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CAMEI



**Coordination Actions in the scientific era
of Medical Education Informatics for
fostering IT skills for healthcare
workforce in the EU and USA**

**D4.3 Roadmap towards a Joint Strategy
fostering IT skills for healthcare workforce in
the EU and USA**

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INTRODUCTION

The aim of the 4th work package of the CAMEI project was to advance support services to motivated and competent communities and organisation from USA and EU in order to assist them in building long-term relationships. A best practice Cooperation Action Plan (CAP), which will be a roadmap that captures detailed medium to long-term research collaboration goals between organisations, was a central activity. CAMEI within this work package also facilitated policy dialogue between policy makers and other stakeholders from EU and USA actors. This achieved by organizing events/meeting, in combination with other relevant events and conferences so as to enable synergies. These activities led CAMEI to produce a “Collaboration framework” to be used beyond the end of the project, as a Road Map towards a Joint Strategy for fostering IT skills for healthcare workforce in the EU and USA.

This deliverable, being a public one, report the methodology and the research that led the CAMEI consortium with the Road Map towards a Joint Strategy for fostering IT skills for healthcare workforce in the EU and USA. Information existing on deliverable D4.2 “D4.2 Report on dialog between policy makers and other stakeholders from the EU and the USA and report on CAMEI Summer School and Conference” is being duplicated here, but presented in a more concrete and systematic way to reach the interesting actors (policy makers, stakeholders, organisations, etc.).

1. VISION

With the expressed, overarching vision of the Transatlantic eHealth/health IT Cooperation Roadmap [1] of supporting a “...collaborative community of public- and private-sector entities, including suppliers of eHealth solutions, working toward the shared objective of developing, deploying, and using eHealth science and technology to empower individuals, support care, improve clinical outcomes, enhance patient safety and improve the health of populations...” this document comes in to specify, as per the CAMEI project’s research outcomes an action roadmap towards a joint strategy in the specific area of IT skills cultivation for healthcare workforce in EU and US.

In this specific area the aim is to cultivate a coordination framework, in both advisory and regulatory capacity for prudent and efficient determination and allocation of resources in a joint eHealth action framework. This framework, through standardization of activities processes and workflows shall strive for targeted specific actions, towards specific stakeholder groups, identifying and dealing with specific challenges, taking into account cultural variations and the rapidly evolving IT and healthcare sectors.

2. RATIONALE FOR THE DEVISED ROADMAP.

In order to formulate a credible roadmap for a Joint Strategy, fostering IT skills for healthcare workforce in the EU and USA we took cues from D2.1. [2] From this document, having established a context of IT skills for healthcare workforce in the EU and USA the following process was implemented. An original systematic classification of key actions for IT skills fostering was carried out, based on surveys conducted on a representative pool of stakeholder experts the results of which are presented forthwith. Following that, a systematic classification of these actions according to the market segment classification that has been defined in D2.1. was performed. Then a determination of the overarching themes for each segment as they emerged from the stakeholder survey was established. Based on that conceptual classification and current stakeholder policies, an executive summary and the specific road map for a joint EU-US strategy towards IT skills fostering was established.

2.1. SYSTEMATIC CLASSIFICATION OF KEY ACTIONS FOR IT SKILL FOSTERING.

An original systematic classification of key actions for IT skills fostering was carried out, based on surveys conducted on a representative pool of stakeholder experts. For this survey the Child Health and Nutrition Research Initiative (CHNRI) methodology for priorities setting was used to assist prioritize actions [3]. The process uses a systematic and transparent approach to assemble and analyze a wide spectrum of collective actions from an array of healthcare experts. The CHNRI methodology has been used previously to identify research gaps and resource priorities in areas such as birth asphyxia and mental health and it is increasingly being used by policy makers, large donors, and international organizations ([3]–[5]). Additionally, it is also being implemented by WHO to set priorities for a set of distinct categories of work.

The main research question set in this study is:

What actions should be prioritized to develop the IT skills competence among healthcare workforce from the perspective of healthcare experts in order to facilitate efficient and effective exploitation of technology in healthcare?

Which is broken down to two sub questions which are:

- *What are the actions needed to develop IT skills competence for healthcare workforce?*
- *What are the healthcare experts' opinions regarding the identified actions in terms of prioritization?*

2.1.1. Participant and recruitment

Selection of study participants, for list actions and score actions, was based on purposive sampling strategy following a set of inclusion criteria, either their record of conducting high quality of research on the topic of eHealth or have a membership in an international health organization. Based on the research question, a diverse group of experts were invited, representing different expertise and geographical locations. For the first research question, a group of 29 experts participated the study to list actions while a group of 34 experts (17 of them from list process) scored the actions for the second research question. *Figure 1* described the overall flow of recruitment process in the study.

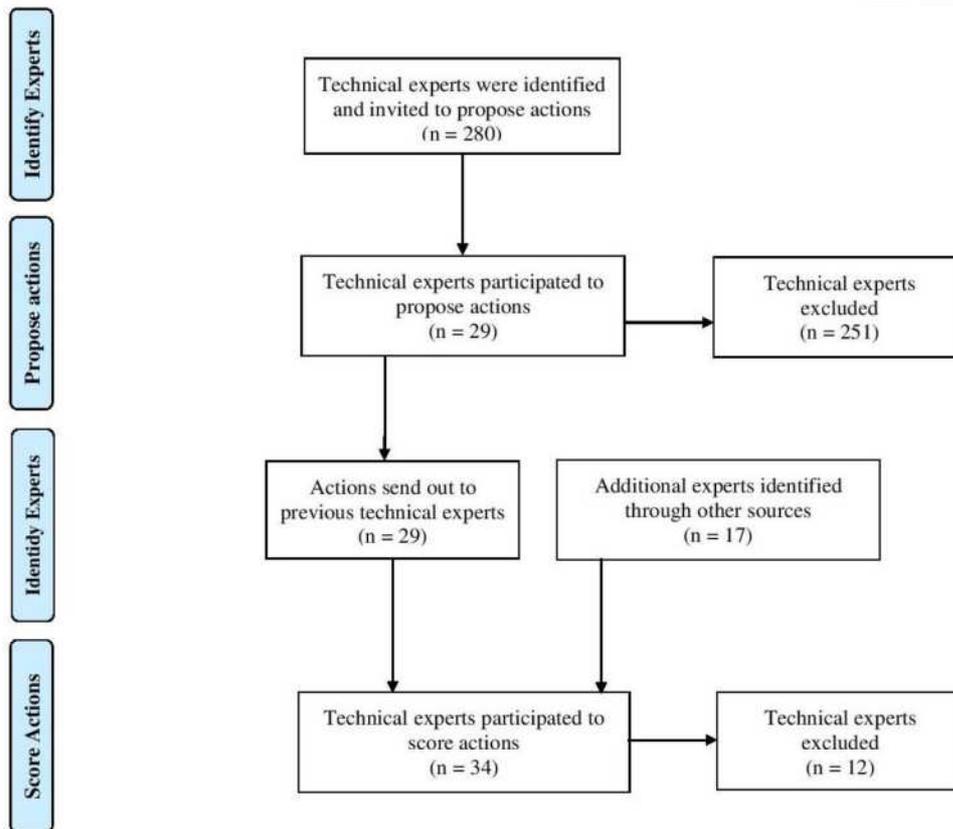


Figure 1 Experts recruitment process

The international health related organizations mainly include:

- American Health Information Management Association (AHIMA)
- Computer-Based Medical Systems (CBMS)
- Standing Committee of European Doctors (CPME)
- European Association of Hospital Pharmacists (EAHP)
- European Federation for Medical Informatics (EFMI)
- European Federation of Nurses Associations (EFN)
- Healthcare Information and Management Systems Society (HIMSS)
- International Medical Informatics Association (IMIA)
- Joint Information Systems Committee (JISC)
- Medical Informatics Europe (MIE)
- Health Level Seven International (HL7)
- openEHR

The expertise of participants in both listing and scoring processes mainly included (**Figure 2**):

- eHealth: EHR, telehealth, clinical decision support, healthcare information system, health knowledge management
- Health informatics: medical informatics, nursing informatics and biomedical informatics
- eLearning and education
- Standardization: SNOMED CT, interoperability
- Clinical expertise: medical doctor, nursing and pharmacy

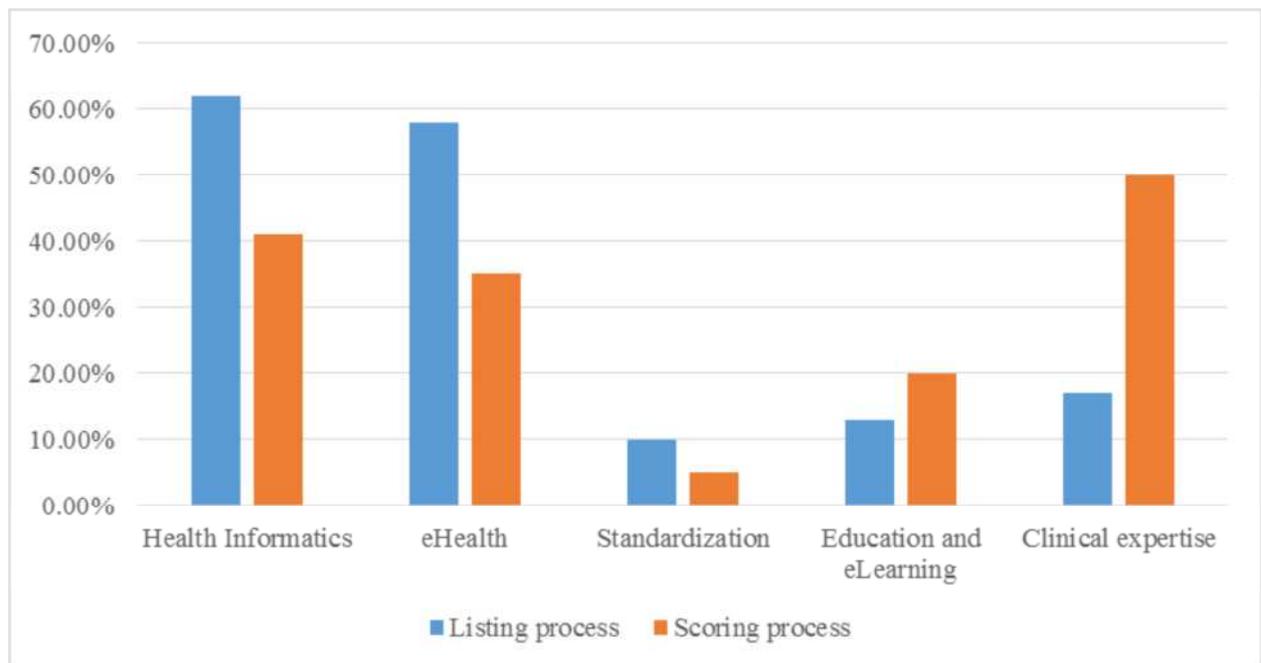


Figure 2 Expertise information of experts

Note: The sum of percentages in each process is greater than 100% because most of experts have more than one filed of expertise.

The listing process involved experts from 14 countries, including US, UK, Finland, Norway, Iceland, Switzerland, Denmark, German, Spain, Czech Republic, Ireland, Austria, Belgium and Netherlands. (**Figure 3**) Among 29 experts, 10% were academics or researchers only, about 69% were academics or researchers and belonged to a non-governmental organization (NGO), and 21% were from NGO only.

In addition to the 14 countries in listing process, more experts from Sweden, Greece, Kosovo, Slovenia, Bulgaria participated in scoring process. (**Figure 3**) Similar to the experts in the listing process, 17% of the experts were academics or researchers only, about 59% were academics or researchers and belonged to a non-governmental organization (NGO), and 24% were from NGO only.

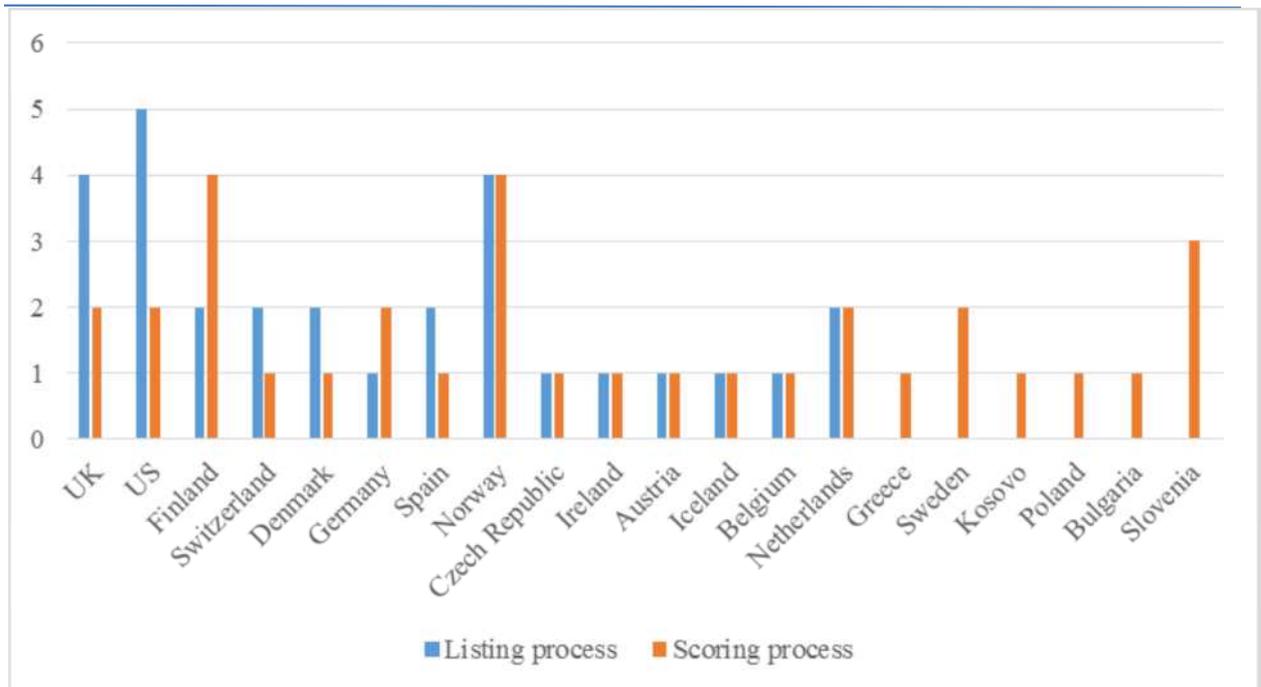


Figure 3 Geographic information of experts

Apart from EU countries, experts from the US were also invited to participate the study (*Figure 3*). Both the EU and the US are actively addressing the needs for skilled workforce. Identifying approach to develop IT skills competence should involve a diverse group of experts rather than isolate the EU experts from the US experts.

2.1.2. Data Collection

Web survey was used for data collection in both the listing process and the scoring process in this study. As the need for participants covering a wide geographic area, web survey makes it easier to recruit large numbers of experts and provide a faster and cheaper analysis [6].

For the first research question, a survey composed of 2 questions was prepared using KI Survey & Report [7] for reviewing. The survey was started with a brief description of the study, followed by two free-text information fields which are to be filled by experts. One of them was to identify the opinions of experts regarding the actions to improve the IT skills competence among healthcare workforce and another one was used to identify the expert group. Both the free text fields were mandatory to fill out. Accompanied with the link leading to the web survey, the emails sent out contained an information sheet including the aim of study, the type of participants, the methodology as well as the workload.

For the second research question, a survey comprised 5 questions was prepared to score the actions. The first four questions were used to assess the likelihood of the proposed actions would satisfy a specific criterion while the last question was used to identify the expert group. Together with the survey link, a document with details explanation about the questions had been enclosed as an attachment.

The experts had to answer all the questions as described before and then submit the surveys. No further information such as results was displayed after the submission.

2.1.3. Data Analysis

The data obtained from listing process was exported to plain text via KI Survey & Report. Then the list of actions was consolidated and narrowed down based on the grounded theory approach. Grounded theory has three mutually supportive features: iteration, constant comparison, and theoretical sampling [8]. The data analysis was commenced as soon as they were collected. Then the constant comparison was performed to understand and explain variation in the data. The constant comparative process combined both inductive and deductive reasoning, in which the researcher formulated conjectures regarding emerging patterns in the data, and refined and elaborated these conjectures by systematically checking them against incoming data [8]. In theoretical sampling, data collection procedures evolved to allow a thorough understanding of key themes. Grounded theory is identified to be prominent in the field of qualitative research include its clearly articulated analytical process, and its emphasis on the generation of pragmatic theory that is grounded in the data of experience [9]. In producing this list, the overlap between actions was limited and the actions were phrased in a way that would easy to understand.

The data obtained from scoring process was exported to an excel file via KI Survey & Report. Each experts scored each action by answering one questions per criterion. According to CHNRI framework [3], the answers to each question are simply: “Yes” (1 point) or “No” (0 points). When the experts were sufficiently informed to answer the question, but can neither agree nor disagree, they were allowed to choose “Undecided” (0.5 points). Furthermore, when the experts didn’t feel they have enough knowledge to answer some questions, they chose “Unqualified to answer” (treated as no answer). Thus, the listed actions got a score for each of the four criteria.

Once all experts finished the scores, intermediate scores for each criterion can be easily computed. Table 1 represents how this has been done. In this example, 5 actions were being scored for criterion 1 by five scoring experts (E1-5). The remaining actions, criteria, and scoring experts, remained exactly the same as shown in Table 1. The intermediate scores were computed by adding up all the informed answers (“1,” “0,” or “0.5”). The number of received informed answers then divided the achieved sum. “Unqualified to answer” were left out of the calculation in both numerator and denominator [3]. All intermediate scores for all actions, therefore, were assigned a value between 0 and 100%. The overall scores were calculated as the mean of the scores for the four criteria. The actions were then prioritized and ranked according to the overall priority scores they received.

Table 1 Score calculation approach

Criterion 1							
	E1	E2	E3	E4	E5	Calcul ation	Criteri on Score
Action 1	1	1	0	-	0.5	Sum (2.5)/an swer(4)	2.5/4=0 .625
Action 2	0.5	0.5	1	0	1	Sum (3)/ans wer(5)	3/5=0.6 00
Action 3	1	-	0	-	0.5	Sum (1.5)/an swer(3)	1.5/3=0 .500
Action	1	0	0	0.5	0.5	Sum	2/5=0.4

4						(2)/answer(5)	00
Action 5	0	-	1	-	-	Sum (1)/answer(2)	1/2=0.500

2.1.4. Results

2.1.4.1 First research question results

A total of 29 responses were received that initially yielded 110 actions from a diverse group of healthcare experts. (See Appendix A) After removing the duplicated actions, the list was summarized into a manageable size with 23 actions that covers the wide spectrum of all possible actions (**Table 2**).

Table 2 The list of summarized actions

Action order	Action
1	Help to recognize eHealth/health IT as a specialty
2	Exposure to relevant ICT solutions and medical technologies, increase users' confidence in eHealth
3	Raise awareness of the importance of eHealth
4	Integrate health IT in curricula at both undergraduate and postgraduate level
5	Guarantee the governance for education and training
6	Training on role specific and organization-specific IT skills for different professional groups
7	Training on patient-centered eHealth/Health IT services for different professional groups
8	Training on the development of processes and activities supported by IT solutions for different professional groups
9	Ensure the competence for educators, train the trainer in eHealth IT skills
10	Improving training on potential healthcare workforce at high school level, undergraduate level
11	Introduce online training tools, e.g. MOOC, as well as in housing training
12	Identification of IT competences needed at international level, allow recognition of competences beyond frontiers, create of competence framework
13	Analysis the skills needed for jobs
14	Carry out regular audit / evaluate of skills of existing and new staff, offer qualification procedure
15	Evaluate training program, identify barriers
16	Set up coordinating body to support availability of ICT in

	broad community of healthcare workers
17	Joint Funding for generic training programs
18	Investment in new technology
19	Define IT skill training programs by regional/national authorities
20	Improve learning arrangements - facilities, methods, equipment (e.g. access to Internet, set platform, mashup environment)
21	Create and use registries
22	Inclusion of healthcare professionals in the development process of the ICT-solutions (e.g. usability testing of software)
23	Increase research in user acceptance of IT for healthcare workforce

The actions most frequently proposed to improve the IT skills competence was in continuous training of healthcare workforce. These actions included integrate health IT in curricula of the existing healthcare field, introduce online training tools, and ensure the competences of educators as well as improve training on role specific IT skills, patient-centered eHealth services, development processes of IT solutions and potential healthcare workforce.

The experts also identified several actions that related to create awareness of eHealth. One of them was to help workforce to recognize eHealth as a specialty, including telemedicine, biomedical informatics, and health informatics. Another action was to raise awareness of the importance of eHealth, continue education and case studies on the value of health information. In addition, exposure to relevant ICT solutions and medical technologies was identified to increase workforce confidence.

Two actions were recognized to address the IT skills needed and another two actions proposed to evaluate the healthcare workforce IT skills and training program. Improving healthcare workforce involvement was considered as significant to develop IT skills competence. Relevant actions included involve healthcare workforce in the development process of ICT solutions, e.g. usability testing of software, and increase research in user acceptance of eHealth.

Actions that focus on the workforce management were described as setting up coordinating organizations to support availability of ICT in a broad community, guarantee the governance for training, and improve learning arrangements - facilities, methods, equipment, for instance, ensure access to computers. In terms of technologies, experts proposed two actions to invest new technologies and create registries. Besides, one expert proposed joint funding for generic training programs.

2.1.4.2 *Second research question results*

Scoring of the 23 actions resulted in a ranking of proposed actions on the basis of the perceived likelihood that they would be feasible, effective, deliverable, or have the maximum impact on IT skill improvement. A wide range of scores was obtained (85.1 – 47.8). Scores for feasibility and effectiveness were relatively high, but the other two criteria contributed to lower the overall score.

Table 3 shows the 10 actions with greatest overall priority score (PS). The action that achieved highest score was about integration of health information technology in curricula for healthcare workforce at different levels. The actions was rated as highly feasible (92.6 of 100), and effective (95.5 of 100). Its

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 likelihood of deliverability (75.8 of 100) and maximum impact on the IT skill improvement (76.7 of 100) were also assessed to be high. The experts recognized this action as the best approach that could benefit healthcare workforce, with an overall priority score of 85.1 of 100.

In addition to that, other actions that focus on continue training among healthcare workforce also obtained high scores. The action about ensuring the trainer competence was ranked second (84.5); training on patient-centered eHealth services was fifth (83.6); training on role-specific IT skills was sixth (80.3) and training on the development of processes and activities supported by IT solutions was tied ninth (75.6).

Table 3 Ten actions with greatest overall priority score

F:Feasible, E:Effective, D: Deliverable, M:Maximum impact, PS: Overall priority score						
Rank	Action	F	E	D	M	PS
1	Integrate health IT in curricula at both undergraduate and postgraduate level	92.6	95.5	75.8	76.7	85.1
2	Ensure the competence for educators, train the trainer in eHealth IT skills	88.2	92.4	79.0	78.3	84.5
3	Raise awareness of the importance of eHealth	88.2	86.3	85.5	77.6	84.4
4	Inclusion of healthcare professionals in the development process of the ICT-solutions (e.g. usability testing of software)	92.6	89.4	83.9	70.0	84.0
5	Training on patient-centered eHealth/Health IT services for different professional groups	91.2	89.4	82.2	71.7	83.6
6	Training on role specific and organization-specific IT skills for different professional groups	83.8	84.8	79.0	73.3	80.3
7	Exposure to relevant ICT solutions and medical technologies, increase users' confidence in eHealth	88.2	81.8	77.4	73.3	80.2
8	Improve learning arrangements - facilities, methods, equipment	81.2	87.5	65.0	76.7	77.6
9	Training on the development of processes and activities supported by IT solutions for different professional groups	77.9	80.3	74.2	70.0	75.6
10	Increase research in user acceptance of IT for healthcare workforce	85.2	81.8	69.3	63.8	75.1

Two high-scoring actions were related to improve the workforce involvement: inclusion of healthcare workforce in the development process of eHealth (ranked 4th) and research in user acceptance (10th). High scores were also given to two related actions that identified education on eHealth, specifically for and improving awareness (3rd) and increasing confidence (7th).

Table 4 Ten actions with lowest overall priority score

F:Feasible, E:Effective, D: Deliverable, M:Maximum impact, PS: Overall priority score						
Rank	Action	F	E	D	M	PS
14	Introduce online training tools, e.g. MOOC, as well as in housing training	83.3	73.4	66.7	66.7	72.5
15	Analysis the skills needed for jobs	81.2	77.2	67.7	55.0	70.4
16	Identification of IT skills competence needed at international level, allow recognition of competences beyond frontiers, create of competence framework	74.2	75.0	72.4	58.3	70.0
17	Help to recognize eHealth/health IT as a specialty	77.9	68.1	71.7	61.7	69.7
18	Guarantee the governance for education and training	82.3	72.7	53.2	56.7	66.2
19	Carry out regular audit / evaluate of skills of existing and new staff, offer qualification procedure	73.5	74.2	53.2	56.7	64.4
20	Joint Funding for generic training programs	66.7	68.2	55.0	61.7	62.9
21	Set up coordinating body to support availability of ICT in broad community of healthcare workers	58.8	59.1	53.3	55.0	56.6
22	Create and use registries	57.6	58.0	53.4	50.0	54.7
23	Improving training on potential healthcare workforce at high school level, undergraduate level	50.0	51.6	41.4	48.3	47.8

Table 4 shows the 10 lowest-scoring actions. Concerns about feasibility were expressed for actions related to identification of IT skills competence needed at international level (ranked 16th, feasibility score 74.2), evaluate of skills of existing and new staff, offer qualification procedure (19th, feasibility score 73.5), and Joint funding for training programs (20th, feasibility score 66.7). For the effectiveness criteria, experts identified actions that introduce online training tools and in housing training for different healthcare workforce as less effective (14th, effectiveness score 74.2). Other effective action was related to helping workforce recognize eHealth/health IT as a specialty (17th, effectiveness score 68.1).

Several actions reached the bottom line because they had low scores in the likelihood that these actions could be deliverable, affordable, and sustainable taking into account the current resources. These actions included guarantee the governance for education and training (18th, deliverability score 53.2), set up coordinating organizations to support availability of ICT in broad community of healthcare workforce (21st, deliverability score 53.3) and improve training on potential healthcare workforce (23rd, deliverability score 41.4). Two actions that proposed to analyse the IT skills needed for jobs and create registries (15th and 22nd, maximum impact score 55.0 and 50.0) received low priority scores because they were perceived having less impact on the improvement of IT skills competence.

Overall, the action that proposed to integrate health IT in curricula was acknowledged as most feasible (92.6) and effective (95.5). Raising awareness of the importance of eHealth was considered to be most deliverable (85.5) while ensuring the competence for educators could impact on the IT skill improvement most (78.3).

2.2. Overarching Themes Linked with identified IT Market Segments

According to D2.1 [2] three market segments were identified as actionable areas for interventions towards fostering IT competences of Healthcare workforce:

- Segment 1: Technology standards in healthcare education, involving technology but also the managerial and medical standards space;
- Segment 2: Strategic R&D, involving policy making and institutional stakeholder involvement;
- Segment 3: IT skills programmes, which involve educational initiatives not barring initiatives for training the trainers or general awareness raising initiatives for eHealth.

From the results presented in section 1 of this report several overarching action themes have emerged regarding each market segment. These are presented below

2.2.1. Segment 1: Technology standards in healthcare education

From **Table 2** several responses address directly or indirectly Technology standards in healthcare education. Those identified as such are tabulated below (Table 5)

Table 5 Stakeholder suggested actions relevant to Technology standards market segment

Actions' Number	Action
1	Training on the development of processes and activities supported by IT solutions for different professional groups
2	Ensure the competence for educators, train the trainer in eHealth IT skills
3	Improving training on potential healthcare workforce at high school level, undergraduate level
4	Identification of IT competences needed at international level, allow recognition of competences beyond frontiers, create of competence framework
5	Analysis of the skills needed for jobs
6	Carry out regular audit / evaluate of skills of existing and new staff, offer qualification procedure
7	Evaluate training program, identify barriers
8	Define IT skill training programs by regional/national authorities
9	Improve learning arrangements - facilities, methods, equipment (e.g. access to Internet, set platform, mashup environment)

10	Create and use registries
11	Inclusion of healthcare professionals in the development process of the ICT-solutions (e.g. usability testing of software)
12	Increase research in user acceptance of IT for healthcare workforce

From these it became apparent that the stakeholders' actions required from the market segment a streamlined framework of standardization of activities and processes in the field of eHealth and Health IT. These standardizations should be specific for each stakeholder group and activity, while also they should provide a streamlined assessment framework for skills and competences. Additionally, standards in market risk management should be incorporated to maintain relevance of eHealth initiatives to quickly changing sectors of healthcare and IT.

2.2.2. Segment 2: Strategic R&D

From **Table 2** several responses address directly or indirectly Policy setting and overall strategic R&D in healthcare education. Those identified as such are tabulated below (**Table 6**)

Table 6 Stakeholder suggested actions relevant to Strategic R&D market segment

Actions' Number	Action
1	Help to recognize eHealth/health IT as a specialty
2	Raise awareness of the importance of eHealth
3	Integrate health IT in curricula at both undergraduate and postgraduate level
4	Guarantee the governance for education and training
5	Identification of IT competences needed at international level, allow recognition of competences beyond frontiers, create of competence framework
6	Analysis of the skills needed for jobs
7	Carry out regular audit / evaluate of skills of existing and new staff, offer qualification procedure
8	Evaluate training program, identify barriers
9	Set up coordinating body to support availability of ICT in broad community of healthcare workers
10	Joint Funding for generic training programs
11	Investment in new technology
12	Define IT skill training programs by regional/national authorities
13	Improve learning arrangements - facilities, methods, equipment (e.g. access to Internet, set platform, mashup environment)
14	Create and use registries

15	Inclusion of healthcare professionals in the development process of the ICT-solutions (e.g. usability testing of software)
16	Increase research in user acceptance of IT for healthcare workforce

From these it became apparent that the stakeholders' actions required from this market segment the identification and codification of the current eHealth policies and infrastructures status. Subsequently it is suggested the formal establishment of a coordinating infrastructure, possibly utilizing registries, electronic or otherwise, in order to establish an institutional infrastructure. This infrastructure (in the form of advisory or regulatory bodies, not necessarily as authoritative policy setters) would coordinate and maximize the impact funding and real world infrastructure allocation. In that fashion efforts of research, as well as outreach activities for raising eHealth awareness to relevant stakeholders will be most effective and resource efficient.

2.2.3. Segment 3: IT skills programmes

From **Table 2** several responses address directly or indirectly IT skills programmes in healthcare education. Those identified as such are tabulated below (**Table 7**)

Table 7 Stakeholder suggested actions relevant to IT skills programmes market segment

Actions' Number	Action
1	Exposure to relevant ICT solutions and medical technologies, increase users' confidence in eHealth
2	Training on role specific and organization-specific IT skills for different professional groups
3	Training on patient-centered eHealth/Health IT services for different professional groups
4	Training on the development of processes and activities supported by IT solutions for different professional groups
5	Ensure the competence for educators, train the trainer in eHealth IT skills
6	Improving training on potential healthcare workforce at high school level, undergraduate level
7	Introduce online training tools, e.g. MOOC, as well as in housing training
8	Carry out regular audit / evaluate of skills of existing and new staff, offer qualification procedure
9	Evaluate training program, identify barriers
10	Define IT skill training programs by regional/national authorities

From these it became apparent that the stakeholders' actions required from this market segment to organize Health IT initiatives for impact and efficiency. Specifically, it was deemed crucial for role and organization specific, patient centered initiatives. On a different axis important was also deemed the coordination and launch of "Teach the Educator"

programmes educating the teachers in themes such as evaluation and overcoming learning barriers in IT related education. All these programmes also should be culturally aware, taking into account the special needs of diverse cultures, especially in cases of transatlantic collaboration. Even specific programmes, addressing cultural issues and how to overcome them in eHealth and IT education overall is a valid form of initiative in this market segment. Finally, the importance of awareness and outreach training should not be downplayed. Considerations or even full-blown initiatives for educating stakeholders about the state of the art and current progress in eHealth is deemed appropriate from the above survey.

3. EXECUTIVE SUMMARY FOR A JOINT STRATEGY, FOSTERING IT SKILLS FOR HEALTHCARE WORKFORCE IN THE EU AND USA

With the promise of more efficient and cost-effective care, eHealth is becoming a key priority to address the current challenges faced by healthcare systems worldwide. A recent EU report indicates that eHealth has the potential to be the third pillar in the health market, along with pharmaceuticals and medical devices [10]. However, eHealth could not intend to replace traditional ways of care delivery, such as face-to-face consultation. Instead, it should represent an advanced way of delivering better quality and efficiency of healthcare services. In this regard, it is important to ensure the competence of healthcare workforce.

The WHO Regional Committee for Europe highlighted the consensus to improve information and knowledge base on member states' health workforce in 2007 [11]. This is also underlined by the Action Plan for health workforce that the EU has released [12]. Member states are urged to adjust their education and training curricula to adapt rapid changes in healthcare and to equip people with the required skills for the future healthcare sector. To cope with these changes, there are several actions under development at European level to assist member states to better train the workforce: EU skills council in the area of nursing and care, pilot health care assistants expert network and database, the Joint Action on Health Workforce Planning that develop European guidelines on forecasting methodologies and analyze future skill needs in the healthcare sector as well as EU mapping study to facilitate the continuous professional development (CPD) ([12],[13]).

The potential of healthcare workforce IT skills development is reinforced by a collaboration between the US and Europe, which was initiated by the Memorandum of Understanding on Cooperation Surrounding Health-Related Communications and Technologies [14].

From this project's outcomes the following, on a per market segment basis, recommendations are provided:

On the Healthcare technology standards market segment it is recommended:

- The Standardization of activities, processes and workflows regarding eHealth and Health IT.
- The Specialization of aforementioned standardization endeavors considering specifics for each stakeholder group and activity (educators' skills, learners' backgrounds, etc)
- The Inclusion in a streamlined eHealth standardization portfolio of skills/competences assessment frameworks.
- The Introduction in the aforementioned portfolio of market Threat and opportunity assessment instruments

On the Strategic R&D market segment it is recommended:

- The Archiving (Identification, codification and maintenance) of current knowledge levels as well as requirements in the specific sector (IT capacities for Healthcare workforce).

- The Creation of Registries (electronic or otherwise) for appropriate allocation of resources.
- The Creation of coordinating Infrastructures to maximize impact of resource allocation.
- The Subsequent, rationalized through aforementioned infrastructures, demonstrated effectiveness increase in eHealth funding
- The eHealth, Health IT awareness increase in stakeholders and subsequent increase in research and stakeholder involvement in the eHealth sector.

On the IT skills programmes market segment it is recommended to:

- Nurture the impact of specificity. Design and implement role specific, organization specific and patient centered eHealth educational programmes.
- Implement “Teach the educator initiatives. Educational eHealth initiatives regarding assessment, evaluation and teaching challenges.
- Cultivate culturally aware eHealth initiatives. Develop culturally specific educational initiatives and incorporate culture specific approaches where necessary.
- Foster eHealth awareness training. Design and implement programs informing about state of the art and current evolutions in eHealth.

From these recommendations the following action plan for a cooperation Roadmap is presented.

4. ACTION PLAN FOR A JOINT STRATEGY, FOSTERING IT SKILLS FOR HEALTHCARE WORKFORCE IN THE EU AND USA

4.1. Challenge

The importance of focusing on skilled healthcare workforce involves the changing nature of health systems as well as the need for innovative approaches to provide high quality healthcare. Patients with chronic conditions need health care that emerges from a multidisciplinary perspective with emphasis on self-management and collaboration [15],[16]. They need self-management skills to prevent complications, and interdisciplinary providers who understand chronic conditions to provide integrated care. Many countries are facing critical skilled workforce shortages in certain health professions and medical specializations [17],[18]. According to the Action Plan for the EU Health Workforce 2012, the growth of new technology, new medical appliances and diagnostic techniques is leading to new ways of healthcare delivery which requires a new mix of skills including technical and e-skills [12]. Improving the eHealth IT competences by a collaboration between the US and Europe demands concrete actions at international level in order to [2]:

- Establish the shared building blocks to support interoperability that concerns terminology and the exchanging of information between systems.
- Use relevant technology to provide patient-centered care and empower patients and citizens towards gaining access to information.
- Increase participation of the public and introduce the workforce to new technologies with the required paradigm shifting in established work habits

4.2. Scope Statement

This action plan recommends activities to cultivate collaboration between EU and US in fostering the IT skills for healthcare workforce. These activities shall span 3 areas previously identified as important market segments (cf. section 2.2) for this goal.

- Segment 1: Technology standards in healthcare education, involving technology but also the managerial and medical standards space;

To efficiently cover these segments, actions need to engage with EU and US eHealth/Health IT professionals and organizations to address eHealth/Health IT workforce needs and concerns. These efforts need to promote development of a global workforce professionally prepared to deploy eHealth/Health IT systems, including international use of jointly developed EU-US tools such as the Health IT Competencies platform (HITCOMP). It also requires to regularly taking stock of the latest trends and developments in eHealth/Health IT (e.g. the growing importance of mobile Health including software and apps). Additionally, Standards Stakeholders and Profile Developing Organizations in eHealth/Health IT should focus on initiatives towards a standardized international patient summary (IPS) (c.f. e.g. [18]) to be in use by 2020, but also to technology standards for healthcare workforce training and education.

- Segment 2: Strategic R&D, regarding policy making and institutional stakeholder involvement;

This segment includes the recognition of complementary opportunities and strengths between EU and US regarding business/trade and capacities as well as actions on how to best emphasize them in a collaborative manner. Crucial in these endeavors are efforts in identifying key EU and US stakeholders, enlisting their support and through them building transatlantic partnerships-alliances

between EU cities/countries/regions and US cities/States that share common eHealth/Health IT challenges.

- Segment 3: IT skills programmes, involving educational initiatives not barring initiatives for training the trainers or general awareness raising initiatives for eHealth.

Key in this segment is the continuous and close engagement between EU and US experts and organizations of eHealth/Health IT professionals in order to address eHealth/Health IT workforce needs and concerns; This close collaboration needs to involve issues and aspects of the whole eHealth/Health IT workforce, taking regular cues from the rapidly evolving technological background.

Time-wise the Scope of this roadmap is planned in the context of the EU H2020 as a long term institutional framework with the decentralized, adaptive and flexible US policy frameworks included in this time scale.

4.3. Action Plan

Stakeholders from all sectors are invited to participate in this action plan. Support and Coordination actions are mainly recommended for strategic R&D goals but extending also in the technology standards segment. Research and innovation actions cover, also, the technology standards segment as well as part of the IT skills programmes segment. Limited public procurement activities are suggested for the covering infrastructural necessities in the IT skills programmes.

<i>Roadmap towards a joint strategy fostering it skills for healthcare workforce in the eu and usa</i>		
Strategic R&D Market segment	Initial Cooperation Roadmap (including executive summary, scope statements for the work streams, action plan and deliverables) delivered to institutional stakeholders. This roadmap is considered adaptable and actively evolving to emerging needs capacities and situations.	Q3 2015
	Collaboration of stakeholders (Through the formulation of an advisory body) known to be and/or potentially interested in developing specifications and/or pilot demonstrations regarding workflows, activities and processes in IT education in healthcare. This body will set concrete outcomes with deliverables through specific tasks. The scope if these tasks shall be to establish priority areas for collaboration and to identify synergies between the standards/interoperability IT space and the endeavours for Healthcare workforce development. It shall also maintain a plan of time-bound actions and deliverables to ensure that a fully competent eHealth/Health IT workforce is available in the sector.	Q4, 2015
	Formulate Support and Coordination funding actions for joint EU-US electronic registries. The objectives of such actions should include the	Q1, 2016

D4.3 Roadmap towards a Joint Strategy fostering IT skills for healthcare workforce in the EU & USA

	<p>archiving of current IT capacities of healthcare professionals, as well as the documentation of requirements for aligning these capacities with societal and market needs in Europe and the US. Target activities for these actions shall be the Identification of key players – US and EU experts in education, IT and healthcare. These shall include both policy and implementation professionals. Engagement of institutional stakeholders for joint EU/US workshops regarding the (health standards and medical education informatics standards) endeavor and its proliferation in healthcare and IT stakeholders shall also be a relevant activity to this action.</p>	
	<p>Creation of Support and Coordination funding actions towards an IT skills Observatory for healthcare professionals. The measurable outcome of such action should be a transatlantic instrument for discovering and exposing to the stakeholders’ community funding and support initiatives for IT skills education in healthcare at both sides of the Atlantic. Target activities for these actions shall, for example, be the compilation of comprehensive databases of skills and competences to map against domains and roles. Structured dialogues and consultation with qualified stakeholders to determine the skills and competences required by each role in each setting, at each level of responsibility.</p>	<p>Q1 2016</p>
<p>Technology Standards in Healthcare education</p>	<p>Initiate Research and Innovation actions for the conceptualization and formulation of the necessary infrastructures for establishing a transatlantic eHealth/Health IT standards space. Expected outcome of such an endeavour would be a complete description of the sector in terms of semantic/syntactic interoperability and patient mediated data exchange standardization. This description should take into consideration both specific stakeholder needs, capacities and backgrounds (including assessment), as well as market and cultural considerations. Examples of endeavours in this action would be the assessment of existing vocabularies (e.g. SNOMED CT) and use of technical standards for healthcare workforce education and alignment with the EU/US common goals established. Beyond this, the development of quality training material (in different types: OER, MOOCS, etc.) for all relevant stakeholders (physicians, patients, caregivers) would also be a priority activity in this</p>	<p>Q2, 2016</p>

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	<p>action.</p>	
	<p>Initiate Research and Innovation actions for establishing a shared standards space for eHealth and Health IT. Objectives of this actions would include the integration of existing and creation of the, required, missing interoperability infrastructures. These are both semantic infrastructures, collaboration frameworks and pilot applications for establishing and using the eHealth/Health IT standards space. Key activities to be supported by this action would be the definition of key terms at any description level (domain, setting, skill, competence, etc.) in order to document the full range of workplace settings in healthcare and to ensure a comprehensive coverage of necessary skills and competences, in conjunction with proposed standards (health standards and medical education informatics standards).</p>	<p>Q4, 2016</p>
<p>IT skills programmes market segment.</p>	<p>Initiate Support and Coordination actions for increasing transatlantic stakeholder awareness on topics of eHealth/Health IT. Expected outcome is the formulation of joint work groups on eHealth/Health IT topics of exact specificity (role specific – organization specific). The overall impact of these actions should be the creation of a stakeholder commons from which further collaborations will follow. Activities should include outreach endeavours but also governance processes (including details for component structuring and possible value sets) for standards (health standards and medical education standards) updates in coordination with global health informatics and medical education informatics standardisation bodies.</p>	<p>Q1 2016</p>
	<p>Initiate Support and Coordination actions for creating a competent eHealth/Health IT educator base in a common basis. Tangible actions should include joint educational platforms, electronic and physical for informing and training the personnel that will take the responsibility to train the IT skills of the Healthcare workforce. Activities supported by this action would also include the creation of suitable tools to assess skills, identify skills gap and formalise these finds into Gap Analysis reports that shall be used to formulate educational material. Further activities in this action would include the infrastructures (e.g. database) of such materials in order to facilitate the covering of the previously assessed skill gap.</p>	<p>Q2 2016</p>

D4.3 Roadmap towards a Joint Strategy fostering IT skills for healthcare workforce in the EU & USA

	<p>Enact Coordination actions to foster partnerships between non for profit/ Non-Government Organizations and institutional/ academic stakeholders for identifying culturally sensitive issues in eHealth/Health IT and recommending specific interventions and actions. Immediate such actions should include Workshops, training courses on cultural/gender issues.</p>	<p>Q3 2016</p>
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5. CONCLUSIONS

The main CAMEI project's long term goal is to create a long lasting effect beyond the end of the project progress. In this respect the Roadmap towards a Joint Strategy fostering IT skills for healthcare workforce in the EU & USA expand the impact of the project. To this end, below the following tasks are going to complement the roadmap towards the smooth exploitation of project results.

- The web-portal will be kept active under the same domain at least for two years after project completion while its further continuation will be based on available funding.
- The White Paper on IT skills for healthcare workforce in the EU and USA and cooperation Opportunities will be provided to both the EU and USA interested parties in order to be used as the foreground on implementing training programmes and new educational material for healthcare workforce. The dialogue on the white paper will remain active and the CAMEI will act as a platform for further engage interested policy makers and stakeholders.
- Successful collaboration cases among EU and USA universities and companies are expected to not only to last but also to develop additional future collaborations with various organisations of the involved regions. The cooperation plans developed within the CAMEI project are also expected to act as a long-term international cooperation mechanisms that will span well beyond project's completion.

Thus the CAMEI project will continue based on its current results to emerge coordination actions in the scientific area of Medical Education Informatics for fostering IT skills for healthcare workforce in the EU and USA.

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APPENDIX A: ORIGINAL ACTION LIST

1. Protected time
2. On-line training tools
3. Mashup environments (play park)
4. Proper career structure
5. Introduction to computer resources available for their use
6. Tools to query computer resources
7. Case studies of activities important to their role
8. Discussion to typical performance measures for evaluating their work
9. How to find and use appropriate resources for their work
10. Creation and use of registries
11. Privacy and security issues
12. Improve confidence in use of systems
13. Enable users to see links between software they make use of at work and in private life to help increase confidence (eg Facebook, online banking)
14. Help understanding of the data story - see the workflow of using HIT and how HIT can make a difference to treatments and outcomes
15. Case studies of activities important to their role, to understand issues that can be caused when data is not captured and shared effectively - incorrect treatment, issues with follow on care, issues with planning for future needs
16. An eHealth strategy with actions
17. Guarantee the governance for HIT education actions
18. A HIT curricula for education on vocational and academic level as well as in house training
19. Ensuring the competences for educators, train the trainer
20. Learning arrangements - facilities, methods, equipment
21. Develop competences using continuing education and case studies related to ethical, legal, societal impact issues of health IT
22. Develop competences using continuing education and case studies related the value of health information: semantics, interoperability, reuse
23. Develop competences using continuing education and case studies related issues related to information management and process reengineering
24. Include mandatory education during the pre-grad course of all eHealth professionals about: electronic health record and safety, continuity of care; importance of documentation; importance of shared vocabularies; decision support; health information sharing and privacy
25. Build graduate education dedicated to health workers in the field of biomedical informatics
26. Build post-graduate course in the field of biomedical informatics
27. Help working at recognizing biomedical informatics as a specialty
 1. Formative training and continuing education on:
28. Effectively read and write from the electronic health record for patient care and other clinical activities
29. Use and guide implementation of clinical decision support
30. Provide care using population health management approaches
31. Patient's privacy and security protection
32. Using information technology to improve patient safety
33. Engage in quality measurement selection and improvement

D3.2 Dissemination Report

34. Use health information exchange (HIE) to identify and access patient information across clinical settings
35. Engage patients to improve their health and care delivery through personal health records and patient portals
36. Maintain professionalism through use of information technology tools
37. Telemedicine and refer those for whom it is necessary
38. Apply personalized/precision medicine
39. Participate in practice-based clinical and translational research
40. Skills needs analysis of jobs/responsibilities
41. Skills audit of staff
42. Creation of competence framework, analyze skills needed
43. Appropriate education and training
44. Investment in new technology
45. Reward and recognition for good performance
46. Ensure access to computers, tablets in workplace
47. Carry out regular audit / evaluate of skills of existing and new staff, reward and recognition for good performance
48. Analyze skills needed - produce checklists
49. Involve medical librarians, senior managers; professional bodies; educators
50. Set up coordinating body
51. Provide appropriate training - both face to face classes and online
52. Evaluate training
53. Think about needs of staff who work in the community - not office based
54. Identify barriers
55. Liaise with staff
56. Include the technology in the education of the health care staff. Like clinical education with technical education in practical process
57. Create awareness of the importance of data quality.
58. Create awareness of the importance of continuity of care data.
59. Teach procedures to collect and quality check patient-provided data.
60. Install procedures that respect the fact that the patient's own the data and act accordingly.
61. Further education - train the trainers
62. Clear identification of IT competences needed at international level, to allow recognition of competences beyond frontiers, creation of competence framework
63. Definition of IT skill training programs by regional/national authorities
64. Use of MOOC as powerful tool to elaborate high added value training courses available everywhere
65. Inclusion of healthcare professionals in the development process of the ICT-solutions, in order to make the solutions relevant and useful (e.g. usability testing)
66. Teaching and training at all levels in education and in professional practice. 67. Development of ICT-subjects in the health professional education programs.
67. Exposure of relevant ICT solutions and medical technologies, investment in new technology
68. To develop plan how to support availability of ICT in broad community of healthcare workers (e.g. general practitioners in remote area, deficit of computers, bad access to internet)
69. To support education of healthcare workers about ICT technologies in healthcare by the courses covering real needs for each discipline on vocational and academic level
70. Realistic competence in computational thinking and software engineering among (select) healthcare workers will be a main driving force. In the same way that health/medicine is now based on natural sciences, it now has to include computational sciences.

D3.2 Dissemination Report

71. Specifically: Personal skills, People skills, Workplace skills and Applied Knowledge skills
72. Training for systems in use. Knowledge about work analysis, workflow and information use.
73. Record-keeping and documentation
74. Training of generic IT skills for all professionals.
75. Training of role specific IT skills for different professional groups.
76. Training of organization-specific system skills and information security practices for different professional groups.
77. Training of generic principles of good practice and responsibilities of health information processing, including code of ethics and information security as tools and warranties of professionals.
78. Training on rights of patients / customers in relation to health data and IT.
79. Training and capability development of key users and managers for the development of processes and activities supported by IT solutions.
80. Searching for information.
81. Evaluating the quality of found information
82. Take courses involving information technology and computer science practice in the field
83. Integrate health IT in curricula of the existing healthcare field (e.g. medical studies, nursing study)
84. Offer dedicated courses for health IT workers on health IT
85. Offer qualification procedures such as "specialist in health informatics" for a medical doctor or nurses, by developing standardized courses and offering certified academic degrees or titles that can be obtained
86. Develop curricula recommendations for health IT skills for health workers
87. Raise awareness of the importance of the quality and integrity of data recorded in ICT systems
88. Education and training on practical topics to promote privacy and data protection friendly practices
89. Listen to the real needs of the different stakeholders in the healthcare sector to develop useful and friendly systems
90. Education and training on the responsible use ITC systems to avoid security and privacy breaches
91. To give incentives for training in important IT skills (e.g. security).
92. To include in any IT deployment plan measures to train the workforce.
93. To increase research in user acceptance of IT for healthcare workers.
94. To define minimal usability requirements that any software for healthcare workers has to fulfil (e.g. extensive usability testing with healthcare workers prior deployment).
95. Usability testing of software for healthcare workers need to be done by regular workers and not geeks
96. Need to be precise to what information is important for healthcare workers, what is out there? How is it used?
97. Be consistent over a longer period of time, not too much information each time just enough to keep up interest. Regularity for example once a week/month so healthcare workers can integrate into their schedule time to educate themselves regarding IT. Consistency of information/education is important.
98. When looking to the future healthcare workers it is crucial to implement IT into the curriculum where healthcare workers are being educated. Connect/integrate it within other courses in the curriculum.
99. Solidarity principle as not to hunt people once they are trained
100. Joined Funding for generic training programs
101. Increase training and expertise at high school and university level

D3.2 Dissemination Report

102. Set up platform to blend theoretical and practical experience
103. Include acquiring of IT skills in existing healthcare training programs
104. Develop post-grad IT skills courses
105. Enable healthcare workers to develop, train and maintain IT skills
106. The first question to ask which professional group will be addressed and what roles they will fulfill.
107. The most important issue for healthcare workers is to know how their work will change as a result of HIT and how it will be supported by HIT.
108. Clinical informatics needs to be included in the professional studies
109. The Universities should have teaching positions in this area. It should focus on tools for representing and navigating in medical information, IT as tool to enable organizational and professional changes, the impact of technology on clinical practice, decision making etc.