	Management of an infection control programme, workplan and projects	20
Quality improvement	Contributing to quality management	4
	Contributing to risk management	2
	Performing audits of professional practices and evaluating performance	9
	Infection control training of employees	5
	Contributing to research	2
Surveillance and Investigation of healthcare-associated infections	Designing a surveillance system	8
	Managing (implementation, follow-up, evaluation) a surveillance system	9
	Identifying, investigating and managing outbreaks	7
Infection control activities	Elaborating infection control interventions	14
	Implementing infection control procedures in healthcare	5
	Contributing to reducing antimicrobial resistance	8
	Advising appropriate laboratory testing and use of laboratory data	3
	Decontamination and sterilisation of medical devices	4
	Controlling environmental sources of infections	2

IC/HH: infection control and hospital hygiene; IPSE: Improving Patient Safety in Europe; TRICE: Training needs assessment in Infection Control in Europe.

Only the tasks reported by at least 50% of countries in 2010 are mentioned.

of Infection Control and Epidemiology (CBIC) has published a proposal for a conceptual model including four specific domains that represent the areas for future development of competencies: leadership, infection prevention and control, technology and performance improvement and implementation science [15]. This model does not conflict with the European approach, although it proposes an intermediate level (proficiency) between the expert and the novice. Such an intermediate level was considered by the NRs but was rejected as they expected that it may add confusion to the already heterogeneous situation in Europe. The TRICE two-level approach was considered more effective to promote standardisation of IC/HH training, and it takes into account the important diversity of duration and content of the existing IC/HH training courses in Europe. Furthermore, all participants to the TRICE agreed that a minimum of competencies for junior/introductory level was useful for both organisations and professionals and acting as a platform for personal and professional development.

The NRs also recommended that the proposed core competencies for IC/HH professionals in the European Union [13] should be seen as stages of a journey with a distinction between the two main categories (junior specialist/introductory level and senior specialist/expert level). They should be useful for the production of tools aimed at helping the development of IC/HH training courses. The introductory level should be considered appropriate for those involved in all technical/common tasks and responsibilities, whereas the expert level should apply to professionals with experience of political challenges or with new, complex, unusual or unexpected situations. The proposed core competencies should address the design of training courses developed preferably according to the Bologna process for standardisation of credits and recognition and to the standards proposed by the European Association for Quality Assurance in Higher Education [16], and they should be owned by those involved as trainers in these courses.

Conclusion

Based on the findings of the TRICE project, we consider that Europe is moving toward acknowledgement and a higher priority for HAI prevention and control. There is nevertheless room for improvement, especially in the recognition of the IC/HH degree for IC/HH professionals and in the standardisation and mutual recognition in Europe of the IC/HH training initiatives.

The future impact of the core competencies for IC/HH professionals in the European Union [13] will depend on (i) the existence of validated IC/HH training courses designed and delivered to enable the acquisition of these competencies, (ii) the widespread recognition that IC/HH doctors and IC/HH nurses need these competencies to ensure that a hospital IC/HH programme meets its goals and agreed deliverables, (iii) the existence of a sustained strategy ensuring that the core

competencies are updated and reviewed at European level and owned and adopted by those running the training courses and (iv) the sustained coordination of, and support for a network for IC/HH training in Europe that will ensure the long-term commitment of institutions to the programmes.

Finally, while training of IC/HH professionals should become a priority for European countries, more emphasis should also be given to basic training in IC/HH in nursing schools and in medical universities. Ensuring that all healthcare personnel has received such basic training before starting their professional activity would certainly contribute to further improvement in the quality of healthcare throughout Europe.

Acknowledgements

The authors wish to thank the members of the pedagogic committee of Work Package 1 of the IPSE project (European Commission, DG SANCO, Project no. 790903, Grant Agreement no. 20044216) who developed the first version of the “Core competencies for infection control and hospital hygiene professionals in the European Union”. Project coordination: Jacques Fabry, Josette Najjar-Pellet (Claude Bernard University Lyon 1, France); ESCMID representatives: Benedetta Allegranzi (WHO, Geneva), Jette Holt (Statens Serum Institute, Copenhagen, Denmark), Christian Ruef (Division of Infectious Diseases and Hospital Epidemiology, Hirslanden Hospital and Medical Center, Zurich, Switzerland), Nina Kristine Sorknes (Norwegian Institute of Public Health, Oslo, Norway) and Andreas Voss (Radboud University, Nijmegen, The Netherlands); Barry Cookson (Division of Infection and Immunity, University College London, United Kingdom).

Funding: The ‘Training in Infection Control in Europe’ (TRICE) project was funded by ECDC through a specific service contract (ECD.1840) with the University of Udine, Italy.

Conflict of interest

None declared.

Authors’ contributions

Silvio Brusaferrero coordinated the project. Silvio Brusaferrero, Barry David Cookson, Francesco Coiz, Elisa Fabbro, Carl Suetens, Carmen Varela Santos, Smilja Kalenic, Rose Gallagher, Tracey Cooper, Jacques Fabry, Philippe Hartemann, Kerstin Mannerquist, Walter Popp, Gaetano Privitera, Christian Ruef, Pierluigi Viale designed the study, designed the questionnaire, contributed to the analyses of the results, drafted and commented on revisions to the manuscript and gave the final approval of this version. Silvio Brusaferrero and Francesco Coiz conducted the statistical analysis. The National representatives of the project completed the national questionnaire, revised the manuscript and gave the final approval of this version. National representatives of the Training in Infection Control in Europe (TRICE) project AUSTRIA Blacky A Department of Hospital Hygiene, Medical University of Vienna
BELGIUM Simon A University of Leuven
BULGARIA Vatcheva-Dobrevska R National Centre of Infectious and Parasitic Diseases, Sofia
CROATIA Budimir A University Hospital Center, Zagreb & School of Medicine, University of Zagreb,
CYPRUS Stavroulla S Ministry of Health, Cyprus

CZECH REPUBLIC Šturma J National Institute of Public Health, Prague
 DENMARK Holt J National Unit of Infection Control, Statens Serum Institute, Denmark
 ESTONIA Lemetsar A Health Board, Tallinn
 FINLAND Lyytikäinen O National Institute for Health and Service, Helsinki
 FRANCE Astagneau P Coordinating centre for nosocomial infection control (CCLIN), Department of Public Health, University School of Medicine, Paris
 GERMANY Mielke M Robert Koch-Institut, Berlin
 GREECE Ftika L Hellenic Centre for Disease Control and Prevention (HCDCP), Athens
 HUNGARY Hajdú Á Hospital Epidemiology Department, National Center for Epidemiology, Budapest
 IRELAND Donlon S Health Protection Surveillance Centre, Dublin
 ITALY Moro M L Regional Health Agency, Bologna
 LATVIA Nikiforova R Infectology Centre of Latvia
 LITHUANIA Gailiene G Institute of Hygiene, Vilnius
 LUXEMBOURG Heisbourg E Health Directorate, Ministry of Health, Luxembourg
 MALTA Borg M Infection Control Unit, Mater Dei Hospital, Msida
 NETHERLANDS Ummels L Radboud University Medical Centre, Nijmegen
 NORWAY Sorknes N Norwegian Institute of Public Health, Oslo
 POLAND Stefanof P National Institute of Public Health (NIZP-PZH), Warsaw
 PORTUGAL Costa C Directorate-General of Health, Lisbon
 ROMANIA Pitigoi D National Institute of Infectious Diseases Prof Dr Matei Bals, Bucharest
 SLOVAKIA Kristufková Z Slovak Medical University, Faculty of Public Health, Bratislava
 SLOVENIA Kolman J National Institute of Public Health, Ljubljana
 SPAIN Pareja-Bezares A Epidemiology and Infection Control Unit. Hospital Son Llàtzer, Palma de Mallorca
 SWEDEN Mannerquist K Swedish Institute for Infectious Disease Control, Stockholm
 TURKEY CetinkayaSardan Y Refik Saydam National Public Health Agency, Ankara
 UNITED KINGDOM (UK)* Sheridan E Health Protection Agency (HPA), London
 UK-ENGLAND Sheridan E Health Protection Agency (HPA), London
 UK-NORTHERN IRELAND Mills A Northern Ireland Government, Belfast
 UK-SCOTLAND Faser C Scottish Government, Edinburgh
 UK-WALES Gauci T Wales Government, Cardiff

- policies in Italian hospitals. *J Hosp Infect.* 2003;53(4):268-73. <http://dx.doi.org/10.1053/jhin.2002.1376> PMID:12660123
7. Daschner FD, Cauda R, Grundmann H, Voss A, Widmer A. Hospital infection control in Europe: evaluation of present practice and future goals. *Clin Microbiol Infect.* 2004;10(3):263-6. <http://dx.doi.org/10.1111/j.1198-743X.2004.00819.x> PMID:15008951
 8. IPSE - Improving Patient Safety in Europe. The IPSE report 2005-2008. Lyon: Université Claude Bernard Lyon1; Nov 2009. Available from: http://www.ecdc.europa.eu/en/activities/surveillance/HAI/Documents/o811_IPSE_Technical_Implementation_Report.pdf
 9. Directive 2011/24/EU of the European Parliament and of the Council of 9 March on the application of patients' rights in cross-border healthcare. Official Journal of the European Union. Luxembourg: Publications Office of the European Union; 4.4.2011:L 88/46. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0045:0065:EN:PDF>
 10. Farrington M, Pascoe G. Risk management and infection control--time to get our priorities right in the United Kingdom. *J Hosp Infect.* 2001;47(1):19-24. <http://dx.doi.org/10.1053/jhin.2000.0829> PMID:11281116
 11. World Health Organization (WHO). WHO Patient Safety Curriculum Guide for Medical Schools. Geneva: WHO; 2009. Available from: http://www.who.int/patientsafety/activities/technical/who_ps_curriculum.pdf
 12. World Health Organization. WHO patient safety curriculum guide: multi-professional edition. World Health Organization, Geneva Switzerland 2011.
 13. European Centre for Disease Prevention and Control (ECDC). Core competencies for infection control and hospital hygiene professionals in the European Union. Stockholm: ECDC; 2013 Available from: <http://www.ecdc.europa.eu/en/publications/publications/infection-control-core-competencies.pdf>
 14. European Commission. The European Qualifications Framework for Lifelong Learning (EQF). Luxembourg: Office for Official Publications of the European Communities, 2008. ISBN 978-92-79-08474-4. <http://dx.doi.org/10.2766/14352>. Available from: http://www.ond.vlaanderen.be/hogeronderwijs/bologna/news/EQF_EN.pdf
 15. Murphy DM, Hanchett M, Olmsted RN, Farber MR, Lee TB, Haas JP, et al. Competency in infection prevention: a conceptual approach to guide current and future practice. *Am J Infect Control.* 2012;40(4):296-303. <http://dx.doi.org/10.1016/j.ajic.2012.03.002> PMID:22541852
 16. European Association for Quality Assurance in Higher Education (ENQA). Standards and Guidelines for Quality Assurance in the European Higher Education Area. Helsinki: ENQA; 2009. ISBN 952-5539-05-9. Available from: http://www.enqa.eu/wp-content/uploads/2013/06/ESG_3edition-2.pdf

References

1. Council of the European Union. Council recommendation of 9 June on patient safety, including the prevention and control of healthcare-associated infections (2009/C151/01). Official Journal of the European Union. 3 Jul 2009. Available from: http://ec.europa.eu/health/patient_safety/docs/council_2009_en.pdf
2. Cookson BD, Jenner EA, Roberts C, Drasar B, Ridgway G. Diploma in Hospital Infection Control: a progress report. *J Hosp Infect.* 2001;48(2):146-51. <http://dx.doi.org/10.1053/jhin.2001.0954> PMID:11428883
3. Goldrick BA. The practice of infection control and applied epidemiology: a historical perspective. *Am J Infect Control.* 2005;33(9):493-500. <http://dx.doi.org/10.1016/j.ajic.2005.04.250> PMID:16260324
4. Bijl D, Voss A. Infection control in the Netherlands. *J Hosp Infect.* 2001;47(3):169-72. <http://dx.doi.org/10.1053/jhin.2000.0885> PMID:11247675
5. Melo-Cristino J, Marques-Lito L, Pina E. The control of hospital infection in Portugal. *J Hosp Infect.* 2002;51(2):85-8. <http://dx.doi.org/10.1053/jhin.2002.1218> PMID:12090794
6. Brusaferrero S, Quattrin R, Barbone F, D'Alessandro D, Finzi GF, Cimoroni M, et al. Factors influencing hospital infection control