International Journal of Medical Informatics 133 (2020) 104032

Contents lists available at ScienceDirect

International Journal of Medical Informatics

journal homepage: www.elsevier.com/locate/ijmedinf

A national eHealth vision developed by University Medical Centres: A concept mapping study

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ARTICLE INFO

Keywords:
eHealth
Telemedicine
Concept mapping
Vision
Health policy

ABSTRACT

Background: EHealth solutions are envisaged to contribute significantly to a sustainable healthcare system. Between 2016 and 2018 the eight Dutch University Medical Centers (UMCs) received Dutch Government's funding to undertake research into the clinical impact, cost-effectiveness and ethical consideration of eHealth. The UMCs collaborated within the consortium *'Citrien fund (CF) program eHealth'* and found that, in order to increase the value of eHealth in routine care, a national vision on eHealth developed by the UMCs was warranted.

Objective: The objective of this paper was to elucidate the process of the 'Netherlands Federation of UMCs (NFU) eHealth vision' development by describing the results of the performed concept mapping study.

Methods: A concept mapping approach was followed. Sixteen members of the steering committee of the *CF program eHealth* were selected as participants. First, each member selected relevant objectives from the eight individual UMC eHealth vision documents, which was to be incorporated into the overall 'NFU eHealth vision'. Second, objectives were rated for necessary to be included in the vision document and the need to achieve the objective within five years. Thereafter, the objectives were sorted into self-created thematic clusters. And finally, the concept map with the thematic clusters and corresponding objectives was discussed with the steering committee to determine the major themes of the 'NFU eHealth vision'.

Results: 38 objectives were determined by the steering committee and grouped into the following 6 thematic clusters on the concept map: 'patient participation and empowerment'; 'infrastructure'; 'education and research'; 'multi-disciplinary care'; 'organisational restructuring'; and 'essential conditions for development of eHealth solutions'. After discussing the concept mapping results with the steering committee, the following five major themes were determined to be addressed in the vision document: 'patient and caregiver'; 'research and innovation'; 'education'; 'organisation of care'; and 'essential conditions for development of eHealth solutions'.

Conclusion: Concept mapping was successfully applied to conceptualise the different values and opinions of the eight Dutch UMCs in order to develop a national vision on eHealth. This vision document will give direction to the development, evaluation and implementation of eHealth in the eight Dutch UMCs and their adherent healthcare providers.

Abbreviations: CF, citrien fund; UMCs, University Medical Centers; NFU, The Netherlands Federation of UMCs (in DutchNederlandse Federatie van Universitair Medische Centra)

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https://doi.org/10.1016/j.ijmedinf.2019.104032
Received 23 September 2019; Received in revised form 7 November 2019; Accepted 8 November 2019

1. Introduction

The financial and resource pressures facing healthcare systems today are likely to increase because of ageing populations and changing patterns of disease. In order to be able to foster quality of care in the long run, sustainable innovations are needed [1].

A promising theme that might be able to make a difference is 'eHealth' [2]. This paper uses the definition of 'eHealth' by Eysenbach (2001): 'e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies' [3,4]. Also, the World Health Organisation's (WHO) classification of digital health interventions (2018) gives a clear overview of the existing classes of eHealth solutions that are available nowadays, such as targeted client communication, prescription and medication management, health financing and data coding [5]. In the Dutch UMCs, all types of eHealth solutions are used. For example, in several medical centres patients can contact their doctors via e-consult or are involved in the process of medication verification by means of eHealth. By the use of eHealth solutions, expectations are that healthcare processes can be carried out more efficiently, and subsequently time and costs can be saved [6–8]. Increased patient participation, enhanced patient empowerment, and improved quality of care are also seen as important potential benefits of eHealth [9–11].

Although expectations are high, evidence about clinical and cost-effectiveness of eHealth solutions are scarce and implementation is still limited [6,12–15]. Barriers mentioned in literature are lack of suitable evaluation methods, lack of technical skills of users, resistance of changing workflow, and lack of interoperability of IT-systems [16–18]. It has been suggested that these barriers could be eliminated by a focused healthcare policy and political commitment concerning eHealth [16]. Therefore, sustainable funding for development and implementation of national eHealth programs and the development of national eHealth strategies, is essential.

The eight University Medical Centers (UMCs) in the Netherlands are internationally recognised for their clinical excellence, education and science. Collectively, they are organised in the 'Netherlands Federation of UMCs' (NFU). Due to the close interconnectedness between patient care, education, and science, the Dutch Government identified the UMCs as key drivers of healthcare innovation in the Netherlands. To support the UMCs with their task of leading innovation in healthcare, funds were made available by the government under the name 'Citrien fund (CF)' between 2014 and 2018. Five major themes were addressed within the CF: 'registration at the source', 'oncology networks', 'action or inaction', 'directing for quality', and 'eHealth'. This paper focusses on the *CF program eHealth*.

One of the aims of the *CF program eHealth* was to constitute a national vision on eHealth, known as the 'NFU eHealth vision'. This vision described the core eHealth strategy the Dutch UMCs would follow for the next few years. In order to develop the 'NFU eHealth vision', a concept mapping approach was chosen, so as to aggregate, conceptualise and structure the different values and opinions of each UMC. The objective of this paper was to elucidate the process of the 'NFU eHealth vision' development by describing the results of the performed concept mapping study.

2. Methodology

2.1. Study design

The concept mapping study, to support the development of the 'NFU eHealth vision' development, took place between September 2017 and September 2018. Concept mapping is a mixed-methods approach, developed by Trochim et al. (1989), that can be used to elicit, structure and aggregate values and opinions from individuals [19,20]. The study results in a graphical map, called 'concept map', that displays the objectives expressed by participants and the relationships between these objectives. The five steps of a typical concept mapping study were followed: (1) *preparation* including the selection of *participants*; (2) *generation of objectives*; (3) *structuring of objectives* through rating and sorting; (4) *concept mapping analysis*; (5) and a final interpretation of the concept map by study participants and stakeholders in view of its future use [19]. The Concept System® Global MAX™ online software was used in phase three and phase four of this concept mapping study.

2.2. Preparation and participants

Purposive sampling was used to select study participants. The *CF program eHealth* was coordinated by a steering committee that consisted of two representatives from each UMC. The 16 members were officially appointed by the board of directors of their own UMC, to give direction to the *CF program eHealth* and to make decisions on behalf of their UMC. All members shared a mutual interest and expertise in eHealth, but had different professional backgrounds from medical doctors, policy makers to senior researchers. All committee members were chosen as participants in this concept mapping study.

Prior to this study the eight UMCs drafted individual vision documents describing themes concerning eHealth they wanted to address in their own institutions. No background information or instructions on how to draft the individual visions were given. These vision documents served as input for the second phase of the concept mapping study: generation of objectives.

2.3. Data collection

2.3.1. Generation of objectives

To generate a set of objectives that might incorporated into the 'NFU eHealth vision' document, each participant was asked to screen the eight individual eHealth vision documents drafted by the UMCs and to select at least three and at most seven of the objectives that were mentioned in each individual UMC document. An objective was considered relevant for inclusion in the final set of objectives, and thereby incorporation into phase three of the concept mapping exercise 'structuring of objectives', if at least four committee members selected the objective. Also, to have a comparable number of selected objectives per UMC, a maximum of seven objectives per UMC vision was allowed. The selection of objectives was discussed with the steering committee to check if any relevant objectives were missing and should be added to final set of objectives.

2.3.2. Structuring of objectives

This phase is also referred to as 'sorting and rating' phase [21]. The final set of objectives that was composed from the selection of objectives from the eight individual eHealth vision documents in the previous phase, was entered by the coordinating researcher (AR) into the online Concept System® Global MAX™ webtool and served as the input for the sorting and rating exercises.

For the sorting exercise, participants were instructed to compile the objectives into self-created thematic clusters and to provide a name for each cluster. The theme-names should have represented the major themes of the definitive 'NFU eHealth vision' document. For the rating exercise, participants were instructed to answer, the following questions, by using a 4 point-Likert scale, ranging from 1 'unimportant', to 4 'very important': 1) 'How necessary is it to include the objective into the vision document?', and 2) 'How important is it to achieve the particular objective within five years?'

In addition, all participants were asked to fill out a short questionnaire containing four general background questions about their age, gender, professional background and the UMC they represented.

2.4. Data analyses

2.4.1. Concept mapping analysis

By the use of the Concept System® Global MAX™ online software, a sequence of multidimensional scaling and hierarchical cluster analyses were conducted to produce visual representations of the relationships among the identified objectives [22,23]. First, sorting data of each participant were compiled into a 'similarity matrix' that shows how often objectives were sorted together. Second, the software applied a multidimensional scaling algorithm to plot points on a data point map, resulting in a two-dimensional map in which each objective is depicted as a point. Subsequently, a hierarchical cluster analysis was performed to identify interpretable and relatively homogeneous clusters of objectives. Concept maps were inspected from a seven-cluster to a three-cluster option. Two reviewers (JH and AR) assessed which objectives were aggregated into each cluster when the number of clusters was reduced. After selecting the best number of clusters, each single objective on the concept map was reviewed. If an objective seemed to belong to an adjacent cluster it was reassigned to that particular cluster. Finally the clusters were labelled, based upon the theme-names suggested by the participants.

As described in paragraph 2.3.2. all objectives were rated on two dimensions: 'necessary to include in vision' and to 'achieve within five years'. Each mean rating score was plotted on a 'Go-zone' graph. Subsequently, this scatterplot was divided into four quadrants, using the overall mean of each dimension. For example, the upper right quadrant contains objectives with values higher than both means of the two dimensions. The objectives situated in the upper right quadrant were used to constitute the major eHealth goals to be accomplished by the UMCs in 2020, as described in the 'NFU eHealth vision' document.

2.4.2. Interpretation and utilisation of a concept map

The final results of the concept mapping study were discussed with the steering committee. The committee members were asked to decide on the definitive theme-names of the clusters. They were also asked if there were any objectives, that were not depicted on the concept map, but that should be included in the 'NFU eHealth vision'. Only if there was consensus among the committee members, an additional objective was added. As a final step, the objectives were presented to and discussed with members of several other healthcare organisations outside the UMCs. The results from the concept mapping study and transcendent discussions served as a solid framework to draft the 'NFU eHealth vision' document.

3. Results

3.1. Generation of objectives

All 16 steering committee members participated in all phases of the study. The mean age was 48 years (SD 31–63), 11 members were male, and 12 had a (para)medical background. The phase 'generation of objectives' yielded a list of 38 objectives that should be included in the 'NFU eHealth vision'.

3.2. Sorting and rating

During the sorting exercise the individual participants sorted the 38 objectives into 3–16 thematic clusters per participant, with a mean of 7.3 (SD 3.4) clusters.

For each objective, the mean rating scores on the questions 'necessary to include in vision' and 'achieve within five years' are described in the Table 1 and visualised in Fig. 2. Objective 3 (innovation is always carried out in collaboration with the patient, because the patient is an expert in having that particular disease) received the highest mean rating scores on both questions (3.6 and 3.4 respectively). On the contrary, objective 30 (Information exchange between healthcare partners in- and outside of the Leiden UMC (LUMC): if possible there will be actively looked for partners outside of the LUMC to share knowledge with, to upscale projects to and to develop and execute projects with) received the lowest mean rating scores on both questions (2.0 and 2.1 respectively).

3.3. Concept mapping analysis

Our final analysis revealed that the sorted objectives could best be grouped into a final concept map with six distinct thematic clusters: 'patient participation and empowerment'; 'infrastructure'; 'education and research'; 'multi-disciplinary care'; 'organisational restructuring'; and 'essential conditions for eHealth solutions'. Each cluster contains four to eight objectives (Fig. 1). Table 1 represents the content of each cluster by describing the overall cluster name, the objectives that are included within each cluster and the mean rating scores for each cluster.

The mean cluster rating scores on the rating question 'necessary to include in vision' ranged from 3.1 (cluster 'patient participation and empowerment') to 2.3 (cluster 'infrastructure'). The mean cluster rating scores on the rating question 'achieve within five years' ranged from 3.2 (clusters 'patient participation and empowerment' and 'multi-disciplinary care') to 2.9 (cluster 'organisational restructuring').

As represented in the upper right quadrant of the 'Go-zone' graph, 15 of the 38 objectives had an above average mean rating score on both rating questions (Fig. 2). The majority of the objectives in the upper right quadrant belonged to the 'patient participation and empowerment' cluster.

3.3.1. Interpretation and utilisation of concept maps

After an interactive discussion about the results, the steering committee decided that almost all of the thematic clusters that were identified in the concept map of this study could be included into the 'NFU eHealth vision' document. After minor adaptations, the following five major themes are addressed in the 'NFU eHealth vision' document: 'patient and caregiver'; 'research and innovation'; 'education'; 'organisation of care'; and 'essential conditions for development of eHealth solutions'. As for the 38 objectives that were identified, the committee and some representatives of healthcare organisations outside the UMCs felt that not all the eHealth objectives they deemed relevant for the future were covered. Therefore, objectives such as 'patient portals', 'eHealth literacy', 'value based health care', and 'artificial intelligence', were added to the final vision document. Text Box 1 provides a summary of the 'NFU eHealth vision' document that was published on December 2018.

4. Discussion

By conducting this concept mapping study it was possible to streamline the different values and opinions of the eight Dutch UMCs on what eHealth objectives they should address collectively in the next five years. Because of the UMCs' task of leading innovation in healthcare in general, this vision can be applied nationwide, and possibiliy even outside the Netherlands. Five major themes - *'patient and caregiver'; 'research and innovation'; 'education'; 'organisation of care'; and 'essential conditions for development of eHealth solutions'* – were agreed upon by the steering committee in this concept mapping study, and were used to constitute the 'NFU eHealth vision'. Because participants worked at UMCs it might not be a surprise that the themes 'research' and 'education' are part of the five major themes. On the other hand, it is interesting to observe that the 'patient participation and empowerment' cluster represented the greatest share of objectives with above average mean rating scores. This implicates that the objectives that concern 'patient participation and empowerment' are of great importance to UMCs, even more than the core tasks 'research' and 'education'. This observation is consistent the current Dutch healthcare system, which is

Table 1
Thematic clusters and objectives suggested by participants, with mean rating scores for both rating questions.

Cluster	Nr.[a]	Objective	Necessary to include in vision	Achieve within 5 years
1. Patient participation and empowerment			3.1	3.2
	3	Innovation is always carried out in collaboration with the patient, because the patient is an expert in having that particular disease.	3.6	3.4
	14	Self-management and self-reliance are important.	2.8	2.9
	15	Demonstrable interaction with the patient.	3.2	3.3
	17	Positive effects of applying eHealth are: strengthening the position of the patient (empowerment), increasing involvement of patient and family in the treatment process, and an increase of self-management and prevention. However, everything should be focused on the continuity of care and the creation of trust and also convenience.	3.0	3.1
	32	Thanks to eHealth, patients are able to make better choices and / or take more control of their illness, recovery and health.	3.4	3.4
	35	Decide better together.	2.8	3.1
	18	Patient participation is essential for the successful implementation of eHealth.	3.3	3.3
	28	Provide care when it is actually needed or desired.	2.9	3.3
2. Infrastructure			2.3	2.7
	4	Remote healthcare.	2.5	3.1
	11	A Blue Button-like facility is desirable.	2.1	2.9
	30	Information exchange between healthcare partners in- and outside of the Leiden UMC (LUMC): if possible there will be actively looked for partners outside of the LUMC to share knowledge with, to upscale projects to and to develop and execute projects with.	2	2.1
	25	Refinement and upscaling of the patient's care continuum.	2.3	2.6
	1	We assume that the new hospital bed is at home. Only if the hospital-specific infrastructure is really needed, patients are admitted, as short as possible.	2.8	2.7
3. Education and research			2.8	3.1
	2	If applicable, we work according to an 'evidence-based participatory design approach', involving all stakeholders. Such as, network partners from the null, first and second line. Health insurers and technological or other cooperation partners will be involved.	2.7	2.9
	5	We link eHealth initiatives to scientific research as much as possible.	3.1	3.3
	21	The development, deployment and outcome of eHealth solutions are scientifically monitored and evaluated.	3.0	3.4
	27	Short-cycle learning trajectories; to give room to eHealth innovators, a development environment is needed in which eHealth concepts can be tested in short timelines. If desired, it is important that promoters receive support where possible and in a structured way.	2.6	3.1
	31	Measuring, collecting and evaluating key data from the new process.	2.6	3.1
	33	Education of medical students takes place on the eHealth theme.	2.9	3.3
	38	Measuring cost-effectiveness.	2.9	3.1
	23	Education is provided for care providers on how to deal with decision aids and 'shared decision making'.	2.4	2.9
4. Multi-disciplinary care			3	3.2
	6	Person-oriented and achieved through better coordination between healthcare providers.	3.3	3.4
	8	The main users are those who provide care (doctors, nurses, and others) and those who receive the care (patients, and people who care for the patient). Because care is 'chain-wise' structured, also related specialties and care providers (other institutions, pharmacy, general practitioner and home care) are involved.	2.6	2.9
	9	Thanks to eHealth, healthcare workers are better able to fulfill their role and to ensure that the care process is better aligned with the personal situation of the patient and his or her loved ones.	2.9	3.4
	12	Digital for those who are able to and want to. Hereby we also create time for those who are not able to, or do not want to, or need extra personal attention.	3.1	3.2
	34	eHealth must offer solutions / added value for challenges in healthcare experienced by healthcare providers / patients and their loved ones.	3.1	3.0
5. Organisational restructuring			2.7	2.9
	7	Coming to a sustainable new way of providing care.	2.9	2.9
	22	Content and organisation of care are leading. ICT developments and possibilities follow.	3.1	3.3
	24	Providing the best possible care and improving health in the region.	2.3	2.5
	26	eHealth development is concerned with the reorganisation of healthcare with the support of IT.	2.6	2.9
6. Essential conditions of eHealth solutions			2.7	3
	10	Co-creation stand in the middle: if appropriate together with patients, with healthcare providers from the healthcare network, with health insurers and with the various involved disciplines.	3.2	3.1
	16	Complicated balance between privacy and patient involvement remains a constant concern. As well as cyber security.	2.6	3.1

(*continued on next page*)

Table 1 (*continued*)

Cluster	Nr.[a]	Objective	Necessary to include in vision	Achieve within 5 years
	19	A promising innovation is further developed towards broad application and implementation.	2.6	3.1
	20	Convenience is important.	2.4	2.8
	36	It is important to stay ahead of 'digital fragmentation' in an organisation.	2.6	2.8
	29	Demonstrably distinctive quality, personal care, efficiency and sustainable networks.	2.4	3.1
	13	An eHealth solution is here primarily a means not an end in itself and are appropriately deployed to ensure that the quality and affordability of care are also maintained in the future.	3.1	2.9
	37	We strive to integrate patient care, research and education through smart and tailored technology that reduces health problems and improves quality of life.	2.6	3.1

[a] The number in this column represents the individual objective number, which was randomly designated by the online web tool. The same individual objectives numbers can also be found in Fig. 1 and Fig. 2. Bold objectives number indicate wheter the objective is represented in the right upper quadrant of Fig. 2.

undergoing a transition from a more paternalistic system, to a system in which patients increasingly want to be in control of their own health [9,24]. eHealth solutions are promising in supporting self-management, but attention should be paid to the group of patients with low eHealth literacy when using eHealth solutions [25]. In the 'NFU eHealth vision' document one can read that eHealth should enhance patient participation and self-management, but if patients are less able to use eHealth solutions extra support should be provided.

In literature, concept mapping is described as a valuable method to support the process of reaching consensus between different stakeholders [26–29]. Our study confirmed that concept mapping was a suitable method for reaching consensus, especially in the process of developing a shared vision. One could argue a Delphi-method may also have been a suitable approach for reaching consensus, as suggested by Kruse et al. [16]. However, we particularly sought for a method that would allow for the structuring of different values and opinions of stakeholders into limited rounds of data processing, to overcharge the steering committee, and where 'peer pressure' was not possible, because of the relatively smaller group size [30]. Also valuable information of the 'sorting' and 'rating' exercises could not have been provided by conducting a Delphi study.

One of the strengths of this study was the ability to take into account the variety of values and opinions of the members of the steering committee. Due to the structured concept mapping approach, in which all committee members participated, an eHealth vision was constituted that represents the visions of all eight Dutch UMCs. Since all study participants worked in the UMCs, one could argue that the inclusion of objectives concerning eHealth outside the UMCs was limited. It was aimed to overcome this limitation by discussing the content of the vision with members of several healthcare organisations outside the UMCs. Also, as most participants have worked outside the UMCs themselves, participants were familiar with health-related working settings and culture outside their UMC as well.

A national vison on eHealth was successfully developed. However, to actually implement and use this vision in daily practice the following prerequisites should be taken into account. Faber et al. (2017) investigated eHealth adoption factors in 30 Dutch hospitals and concluded that 'a larger size of the hospital', 'top management support' and 'organisational readiness' are important antecedents for eHealth adoption [31]. Due to acceptance of the 'NFU eHealth vision' by the NFU, the UMCs' coordinating organisation, the boards of directors of all eight UMCs indirectly accept the 'NFU eHealth vision' as well. Also, most of the members of the steering committee have a top management function concerning eHealth within their UMC. Therewith, 'top management support' seems to be covered. The eight Dutch UMCs are among the hospitals with the largest sizes in the Netherlands, having the antecedent 'a greater size of hospital' checked as well. Finally, 'organisational readiness', including topics such as infrastructure, security and financial readiness, should definitely receive attention. To actually have 'organisational readiness' all stakeholders need to participate in the current healthcare transition. This antecedent is not evident at this moment in time and is therefore well described within the major theme 'essential conditions for development of eHealth solutions' of the ‘NFU eHealth vision’ document. Although, the fundamentals for successful implementation of the 'NFU eHealth vision' seem to be in place, close monitoring of actual effectuation is essential.

5. Conclusion

This concept mapping study successfully structured the different values and opinions of the eight Dutch UMCs into 38 objectives and 6 thematic clusters. Based on these results, a national vision on eHealth was developed, comprising the following five major themes: ‘patient and caregiver’; ‘research and innovation’; ‘education’; ‘organisation of care’; and ‘essential conditions for development of eHealth solutions’. The 'NFU eHealth vision' document is meant to give direction to

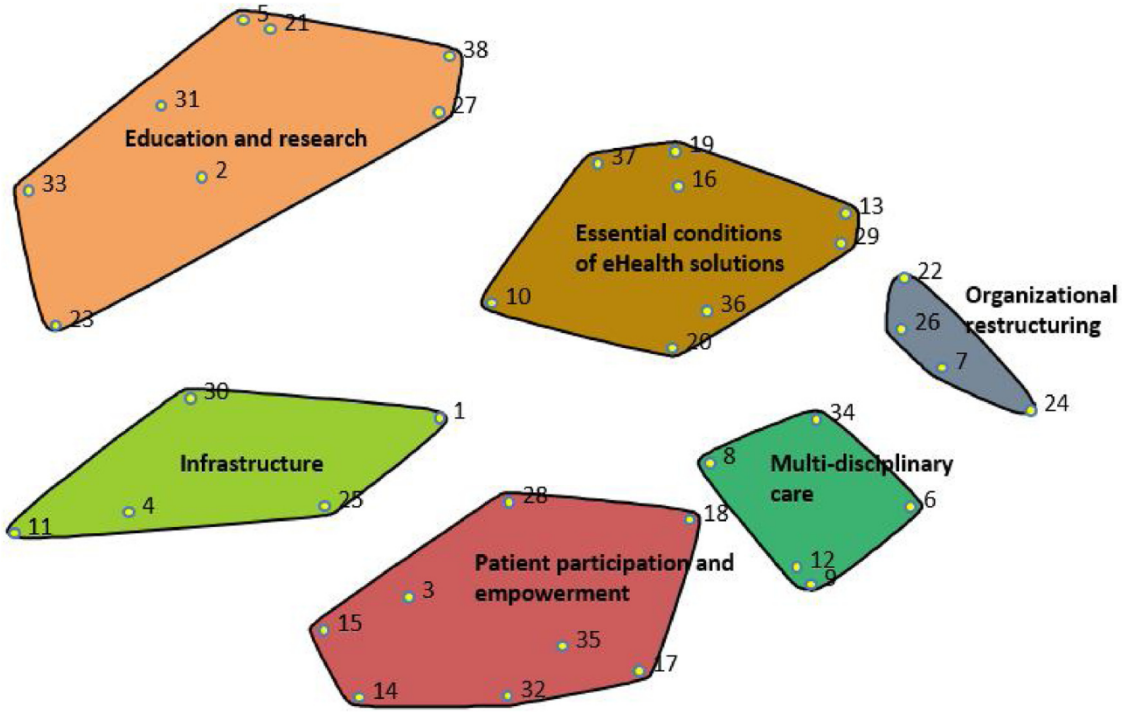

Fig. 1. Concept map with six clusters. Numbers correspond with objectives in Table 1.

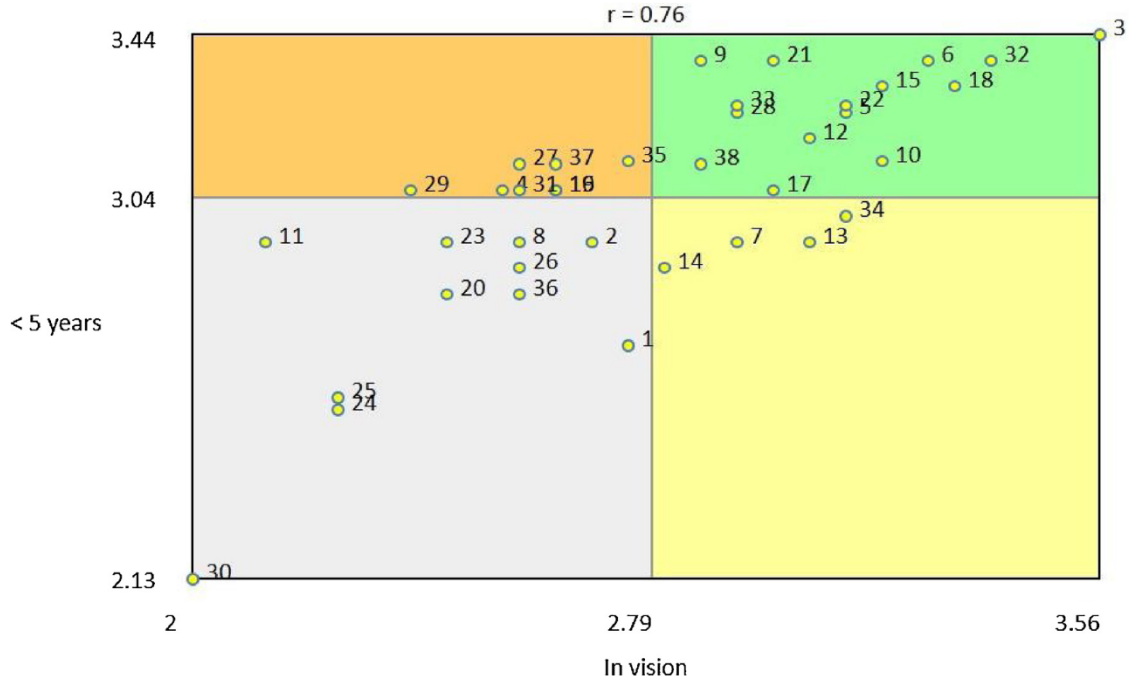

Fig. 2. Go-zone graph showing the mean scores of each objective on the rating questions 'necessary to include in vision' and 'achieve within five years'. A 4 point-Likert scale was used for scoring (1 unimportant, 4 very important). Numbers correspond with objectives in Table 1. The horizontal and vertical line represent the mean rating score of the belonging rating question.

development, evaluation and implementation of eHealth solutions in the Dutch UMCs, and their adherent healthcare providers.

Authors' contributions

AR conceived the original idea for this study. JH assisted with the design and analysis. AR wrote manuscript with critical feedback from JH, MK, NC and MS. All authors contributed to and approved the final manuscript.

Funding

This study was funded through CF program eHealth of the Netherlands Organisation for Health Research and Development (ZonMw). This organisation had no involvement in this study, nor this paper.

Box 1
Summary of the NFU eHealth vision*.

1. Patient and caregiver

- EHealth supports the patient to take control about their own health, illness and recovery. EHealth also supports communication between patients and multiple caregivers.
- In 2020 the UMCs have a similar policy concerning release of results and functionalities of the patient portal.

2. Research and innovation

- Development, evaluation and implementation of eHealth solutions need to be scientifically controlled.
- If possible, innovations will be developed with together with the patient.

3. Education

- In 2020 eHealth is an integral part of all education programs provided to care givers.

4. Organisation of care

- When healthcare processes undergo reorganisation due to eHealth solutions, rearrangement of compensation of costs need to be looked at as well.
- In 2020 the UMCs will have solid network of partners in the region to share knowledge with and execute projects with.

5. Essential conditions for development of eHealth solutions

- For successful development of eHealth solutions the UMCs will take into account the following aspects: usability, data safety and legislation, standardization of data, and funding.

*A complete version of the vision document (in Dutch) can be found on the NFU eHealth website: www.nfu-ehealth.nl/visie.

Ethical approval

Not applicable.

Conflict of interest statement

The authors have no conflict of interests to declare.
Summary Table
What was already known on the topic:

- Potential benefits of eHealth are an increase in patient participation, enhanced patient empowerment, and improved quality of care.
- Concept mapping is a creative method to conceptualise values and opinions from several stakeholders.

What this study adds to our knowledge

- This study identifies the major themes concerning eHealth that the Dutch UMCs aim to focus on in the next couple of years.
- 'Patient participation and empowerment' is considered a very important theme eHealth solutions contribute to.
- A concept mapping approach is highly eligible in reaching consensus in a group of participants with different backgrounds and strong values and opinions.

;1;

Acknowledgements

The authors would like to thank all of the committee members of the *CF program eHealth* for investing their time and effort to participate in this concept mapping study. A special thank you to Zab Moghal (MPhil, Cantab) for providing help with the English Language.

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