Prioritization of actions needed to develop the IT skills competence among healthcare workforce

Sisi Li[1*], Panagiotis D Bamidis[2], Stathis Konstantinidis[3], Vicente Traver[4], Nabil Zary[1]

[1]Karolinska Institutet, Sweden;
[2]Aristotle University of Thessaloniki, Greece;
[3]University of Nottingham, United Kindom;
[4]Polytechnical University of Valencia, Spain

*** Corresponding author:**

Sisi Li,

Karolinska Institutet, Dept of LIME,

17177 Stockholm, Sweden,

Email: sisi.li@stud.ki.se

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ABSTRACT

Background: Health related information and communication technology is globally an important and growing sector. With the promise of more efficient and cost-effective care, eHealth is becoming a key priority to address the current challenges faced by health systems worldwide. Addressing IT skills for healthcare workforce is seen as an important element of achieving greater social inclusion.

Objective: To identify and prioritize the actions needed to improve the IT skills of healthcare workforce across the EU from different perspectives of experts in healthcare.

Methods: A diverse group of experts, representing different fields of expertise in healthcare and geographical locations participated in the study. A scientific priority-setting methodology was used to systematically list and score actions that would improve IT skills among healthcare workforce. The participants evaluated the actions using several criteria: feasibility, effectiveness, deliverability, and maximum impact on IT skills improvement.

Results: The actions that scored highest were related to appropriate training, integrating eHealth in curriculum, involving healthcare workforce in the eHealth solution development, improving awareness of eHealth as well as learning arrangement. The actions that scored lowest were related to the workforce management, identification of IT skills competences needed, joint funding for training program and training on potential workforce.

Conclusion: To maintain highly IT skilled healthcare workforce, eHealth related knowledge and skills in current curricula, improving awareness of eHealth and continuous training according to the different professionals' needs should be addressed. In addition, healthcare workforce should be actively and continuously included in the development of eHealth solutions.

Keywords: eHealth, healthcare workforce, priority setting, IT skills competence, CHNRI

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1 Introduction

Healthcare systems throughout the world are endeavoring to rise to the challenges that result from ageing population, prevalence of chronic conditions, rising life expectation and multi-morbidity (Suzman et al. 2014; Yach et al. 2004; Willy Palmand and Irene A. Glinos 2010). It is unsustainable to maintain the traditional healthcare delivery and is increasingly recognized that integrated care can significantly improve the quality and continuity of services (Kodner & Spreeuwenberg 2002). With the promise of more efficient and cost-effective care, eHealth is becoming a key priority to deliver innovative healthcare. 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 (European Comission 2009). The 2010 EU Citizenship Report underlined the role of eHealth in facilitating cross border healthcare (European Commission 2010). That said, eHealth should 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. With this regards, it is important to ensure the competence of healthcare workforce.

Improving the eHealth IT competences has been frequently emphasized by politicians at international level. The WHO Regional Committee for Europe highlighted the consensus to improve information and knowledge base on member states' health workforce in 2007 (WHO 2007). It is also 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 (European Commission 2011). To advance this area, the Transatlantic Economic Council has decided on a mutual Cooperation Roadmap that focuses on advancing interoperability of EHR and gaining eHealth workforce development (European Commission 2015).

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According to the EU project "Chain of Trust", which analyzed the results of 6704 patients and health professionals experience on eHealth, the issue of confidence and skills was very much present (The Chain of Trust Consortium 2014). The study revealed an extensive lack of understanding of telehealth among users, and expressed concerns regarding the user acceptance of telehealth. In relation to health professionals, the study showed only 21% respondents reported that their management team promotes the use of telehealth and 43% of them said not. Besides, the lack of appropriate education and training is perceived as one factor that affects the health professionals' confidence towards integrating telehealth into their workflow while ensuring efficiency and patient safety (The Chain of Trust Consortium 2014).

Traditional curricula do not always equip healthcare workforce with the required knowledge and skill sets to make optimum use of eHealth. A study, which assessed the IT attitude, experience and competence of 846 1st-year Medical Sciences Division undergraduates, showed that students have a fundamental lack of understanding of basic IT skills (Sieber 2009). Ornes et al. (Ornes & Gassert 2007) also concluded that students received limited informatics exposure and may not be adequately prepared to use information technology in undergraduate education.

Identifying approaches for achieving a robust supply of highly proficient eHealth workforce and assuring health care, public health, and allied professional workforce have the IT skills is needed to use eHealth efficiently. Equally, there is a great needs in identifying and addressing competence and knowledge deficiencies among all staff in healthcare delivery, management, administration and support to ensure a comprehensive effective application of ICT solutions in and for health services.

However, searching for studies that were done either identifying approaches for eHealth workforce development or addressing the IT skills competence absences with involvement of different healthcare workforce showed that such studies were lacking. The actions they contain might only centre on the specific area or specific workforce

group (Mantas et al. 2010; Fetter 2009; Smith et al. 2011a; Kaufman et al. 2014). In this study, the healthcare workforce refers to "*all people engaged in action whose primary intent is to enhance health*" as defined by WHO (WHO 2006). The eHealth/health IT skills refers to "*any competence and knowledge deficiencies among all staff in healthcare delivery, management, administration and support to ensure universal application of ICT solutions in health services*."(European Commission 2013)

To the best of our knowledge, very few amount of studies has previously been carried out or published, using a systematic approach to setting priority for the IT skills competence development among healthcare workforce. Collaboration between experts from diverse backgrounds in healthcare is the way to ensure the IT skill issues that faced by healthcare workforce be addressed appropriately. The objective of this study is to identify the actions needed to develop the IT skills competence among healthcare workforce with collaboration of experts from diverse backgrounds in healthcare at European level. In addition, to identify the priorities of actions for further development of IT skills competence within healthcare workforce.

2 Methods

The Child Health and Nutrition Research Initiative (CHNRI) methodology for priorities setting was used to assist prioritize actions in this study (Rudan et al. 2008). The process uses a systematic and transparent approach to assemble and analyze a wide spectrum of collective actions from an array of healthcare experts. Prioritization criteria relevant to the topic were used to score the actions and then rank the actions based on the overall priority scores. 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 (Lawn et al. 2011; Rudan et al. 2008; Tomlinson et al. 2009). Additionally, it is also being implemented by WHO to set

priorities for a set of distinct categories of work. The CHNRI methodology involves four stages (Fig. 1):

Stage 1: Define the context and criteria

Defining the context is a critical part of the CHNRI process, because priority scores for many actions may strongly depend on the context in which the process takes place. The context for this study was defined to address priorities on actions that could assist in improving IT skills competence among healthcare workforce at European level. It was specified as followed:

- Scale of the study: EU
- Problem: deficiency of IT skills competence
- Target population: healthcare workforce

Based on CHNRI's conceptual framework (Rudan et al. 2008), four scoring criteria were identified: (i) likelihood of feasibility; (ii) likelihood of effectiveness; (iii) likelihood of deliverability, affordability, and sustainability; (iv) maximum potential impact on competence improvement.

Stage 2: Experts input – listing and scoring actions

A diverse group of leading experts, representing different expertise and geographical locations, were invited to participate in the CHNRI process so that the mix contains a diversity of views from the wider community. The selection 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, 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)

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- 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

There were 29 experts participated the study to list actions while 34 experts scored the actions, with an overlap of 17 experts who were involved in both processes. (Fig.2) In the listing process, experts proposed actions that they thought were important to improve IT skills competence among healthcare workforce. The experts were from 14 countries, including US, UK, Finland, Norway, Iceland, Switzerland, Denmark, German, Spain, Czech Republic, Ireland, Austria, Belgium and Netherlands. 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. The process was open-ended and all the proposed ideas from each of the experts were collected independently. The list of actions were compressed to highlight important gaps, yet still represent the range of possibilities to improve IT skills. Then the final list of actions was reviewed by the authors to ensure that they were framed correctly and comprehensively to allow scoring.

In the scoring process, experts evaluated the final list of actions independently according to the criteria as described in Stage 1. Every expert scored all four criteria, which limiting potential impact of any single expert on overall scores. In this way, the listed actions received four "intermediate scores", ranging from 0% to 100%. These values represented a direct measure of the collective optimism of the experts. In addition to the 14 countries in listing process, more experts from Sweden, Greece, Kosovo, Slovenia, and Bulgaria participated in scoring process. 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.

Apart from EU countries, experts from the US were also invited to participate the study as the close collaboration between the European Commission and the United States (European Commission 2011). 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.

The expertise of participants in both listing and scoring processes mainly included (Fig.3):

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

A full list of experts with their expertise and affiliations are presented in Table S1 and S2.

Stage 3: Address external stakeholder's value

The CHNRI methodology ensures the involvement of stakeholders in the process regardless of their expertise. The term "stakeholders" refers to all individuals and/or groups who have interest in prioritization of health research, therefore will comprise a large and very heterogeneous group (e.g. expected recipients of the research, taxpayers, medical students, health workers, journalists and media, political experts, etc.)(Rudan et al. 2008). They lack expertise to directly decide research priorities, but

they can still weigh the chosen priority-setting criteria based on values assigned by them (Kapiriri et al. 2007). In this study, it was decided that the external stakeholder's value will NOT be addressed and final rankings were based on the priority scores from the perspectives of experts.

Stage 4: Compute priority scores and assign ranks

Each experts scored each action by answering one questions per criterion. According to CHNRI framework (Rudan et al. 2008), 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.

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(Rudan et al. 2008). 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 according to the formula:

[(Criterion 1 score) + (Criterion 2 score) + (Criterion 3 score) + (Criterion 4 score)] /4

The actions were then prioritized and ranked according to the overall priority scores they received.

3 Results

List action

A total of 29 responses were received that initially yielded 110 actions from a diverse

group of healthcare experts. The full list of 110 actions from each individual expert are presented in Table S3. After removing the duplicated actions, the researcher summarized the list into a manageable size with 23 actions that covers the wide spectrum of all possible actions (Tab. 1).

The actions most frequently proposed to improve the IT skills competence were 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 s 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

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technologies, experts proposed two actions to invest new technologies and create registries. Besides, one expert proposed joint funding for generic training programs.

Score actions

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 2 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 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).

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).

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Table 3 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 analysis 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 have 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).

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4 Discussion

Main findings

Prioritization mechanisms are necessary to facilitate the current demand for skilled healthcare workforce, particularly competence to support national eHealth work agendas (Kaufman et al. 2014; Smith et al. 2011a). The overall message of this prioritization study suggests that actions to improve IT skills competence among healthcare workforce in the EU should concentrate on improving workforce training, inclusion of healthcare workforce in the development of eHealth solutions, raising awareness of eHealth as well as improving learning arrangements. The results are general in line with the recommendations from a recent eHealth Stakeholder Group report (EFN 2014) that focus on eSkills and health workforce.

Of the top ten actions, five were related to training among healthcare workforce, which reflects the significance of continuous training in IT skills development since the gap between current curriculum and eHealth (Sieber 2009; Ornes & Gassert 2007). The importance of training for healthcare workforce in the use of new technologies was also acknowledged in several studies as well as a Green Paper on the EU health workforce (Smith et al. 2011b; Ehnfors & Grobe 2004; European Social Network 2009). Moreover, the results showed the great need of involving healthcare workforce in decisions on introducing eHealth, as well as in designing, testing and deploying eHealth. Similar results were also demonstrated in another study, user involvement is perceived as crucial to ensuring acceptance in the long term (The Chain of Trust Consortium 2014). Furthermore, improving learning arrangements was considered as an essential approach to improve the workforce IT skills. It has been identified by Rachel (Fields n.d.) that being limited or with not enough access to technology was one of the top ten challenges faced by healthcare workforce.

The 2012 Action Plan for the EU Health Workforce from the European Commission (EUROPEAN COMMISSION 2012) outlined three priority areas of actions to

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promote a sustainable healthcare workforce: forecasting workforce needs and improving workforce planning methodologies, anticipating future skills needs in the health professions, and share good practice on effective recruitment and retention of health professionals. However, the two actions related to identify the IT skills needed did not feature as highly despite being crucial for future workforce plan. These lower prioritization were due to the concerns on the maximum impact on IT skill improvement.

Two exception actions addressed training issues, "introduce online training tools" and "training on potential workforce", respectively, were ranked low priorities. Although a recent systematic review of the effectiveness of online eLearning suggested that eLearning possibly superior to traditional learning (George et al. 2014), experts probably feel the actions were not deliverable, affordable, and sustainable.

Scores for feasibility and effectiveness of the 23 actions were relatively higher than deliverability and maximum impact. For instance, while the action "Guarantee the governance for education and training" scored 82.3% on feasibility, it scored poorly on deliverability (53.2%). This illustrates the fundamental characteristics of health system delivery across the EU.

Methodology consideration

Alternative methods

There exist a number of comprehensive approaches to set priority in health research, which provide structured, detailed, step-by-step guidance for the entire priority setting process. Except the CHNRI approach, other common approaches are 3D Combined Approach Matrix (CAM), Essential National Health Research (ENHR), and Burden of Disease Approach to priority setting (Viergever et al. 2010; Gabriela Montorzi et al. 2010).

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The CAM offers a structured framework to identify, explore and analyze a large amount of information for priority setting and takes into account the influence of different actors and factors (Global Forum for Health Research 2009). It allows a multidimensional approach by integrating the public health, the institutional, and the equity dimensions. The process for deciding on priorities is consensus-based on all available and relevant information rather than individual knowledge and judgment. The strength of the CAM lies in its flexibility and diversity of application (Ghaffar 2009). However, the approach is highly time-consuming and does not represent an algorithm for priority setting by ranking competing options, or differentiating the strategies according to their priority (World Health Organization 2008).

The ENHR approach provides guidance for health priority setting in the areas of resource allocation and donor investment on national-level (Uneke et al. 2013). It's a participatory and transparent process that involves stakeholders from multilevel. The method mainly address the issue of equity and social justice, which pays a great attention to the most vulnerable groups of the population (Gabriela Montorzi et al. 2010). But the decisions on funding based on individuals' knowledge may bias the priority results.

The Burden of Disease Approach relates research on burden of disease, cost-effectiveness, and financial flows (Gabriela Montorzi et al. 2010) . The method can be used to assess the benefits of health interventions as improve professional training curricula in public health, but requires sophisticated health information system and high statistical expertise.

Another method considered for this study was the Delphi approach, which has been used in several study for priority setting (Byrne et al. 2008; Browne et al. 2002). The Delphi refers to *"a type of survey research that is used to question a panel of experts regarding an issue, and then through sequential structured feedback and response by the same panel, to determine the consensus of the group"*(Rudy 1996). The process

involves background reading, expert interaction and consensus on priority through three round discussion. Nevertheless, in Delphi approach, the entire process and outcome can be easily influenced by one strong voice, resulting in inaccurate evaluations that gather support for certain issues. Comparison between CHNRI and Delphi approaches conducted by Global action plan for prematurity and stillbirth meeting illustrated that the individuals would eventually advance the ideas in the Delphi approach which originally resonated with them since it was too difficult to remember all pros and cons of all possible options throughout the whole process (Dean et al. 2013).

One alternative method for data analysis is thematic content analysis. It is a method for identifying, reporting, and analyzing patterns (themes) within the data (Floersch et al. 2010). Usually, patterns are detected by comparing units of text and sorting them into categories of umbrella and subthemes. However, thematic analysis does not use a constant comparative method and lacks of established analysis procedure. The process focuses on the human experience subjectively. In contrast, grounded theory aims to quantify content in a systematic and reliable manner, allowing the theory to emerge from the data itself.(Floersch et al. 2010)

Strength and limitations

The main strength of the CHNRI methodology over the alternative approaches can be summarized as: (i) clearly defined context and key criteria that qualify some actions as a funding priority over the others; (ii) transparent process for individual input and decision making in priority setting; (iii) systematic way in scoring actions, thus limiting the influence of individual biases on the outcome; (iii) prevent individuals from dominating the process; (iv) an intuitive quantitative outcome that is easy to justify and understand; and (v) incorporate the opinions of stakeholders and wider public.

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Still, the methodology is not free of some possible biases. First of all, the method name may be confusing for experts since this study had nothing to do with child health. Although the methodology attempts to involve a wide range of opinions from the participants, many good ideas may not have been included in the initial list of actions. This CHNRI study differed from previous exercises by the way to list initially actions. According to the CHNRI guideline, the options should be listed in three research domains, including health research to assess burden of health problem, health research to improve performance of existing intervention, and health research to develop new interventions (Rudan et al. 2008), which is beyond the scope of this study. The listing process ended up with open-end questions that may result in multilevel answers from experts. Although efforts were made to phrase the initial actions in a better way, the process was done only by the main authors and some phrased actions may still confusing for experts. In addition, experts understanding in "IT skills competence" and "healthcare workforce" would be a bias on the outcomes.

Another concern over the CHNRI process is that the possible bias regarding the opinions of a very limited group of experts and the results from the choice of the experts. As the study was based on EU-level, the experts participated the study only covered 18 EU countries. Although the US experts also involved the studies, their opinions were generally in line with the EU experts. The concept of "healthcare workforce" relates to a broad range of individuals with both clinical background and non-clinical background (WHO 2006), however, not every expertise was involved and balanced among experts. The number of individuals who possess enough experience, expertise and knowledge on IT skills competence among healthcare workforce to evaluate the actions presented is rather limited.

The CHNRI methodology is not free of bias that results from scoring process. In order to improve the responsiveness of experts and decrease the burden of scores, a minor change was made to score the actions by answering one question per criteria rather than three questions according to the CHNRI guideline. It could affect the accuracy of

results to some extent. As for the calculation of priority scores, the answers "yes" got 1 positive point, "no" got 0 - no extra point, if it is "undecided", a positive grade (0.5) still add to the achieved sum. Nevertheless, comparing to other priority setting methodologies mentioned above, the CHNRI approach is prominently featured in the special algorithm and limiting the individuals' bias on the outcomes.

Validity and reliability

The fundamental principle of CHNRI methodology is "wisdom of crowds", which refers to the process of taking into account the collective opinion of a group of individuals rather than a single expert to answer a question (Brand 2012). It has been shown that the average of collective guesses is often better than any expert judgment. By giving each individual the equal right and opportunity to express their own judgment, the personal biases that each one brings to the process tend to negate and diminish, regardless of the participant selection. Following the CHNRI guideline, the same action was scored by a larger group multiple times that improves the degree of accuracy.

Future work

The results from this study present a first step towards identifying the priorities of actions needed to improve the IT skills competence among healthcare workforce. Further research that includes experts with more expertise in healthcare is essential to better characterize all actions that needed for adoption of health information technology among workforce. One of the interesting approaches is to incorporate opinions from wider public who are interested in priority setting in health area but lack of expertise to list actions. In this way, the final priority score for each action will contain the input from both experts and the stakeholders. Graduate medical students may represent a significant group as most of actions will help them to develop the IT skills competence.

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The CHNRI methodology ensures transparency in scoring process, therefore, it offers the potential to expose the points of the greatest agreement and the greatest controversy among the experts (Rudan et al. 2008). In this case, in addition to the information on how each action fulfills with the chosen priority setting criteria, information about the amount of agreement between the experts on each action could also be obtained. Since the study context and other components of the contexts may change over time, actions can be taken so research portfolio will continuously be adjusted to the context and aim, including: (i) adding further actions to the list; (ii) adding additional criteria; (ii) re-scoring all actions in the redefined context.

5 Conclusion

This study aimed to recognize what actions are important to develop the IT skills competence among healthcare workforce from the perspectives of different experts at European level and to identify the priorities of the identified actions. A diverse group of experts in healthcare listed a large spectrum of actions and scored the listed actions. All the information from experts was collected by web-based survey.

A final list of 23 actions were listed and scored by experts with backgrounds in nursing, pharmacy, medicine, health informatics, education, standardization, eLearning and eHealth. The findings are a clear call for attention to integration of eHealth in current curricula, training for both educators and healthcare workforce, raising awareness of the importance of eHealth and inclusion of workforce in the development of eHealth solutions.

This study firstly explored the actions needed to develop IT skills competence among healthcare workforce using CHNRI methodology and systematically ranked priority list for generates specific suggestions. It is definitely clear that more researches in this field are required in order to provide comprehensive understanding of actions needed to foster IT skills competence for healthcare workforce at different levels.

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Figure 1 CHNRI methodology process

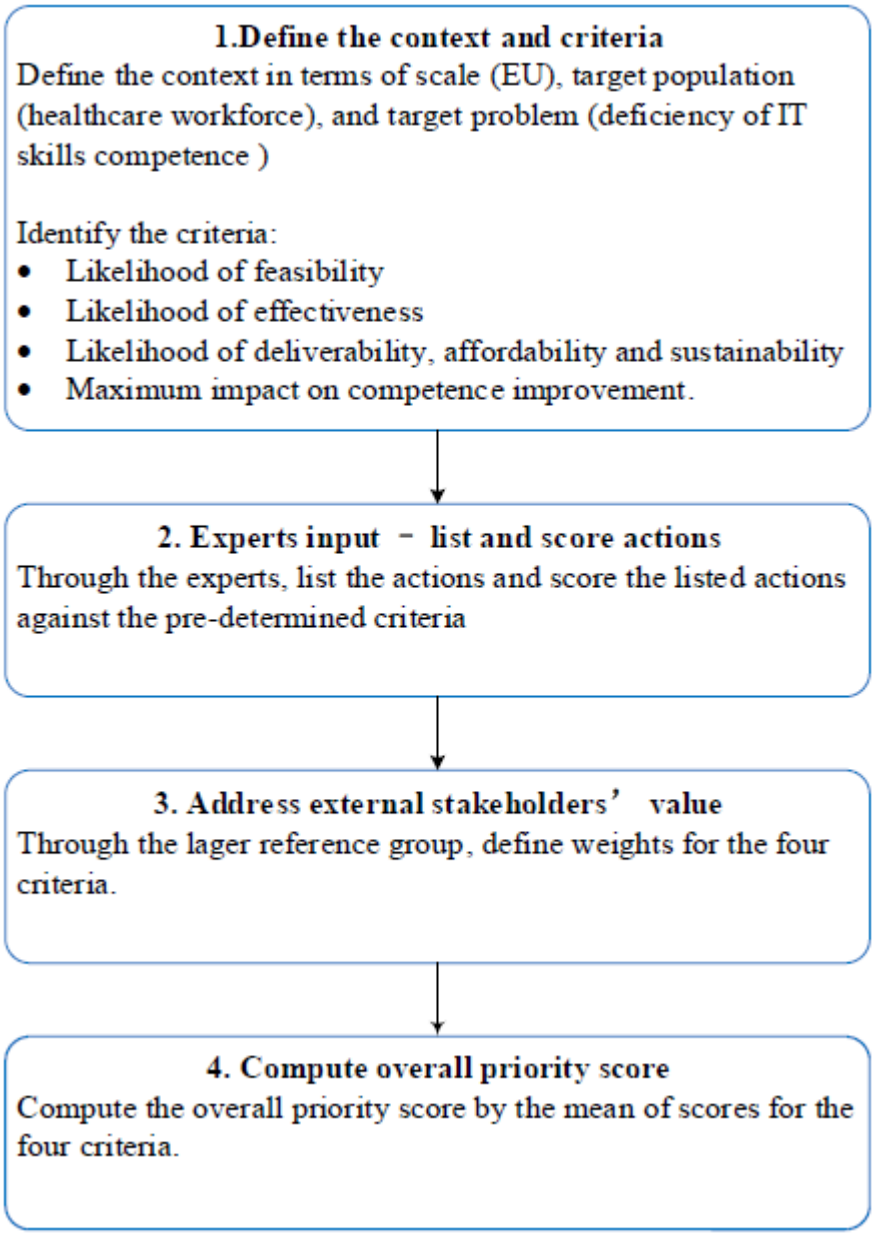

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Figure 2 Experts recruitment process

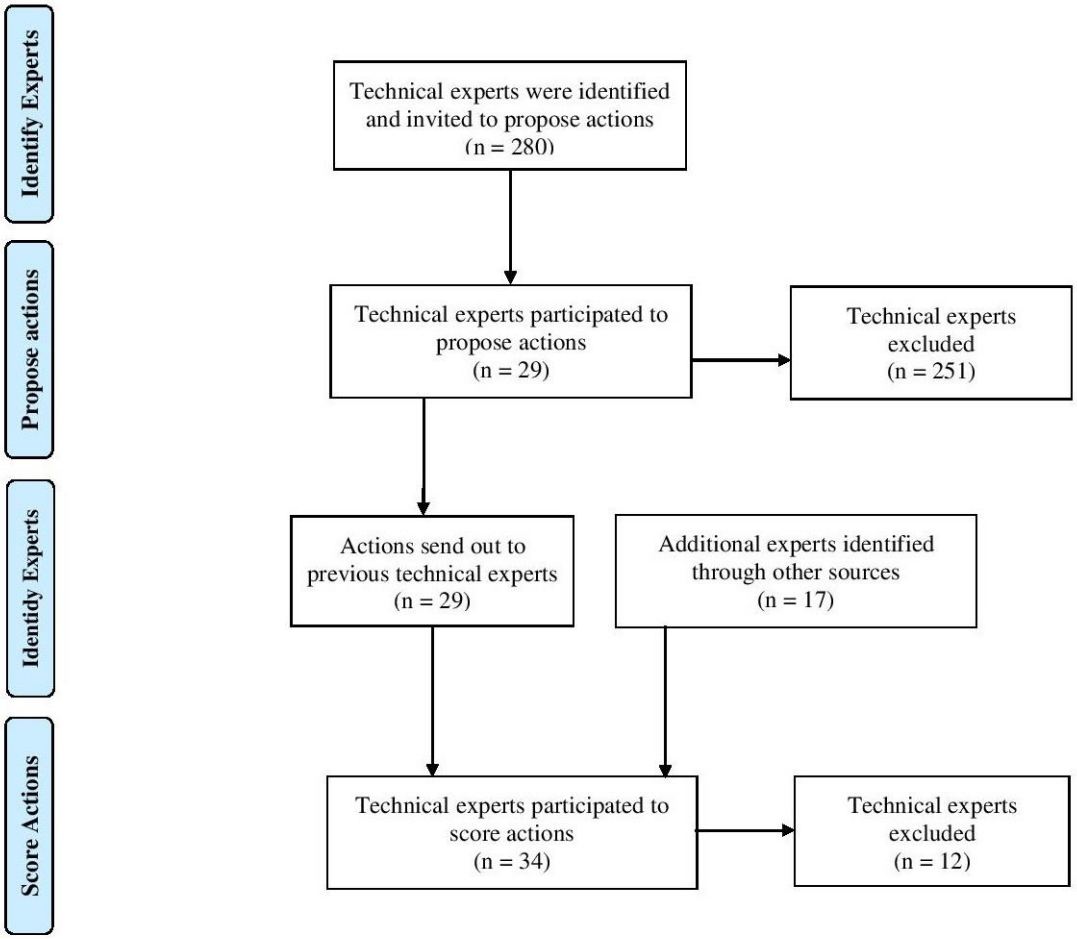

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Figure 3 Information about the participants' areas of expertise

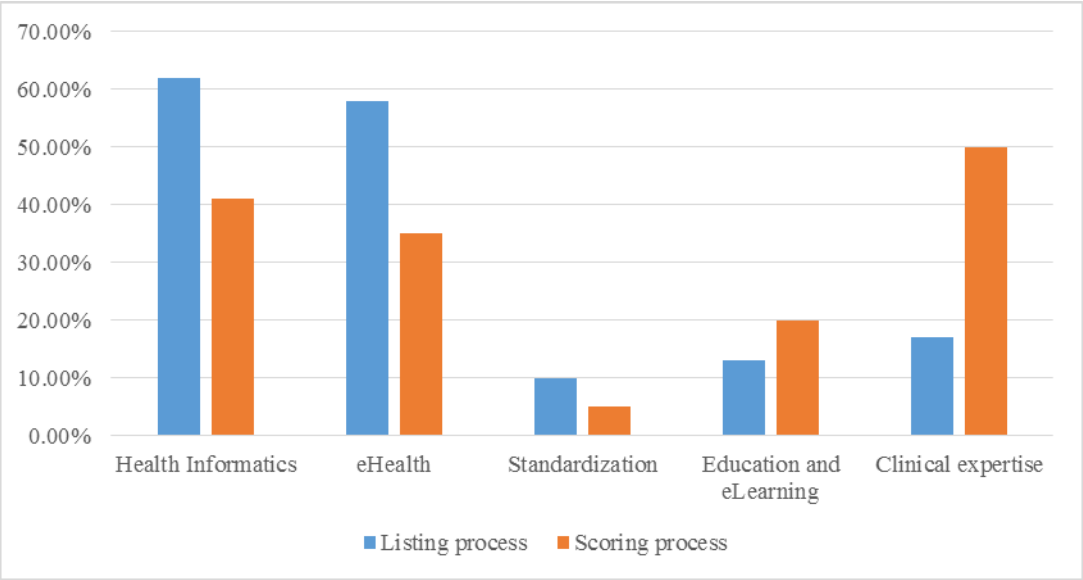

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Table 1 List of summarized actions

Number	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)

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23	Increase research in user acceptance of IT for healthcare workforce

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Table 2 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**

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Table 3 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**

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