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Physicians' experiences of participation in healthcare IT development in Finland: Willing but not able

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ABSTRACT

Objective: To learn (1) about the kind of experiences that physicians have with participation in healthcare IT development; (2) whether physicians are interested in participating in IT development activities, and if so, how; and (3) the visions that physicians have regarding future IT systems.

Methods: A web-based questionnaire which was answered by about one-third of the working-age physicians in Finland, which is exceptionally broad and sizeable a sample. This research deals with only a small part of the entire questionnaire. The questions used for this study were both quantitative and qualitative. Statistical methods were applied to the former and content analysis to the latter.

Results: The responding physicians were highly critical of their IT systems, and their experiences with the current methods of participation, or rather the lack of it, were quite negative. However, a very significant proportion of the respondents were willing to contribute to IT systems development, contrary to a common assumption that clinicians are disinterested. Visioning of future systems was quite cautious, dealing mainly with usability improvements to the current systems.

Conclusions: Major improvements are needed both in the usability of the systems currently in use in Finland and in the collaboration between end-users and developers. Improved methods of participation need to be developed and applied, particularly for the procurement, deployment and on-going development of commercial-off-the-shelf applications.

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1. Introduction

1.1. The need for end-user participation in healthcare IT development

A large body of research supports the argument that healthcare information technology (IT) development should involve end-users, i.e. healthcare professionals as the primary users of these systems.

Firstly, clinicians seem to have a critical attitude towards the adoption and usefulness of healthcare information systems. Studies have indicated that the most significant barriers in electronic health record (EHR) system adoption and use are concerns about the amount of time it takes to use the system [1–3]. Following this, questionnaire studies about

system adoption and user satisfaction have shown worrisome findings. A recent survey of over 10,000 respondents from medical offices in the USA pointed out serious challenges to the appropriate use of patient charts (medical records): 86% of respondents agreed that an incorrect chart had been used for a patient during the past 12 months; 63% indicated that a patient's chart was not available when needed; and 44% stated that a patient's medication list was not updated during the visit [4]. Further, a cross-sectional survey with primary care physicians, which was conducted in seven countries, found significant satisfaction differences with the overall experience of practicing medicine at the information system level [5]. Similar findings have been reported in Finland, where information and communication technologies are widely used in healthcare. Recently, several critical articles have been published in national medical journals [6–10] and the recently published results of a national usability survey indicated that physicians assess their EHR systems very critically [11,12].

Secondly, several researchers have emphasized the need for understanding contextual aspects behind system design and involving end-users in development activities. One may argue that clinical work and processes have characteristics that are typical to the healthcare delivery domain only, and therefore, are crucial for consideration in healthcare IT development: a high degree of communication and collaboration among professionals [13,14], diverse and dynamic working practices [15,16], and governmental and professionals regulations [17]. According to Nykänen and Karimaa, the starting point for development should be to obtain an insight into the healthcare work practices where the information systems are to be used [18]. Toivonen et al. argue that work processes and IT systems should be developed simultaneously [19]. Johnson et al. contend that significant attention should be paid to user-centred design guidelines during healthcare information system development in order to avoid the dissatisfaction and abandonment currently experienced [20]. This argument has been supported by recent empirical study findings that indicate widespread EHR adoption and integrated use among those systems that have been developed in accordance with the principles of user-centred design [21]. Further, Zhang has expressed his concern and experiences with the current state of user considerations in healthcare technology development as follows: "In healthcare the culture is still to train people to adapt to poorly designed technology, rather than to design technology to fit people's characteristics" [22]. This claim has been supported by Bleich and Slack and De Rouck et al., who argue that physicians will become enthusiastic IT users if they find the systems useful and helpful [23]; however, at present healthcare professionals still seem to be lagging behind in participation in IT development [24].

Thirdly, there has been a growing interest towards user-oriented development methods in the field of health informatics research in the twenty-first century. Discussions about user involvement have been dominated by the evaluation approach [25,26], since a number of usability evaluation studies have been published of systems already in use or in trial or prototype stages. Moreover, a structured literature review has indicated usability tests, interviews and questionnaires being the most commonly used methods for user involvement in the healthcare technology lifecycle [27]. How-

ever, in recent years a participatory approach has gained interest in design, too. Among other researchers, Clemensen et al. have proposed that participatory design holds the potential as a research approach that might effectively merge computer technology and health-related interventional research [28]. Also, Pilemalm and Timpka have argued strongly on behalf of participatory assessment, and suggested the use of a participatory design-based method, action design, in the design of a large-scale healthcare information system [29].

User-oriented studies of healthcare IT development typically address issues other than end-users' experiences and opinions of IT development. For example, established usability questionnaires (e.g. Software Usability Measurement Inventory, SUMI [30] and System Usability Scale, SUS [31] questionnaires) focus on human–computer interaction, rather than on user experiences, user support, or IT development and design activities. Additionally, user-oriented research and participatory assessment studies seem to be characterized by short-period projects with an emphasis on summative results. These studies often lack a uniform way to describe how study results contributed to the system's iterative development cycle. Therefore, it remains unclear how the research findings and related development work appear from the end-users' viewpoint. In this article we report results from a national questionnaire study, which aimed at researching clinical physicians' experiences of participation in healthcare system development and their visions of clinical IT tools in the future.

1.2. Healthcare delivery in Finland as a particular context for healthcare IT development

This research reports on a study conducted in Finland. Some particular aspects of healthcare in Finland are thus pertinent to the analysis of the results. The local level of elected government, the municipalities, have by law the primary responsibility of arranging social and healthcare services for the people living in their areas. There were 440 municipalities in 2005 for a population of 5.2 million. Preventive and primary care is organized among 251 health centres operated by individual municipalities or a few municipalities in collaboration, while specialised care, ranging from regional hospitals to central hospitals up to the five university hospitals, is provided by 20 federations of municipalities called hospital districts. The national government has a guiding role only. Public health services are mainly financed from municipal taxes, about 20% of the costs being covered from national taxes. Private healthcare (private clinics and hospitals) covers 31% of all outpatient visits nationally and 65% of specialist visits [32]; it is mainly comprised of specialised out-patient care (clinics with speciality areas such as occupational health, general practice, psychiatry, and gynaecology), which is available mostly in the larger cities. For this, we use a concept "private providers (PP)" [33]

Patient information systems including EHR systems were introduced in the early 1980s. Currently EHR systems are used comprehensively on all levels of healthcare [34,35]. The bottom-up structure of the healthcare system means that each health centre and hospital district has decided independently on which IT systems to procure. All systems are locally

developed, due to the barriers of language, small market size and peculiar healthcare system that have made Finland unattractive to international vendors. The number of different EHR systems currently in use in the three sectors of healthcare are as follows. The two largest vendors share the bulk of the market in all sectors.

- Public healthcare centres (PHC): four systems by three vendors.
- Public hospitals (PH): five systems by four vendors.
- Private provider organisations (PP; clinics and hospitals): six systems by five vendors.

Electronic information exchange among organizations has progressed rapidly: fully interoperable patient data exchange is regionally in operational use in most of the healthcare institutions [34]. Currently, nation-wide healthcare information infrastructure projects and strategies are under development [33,36]. In addition, Finnish healthcare professionals are generally considered to have good information and communication technology (ICT) skills [37]. Existing comprehensive basic IT infrastructure together with healthcare professionals with advanced ICT skills, are seen as strengths in the further development of eHealth systems.

Similar to other industrialised countries, the effects of new technology adaptation seem to be manifold in Finland. The success of healthcare information systems is an ongoing topic of discussion. Several national studies have pointed out both advantages and shortcomings in technology adaptation and its use in clinical settings [38–41]. One can argue that the main challenges for IT development derive from the strongly decentralised healthcare delivery system, a wide diversity of disintegrated information systems in use, as well as the compartmentalized nature of ICT development.

2.   Related research: studies addressing participatory healthcare IT development

Although the relevance of and need for a user-oriented approach in healthcare IT development seems to be widely established and argued, only a few researchers have systematically investigated the effects and practices on user involvement. A literature review by Shah and Robinson on the benefits of and barriers to involving users in medical technology development revealed that the main benefits of user involvement are associated with an increased access to user needs and experiences, enhancements in design and user interfaces, and improvements in the functionality, usability, and quality of applications [42]. On the other hand, the review determined some key impediments in involving users: lack of resources, communication and cooperation between users and developers, attitudes of technical developers, lack of understanding and appropriate knowledge about methods to be used [42]. Furthermore, it has been argued that in healthcare IT system development there is a need for designers who have user interface and interaction design skills [43].

In addition, research on participatory healthcare technology development has paid relatively little attention to the viewpoint of the *developer–end-user* and *vendor–healthcare*

provider–physician collaboration. Heeks introduced the concept of "design–reality gap" with reference to misunderstandings and mismatches between the current realities and design conceptions of healthcare information systems [44]. He identified the two key stakeholders as system designers and end-users. Typically, empirical studies have not addressed these issues. As an exception, a user satisfaction study by Edsall and Adler included a question about the support and service provided by vendors [45]. The results indicated that the physician respondents were generally happy with the service provided by their EHR companies. On the other hand, results from other empirical usability studies have encouraged the researchers to suggest recommendations and approaches for enhanced collaboration. Johnson et al. [20] and Armijo et al. [46] stress the need for a multidisciplinary approach and collaborative effort between vendors, researchers, physicians, administrators, and others. Edwards et al. [47] argue for healthcare providers to promote a participatory development approach when selecting healthcare IT vendors. They suggest a selection criterion related to end-users' feedback on system use in order to provide the vendors data for further development work and improvement in their products' usability characteristics.

3.   Objectives of the study

The growing interest towards end-user issues in health informatics derives from established study results and challenges in system development. This paper reports results relating to physicians' experiences in healthcare IT development in Finland. Its objective is to contribute to the discussions on practices in participatory healthcare technology development by answering the following research questions:

1. What kind of experience do physicians have regarding participation in healthcare IT development?
2. Are physicians interested in participating in IT development activities? If so, how?
3. What are the visions of physicians regarding future IT systems?

In health informatics research several concepts are used to refer to end-user participation in information systems development. Probably the most commonly applied include user involvement [27,42], participatory design [28,29], activity analysis [50], and user- or human-centred design and development [20,51]. In this paper, 'participatory development' is used to refer to the kinds of activities that involve end-users, in our case clinical physicians, in healthcare IT development and are characterized by close collaboration between developers and end-users.

Similarly in the research literature, the terms healthcare IT and healthcare information systems are used to cover a wide range of applications. Typically, healthcare IT is associated with hospital computer systems with functions like patient administration and discharge, order entry for laboratory tests or medications, and billing functions [52]. We use the concept 'healthcare IT' to refer to a range of systems that physicians utilize daily in patient care work in clinical environments.

4.   Materials and methods

4.1.   Study design

The study presented in this paper about participatory healthcare IT development was part of a larger nation-wide survey project that studied healthcare information systems as tools for clinical physicians in Finland [48]. This questionnaire was targeted at all Finnish physicians under age 65 who were actively engaged with clinical work in all sectors of healthcare (PHC, PH, PP; cf. Section 1.2). The survey was conducted in the spring of 2010 and included several themes: usability, information management and information quality, support for collaborative work, user-oriented and participatory IT development and occupational health [11]. Some of the study results have already been reported in academic forums. For example, Vänskä et al. reported that physicians' assessments of their EHR systems are critical [11], Winblad et al. found that there are differences between the opinions of the physicians working in hospitals and in healthcare centres [12], and Viitanen et al. reported numerous usability problems and deficiencies, which considerably hinder the efficiency of IT use and physicians' routine work [49].

The questionnaire incorporated several healthcare IT-related research themes and included 38 questions and sets of questions. The questionnaire began with 16 questions regarding the respondent's background (e.g. questions about age, gender, working sector, fields of specialisation) and experience in using healthcare IT (e.g. the name of the principally used EHR system and an estimation of the amount of time the respondent had used the system). The main part (about themes listed in the previous paragraph) of the questionnaire consisted of 16 sets of questions which were formulated as positive or negative statements using a five-point Likert scale ("strongly agree–strongly disagree"), two open-ended research questions and four multiple-choice questions [11,12].

The national web questionnaire was designed in an iterative manner by a multidisciplinary group of researchers who were experts in the areas of medical practices (medical doctors), medical informatics, usability research, sociology of technology, and occupational health. The research project was coordinated and supported by the Finnish Medical Association [11,12].

The main usability related results of this large questionnaire, which have been published in other academic forums, are briefly summarised in the following. Physicians' assessments of their EHR systems were critical. Given the rating scale from 4 = fail to 10 = excellent (the standard marking scale in schools in Finland), the average marks varied from 6.1 to 8.4 [11]. Dissatisfaction with the system was highest in the public sector, particularly among young physicians in public hospitals [48]. The study revealed several usability problems and deficiencies, which considerably hinder the efficiency of IT use and physicians' routine work [12]. The systems currently used lack appropriate features to support typical clinical tasks, require the physicians to perform fixed sequences of steps and tasks, and poorly support the documentation and retrieval of patient data [12,48]. Further, findings on the IT support for collaboration between physicians, nurses, and patients were mainly negative [49].

This paper focuses on the three sets of questions that specifically addressed user-oriented IT development, presented in Fig. 1 (referred to as questions A, B, and C later on in the paper). The first set of questions (A) was about the physicians' experiences in giving IT use-related feedback and their opinions on the software providers' development activities. This set of questions included six five-point Likert scale statements. The second set (B), formulated as a multiple choice question, inquired into the physicians' interest towards system development and the ways in which they participated and contributed to those activities. The third set (C) was an open-ended question about physicians' visions of future healthcare IT systems. Several respondents offered general comments about the survey and its contents that were closely related to the answers given to Question C and addressed their vision of future IT systems. These general comments (Question D) were also reviewed and incorporated into the material during the analysis phase.

4.2.   Data and analysis

The web-based questionnaire was available from mid-February to mid-March 2010. During that time 3929 physicians, representing one-third of the Finnish physicians working actively in clinical work, replied to the email invitation sent by the Finnish Medical Association. The demographics of the respondents indicated a high correlation between them and the demographics of all working-age physicians in Finland held by the Finnish Medical Association register [11].

The research data for this paper consisted of the responses of the questions presented in Table 1. Also the answers given to the question about the overall EHR ratings (reported in previously published articles [11,12]) are utilized as a reference when presenting IT development-related results. In the questionnaire study, only 2484 physicians responded to this question. Despite the missing data from one in three respondents, there was no significant difference between respondent demographics or EHR systems and the missing answers [11].

The statistical analysis of the quantitative questions was conducted using the SPSS software (version 18), and p-values were calculated using Chi-square tests. Question A included six sub-items (see Fig. 1) formulated as positive statements with a five-point Likert scale ("strongly agree"–"strongly disagree"). For the results, answers "Strongly agree" and "Agree" were combined to form a category "Agree", and "Disagree" and "Strongly disagree" formed the category "Disagree".

The analysis of the qualitative data from the two open-ended questions C and D followed the principles of the content analysis method [53]. Two researchers reviewed the qualitative data independently, and based on that a classification of four main categories was jointly outlined. Jointly the categories were further specified after a reread of the material. The data was then categorized to the detailed categories (i.e. after reading each open-ended answer, it was marked into one or more of the four categories) independently by the two researchers. Finally qualitative data in each category were summarized. The categories and the number of comments are presented in
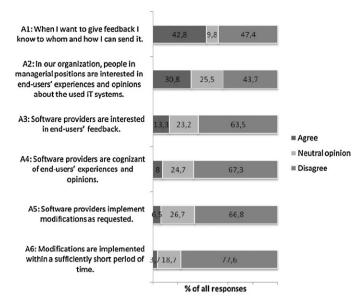
Fig. 1 – Frequency of responses to Question A: physicians' experiences about giving feedback to managers and software providers, and physicians' satisfaction with software providers' work regarding the development of currently used healthcare IT systems.

Table 1 – Questionnaire items and number of responses in the web survey addressing the physicians' experiences and opinions about participation in healthcare IT development (translated from Finnish by the authors).	
Questions	Number of responses
A. *What kind of experience do you have regarding the giving of feedback and the development of the currently used IT systems? (alternative answers: "strongly agree", "agree", "neutral opinion", "disagree", "strongly disagree").* 1. When I want to give feedback I know to whom and how I can send it. 2. In our organization, people in managerial positions are interested in end-users' experiences and opinions about the used IT systems. 3. Software providers are interested in end-users' feedback. 4. Software providers are cognizant of end-users' experiences and opinions. 5. Software providers implement modifications as requested. 6. Changes and improvements are implemented within a sufficiently short period of time.	Approximately 3800 responses were received (the exact numbers differed slightly among the six sub-items).
B. *Are you interested in participating in IT development activities in the future? If so, how? You can select one or many issues.* 1. I would be interested in introducing my work context and related needs to software developers/providers. 2. I could take part in a group of end-user representatives that aim at contributing to the IT development. 3. I would like to write feedback and ideas of enhancement into a web-based forum provided by software developers/providers. 4. I would like to provide direct feedback, for example mail comments and ideas of enhancements to software developers/providers. 5. If our organization had a physician responsible for collaborative activities with the software provider, I would be interested in talking to her and discussing my experiences. 6. I am not interested in participating. 7. In some other way. Please describe how.	Responses were received from 3741 physicians.
C. *What is your vision of healthcare IT systems for the future? Ideally, what kind of systems would those be?*	1664 free-form comments were received with the average length of a written comment being 293 characters (without spaces).
D. *General feedback about the survey or its contents.*	1200 free-form comments were received with an average length of 320 characters (without spaces).

Table 2 – Classification and the number of findings of qualitative data.

Category 1: Physicians' opinions about current IT development activities, N = 124
    End-users' viewpoint is ignored by system designers and developers (N = 74)
    Development work does not consider physicians' feedback and requests for changes (N = 28)
    Other comments (N = 22)

Category 2: Physicians' experiences in participation in IT system development, N = 35

Category 3: Physicians' experiences in the use of their healthcare IT systems, N = 1191
    Argument: Healthcare IT systems are poor (N = 379)
    Experiences on the use and suitability for clinical tasks (N = 216)
    Examples of a problematic use situation (N = 207)
    Positive comments about existing IT systems (N = 158)
    Argument: IT systems reduce time with patients (N = 126)
    Argument: Too many software products are in use (N = 57)
    Comments about regional information systems (N = 37)
    Comments about decision making when systems are procured (N = 10)

Category 4: Development in the future: physicians' suggestions regarding development activities and hopes and visions of healthcare IT systems, N = 2854
    Lists of needed functional features (N = 930)
    Lists of attributes or characteristics of an appropriate system (N = 656)
    Vision: IT systems should to be consistent and interconnected (N = 453)
    Vision: Only one system/database in Finland (N = 292)
    General hopes for the future healthcare IT systems (N = 142)
    Vision: IT systems should support cross-organizational collaboration (N = 135)
    Visions including patient's point of view on healthcare IT system usage (N = 86)
    Suggestion: IT system development should involve end-users (N = 78)
    Suggestion: Incomplete systems must not be deployed (N = 58)
    Vision: Back to "paper notes" (N = 15)
    Vision: Completely paperless (N = 7)
    Suggestion: Healthcare organizations should have authorized physicians to participate in IT development (N = 2)

Table 2. The data categorization was conducted with the help of the Microsoft Excel software.

5. Results

The results have been divided into four sections.

5.1. Respondent demographics

In total, 3929 physicians responded to the web questionnaire. Hence, the response rate to the study was 31.3% (the total number of physicians in Finland in clinical work is 14,411 and the register of email addresses from the Finnish Medical Association covered 95% of them [11]). Most of the respondents were women and between 35 and 44 years old (Table 3). Almost half of the responding physicians were working in public hospitals, whereas about one in four worked in public healthcare centres and also about one in four in other healthcare organisations (Table 3).

Most of the 3929 respondents mainly worked in outpatient clinics or in wards, and only less than five percent in emergency departments or in administrative departments (Table 2). Approximately two-thirds of the respondents were users of the three most widely used EHR systems in Finland: system A with 25.7%, B with 25.5% and C with 14.4%. In general, the respondents can be regarded as experienced users, since most of them had used their EHR systems for more than three years and assessed themselves as rather experienced users (given the five point scale from 1 = "beginner" to 5 = "very experienced", more than 90% answered 3, 4 or 5) (Table 3).

In the questionnaire, three background questions addressed the respondents' interests and attitudes towards the use of IT systems and technology applications in general (Table 3). About half (51.6%) of the physicians agreed with the statement "I'm enthusiastic about IT" (18.6% strongly agreed and 33.0% agreed). Most of the respondents had a greater interest in utilizing IT systems rather than understanding technical issues or developing systems. However, physicians do not seem to be very patient IT users, since nearly 70% of the respondents agreed with the statement "I get easily annoyed if problems occur with IT systems."

5.2. Physicians' experiences in giving feedback and development activities

Question A in the survey addressed physicians' experiences in contributing to IT development, and thereby was related to collaborative activities between end-users and software providers as well as people in managerial position in healthcare units.

The responses showed rather negative results about development-related activities within organizations (Fig. 1). Of all the responding physicians, nearly half (47.4%) disagreed with the statement about knowing to whom and how they can send feedback about their systems (Statement A1). Similarly, almost half (43.7%) of all the respondents disagreed with the statement "In our organization, people in managerial position are interested in end-users' experiences and opinions about the used IT systems" (Statement A2).

On an average, more than 60% of the respondents disagreed with four positively formatted statements: "Software providers are interested in end-users' feedback" (Statement A3, 63.5% disagreed), "Software provider are cognizant of end-users' experiences and opinions" (Statement A4, 67.3% disagreed), "Software providers implement modifications as requested" (Statement A5, 66.8% disagreed), and "Modifications are implemented within a sufficiently short period of time" (Statement A6, 77.6% disagreed) (Fig. 1). Physicians are especially dissatisfied with software providers' abilities to implement changes and improvements within a sufficiently short period of time (Statement A6) 77.6% disagreed with this statement.

Further analysis showed variances among the responses from physicians working in public hospitals, healthcare centres, and private provider organizations. Approximately half of the physicians in healthcare centres agreed with Statement A1 about knowing to whom and how to provide IT related feedback (50.1%), as compared to 42.1% of their colleagues in private provider organizations and only 36.5% in public

Table 3 – Respondent demographics ($N = 3929$).	
	Valid (%)
Gender	
Female	57.8
Men	42.2
Age	
<34 years	12.1
35–44 years	23.6
45–54 years	35.3
>55 years	29.1
Healthcare sector[a]	
Public hospital (PH)	49.6
Public healthcare centre (PHC)	23.4
Other (private providers – PP)	27.0
Clinical unit	
Ward	22.1
Outpatient clinic	69.0
Emergency department	4.5
Administration	4.4
Principally used EHR system[a]	
A (PHC, PH)	25.7
B (PH)	25.5
C (PHC, PH)	14.1
D (PP)	9.9
E (PH)	5.7
F (PHC, PH, PP)	4.3
G (PP)	2.6
H (PP)	2.2
I (PP)	1.3
J (PHC)	1.3
Other	7.5
How long have you been using the EHR system?	
Less than ½ years	6.2
½–1 years	4.8
1–3 years	23.9
More than 3 years	65.1
How experienced of an EHR user do you consider yourself?	
Beginner	1.2
2	7.1
3	26.5
4	42.2
Very experienced	23.1
I'm enthusiastic with IT	
Strongly agree	18.6
Agree	33.0
Neutral opinion	21.4
Disagree	19.3
Strongly disagree	7.6
I'm more interested in utilizing IT systems than understanding technical issues and developing systems	
Strongly agree	45.3
Agree	34.9
Neutral opinion	13.9
Disagree	3.9
Strongly disagree	1.9
I get easily annoyed if problems occur with IT systems.	
Strongly agree	23.8
Agree	45.0
Neutral opinion	15.6
Disagree	12.5
Strongly disagree	3.2

[a] Healthcare organizations in which the systems are used: PH = public hospitals, PHC = public healthcare centres, and PP = private providers of healthcare services.

hospitals (Table 3). Similar findings applied to Statement A2 about managers' interest towards end-users' opinions as well. Compared to the overall findings and percentages, in public hospitals the difference between agree/disagree responses was even higher (25.4% agreed against 51.4% disagreed) whereas in healthcare centres and private provider organizations responses were about the same (37.0% against 36.4%, and 35.7 against 35.5%, respectively).

Answers to both statements (A1 and A2) also indicated that, in general, physicians working in wards and emergency departments had more critical opinions than their colleagues in outpatient clinics and administration departments (Table 3). Additionally, physicians working in administration departments had significantly more positive experiences than others: more than half agreed with the two statements (61.9% with the statement A1 and 50.3% with A2), whereas on an average the total percentages were 42.8% and 30.8% (Table 4).

Physicians' responses to statements A3–6 indicated significant challenges in collaborative activities between physicians and software providers. Cross-tabulation between the principally used EHR systems and responses showed that compared to others, the users of systems I and F were significantly more satisfied with the software providers' abilities to work collaboratively and implement requested modifications. Of these systems, System I had rather high overall ratings, whereas System F rather low. The reason for the low ratings of system F compared to the other systems could be the fact that System F had only been in use in public hospitals for approximately two months before the questionnaire was available. 44.6% of the users of System F worked in public hospitals, others in the public healthcare centres or private provider organisations. Further, among the three most widely used EHR systems (systems A, B and C) the statistics indicated considerable negative results (Table 5).

5.3. Physicians' interest in participating in and contributing to IT development activities

In general, physicians seem to be highly motivated and interested in contributing to the development of their currently used IT systems. More than half of the respondents ($N = 2051$, 52.2% of all respondents in the study) would be interested in telling about and discussing their experiences with a colleague who had been named as a person responsible for collaborative activities between end-user organization and software provider (Fig. 2). Compared to the other four suggestions regarding possible collaboration and participation (questions B1–4), this was the most popular one. A significant amount of physicians (37.6% of all respondents) also expressed their interest in introducing their work to software developers or providers ($N = 1477$, Question B1) and providing direct feedback by email (Question B4, $N = 1159$, 29.5% of all respondents). Further, physicians also supported the idea of a web-based feedback forum ($N = 731$, 18.6% of all respondents, Question B3) and a group of end-user representatives that contribute to the development ($N = 608$, 15.5% of all respondents, Question B2). Only 649 (17.3%) of the 3741 physicians who responded to Question B were not interested in taking part in development activities.

Table 4 – Cross-tabulation between the respondents' demographics relating to clinical environments and the answers to two statements (A1 and A2) addressing the physicians' experiences about giving feedback and collaboration with people in managerial position in healthcare organizations and units (P < .001).

	Statement A1: When I want to give feedback I know to whom and how I can send it (N = 3851)		Statement A2: In our organization, people in managerial positions are interested in end-users' experiences and opinions about the used IT systems (N = 3813)	
	Agree (%)	Disagree (%)	Agree (%)	Disagree (%)
Total	42.8	47.4	30.8	43.7
Sector				
Public hospital (PH)	36.5	54.0	25.4	51.4
Public healthcare centre (PHC)	50.1	39.6	37.0	36.4
Other (private providers – PP)	42.1	48.0	35.7	35.5
Clinical unit				
Ward	34.5	56.0	23.9	52.4
Outpatient clinic	44.7	45.0	32.5	40.7
Emergency department	34.9	58.9	20.2	62.4
Administration	61.9	29.8	50.3	27.3

According to further analysis, there are no notable differences between all respondents' demographics (N = 3929) and the demographics of those physicians who expressed their interest in participating in and contributing to IT system development. However, some interesting observations can be made. Male respondents seemed to be more interested in taking part in a group of end-users and writing feedback into a web-based forum (suggestions B2 and B3) than their female colleagues (59.5% of the respondents to statement B2 were men, and to statement B3 51.7% men). Likewise, among the most experienced EHR users (those who considered themselves as belonging to this category) the interest towards participating in an end-user group was notably higher than the interest in discussing their experiences with a physician responsible for collaborating with software providers (e.g. the proportion of those respondents belonging to the category "very experienced EHR users" was 41% to statement

B2 but only 22.9% to statement B5 and 30.2% to statement B1).

In addition, 106 respondents answered that they were interested in participating in IT development activities in some other way than the suggested ones. A brief analysis of the written answers to the question "How?" resulted in the following findings:

- "I have tried to contribute to the development, but have already given up; I used to be interested but not anymore", N = 40.
- Giving feedback directly to software developers and providers, N = 6.
- "I am currently giving feedback to developers", N = 5.
- Answering these types of questionnaires, N = 5.
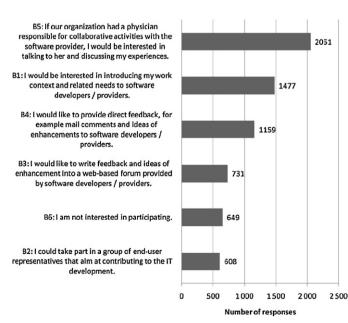- "I would like to contribute to the development on a national level", N = 4.

Fig. 2 – Responses given to Question B: physicians' preferred ways of participating in and contributing to healthcare IT development.

Table 5 – Cross-tabulation between principally used EHR system and physicians' answers to four statements (QA3–6) addressing the end-users' experiences about collaboration with software providers (P < .001). In the table EHR systems are listed according to overall ratings given to them (these results have been reported in other academic articles [11,12]).

	Principally used EHR system[a] (N = 3929) Respondent (%)	Overall ratings for EHR systems[b]	QA3 Software providers are interested in end-users' feedback (N = 3810)		QA4 Software providers are cognizant of end-users' experiences and opinions (N = 3792)		QA5 Software providers implement modifications as requested (N = 3781)		QA6 Modifications are implemented within a sufficiently short period of time (N = 3785)	
			Agree (%)	Disagree (%)	Agree (%)	Disagree (%)	Agree (%)	Disagree (%)	Agree (%)	Disagree (%)
Total		6.6	14.7	59.8	9.8	63.3	8.1	63.2	5.1	73.6
EHR systems[a]										
I (PP)	1.3	8.4	51.1	12.8	54.2	10.4	47.9	16.7	34.0	17.0
D (PP)	9.9	7.2	16.0	46.6	10.5	51.1	9.6	49.3	6.6	61.5
E (PH)	5.7	7.2	23.6	46.8	14.7	50.0	11.0	52.5	5.9	67.7
G (PP)	2.6	7.2	14.0	55.0	7.8	57.8	5.9	61.4	4.9	67.6
A (PHC, PH)	25.7	6.9	11.8	65.2	7.2	68.2	5.5	67.6	3.2	78.4
J (PHC)	1.3	6.9	20.0	58.0	14.0	52.0	10.2	57.1	8.0	74.0
H (PP)	2.2	6.7	16.3	48.8	13.1	50.0	13.3	51.8	6.0	61.9
F (PHC, PH, PP)	4.3	6.3	31.8	34.7	23.8	41.5	22.1	41.7	15.2	57.9
C (PHC, PH)	14.1	6.2	12.0	65.0	7.0	68.8	7.1	68.6	3.0	79.9
B (PH)	25.5	6.1	8.5	70.2	4.3	74.7	3.1	72.9	2.5	81.2

[a] Healthcare organizations in which the systems are used: PH = public hospitals, PHC = public healthcare centres, and PP = private providers of healthcare services.
[b] These results have been reported in earlier publications [11,12].

- Whatever ways that would work, N = 4.
- Working as a hired specialist in a development group, N = 4.
- Taking part in piloting and evaluating activities organized by providers, N = 3.
- Sharing information in discussion sessions in my own organization, N = 2.

5.4. Open ended comments and visions of future IT systems

In this section we present the findings from the qualitative analysis of the open-ended answers. These findings were divided into four categories as presented earlier in Table 1. In the following we present a short summary of the findings.

5.4.1. Physicians' opinions about current IT development activities, N = 124

Responding physicians argued that their point of view was missing in IT development; healthcare IT systems were designed and developed by people lacking know how of the substance and there were not enough experienced clinical physicians involved in the development. It was also argued that healthcare organizations should give more opportunities to clinical staff to participate in IT development. "IT developers never ask for the users' opinions or experiences"—this view came forth strongly. In the physicians' opinion, developers seemed not to be at all interested in the users' needs or visions and never visit the physicians' workplace at hospitals or health centres. Physicians argued that healthcare IT systems were developed by engineers and medical doctors who were working in administrative positions.

Several of the responding physicians had complained or made proposals for corrections or new features regarding their current systems. However, based on their experiences, complaining did not change matters and the existing errors were not fixed. The developers were blamed for often rejecting change requests presented by physicians by referring to technical reasons. Physicians claimed that proposing corrections was frustrating, because no feedback or answers were ever obtained from the developers.

Respondents also argued that software providers did not establish an interface between their software and other providers' software easily and quickly enough, and that the cost of establishing an interface was too high. Physicians also thought that IT systems had been deployed in healthcare before their suitability to clinical use had been tested and confirmed. Sometimes users were not sure why updates or new versions had been installed. In the opinion of the respondents, new versions of the existing software were not always better than the old ones. Some of the respondents suggested that healthcare IT providers should learn usability and user interface issues from other IT domains, for example from the game industry. Also a need for user interface design specialists was raised.

5.4.2. Physicians' experiences in participation in healthcare IT system development, N = 35

The physicians indicated that the most common way to participate in IT development seemed to be by providing feedback. Quite a few of the respondents had sent feedback about the

software in use to the developers. These physicians were extremely frustrated, because no answers had been received even if they knew the feedback had reached the company. Few of the physicians had been asked to participate in a group of end-user representatives arranged by the software company in an effort to contribute to the software development activities. Nevertheless, these physicians found such activities quite pointless; one respondent even wrote that this kind of participation was a waste of time. On the other hand, some respondents had positive experiences regarding intensive and long-term participation on system development activities. In their comments the physicians suggested that participating in IT development would be more tempting if it could be done during the official working hours, not as extra work, so that the employer actually allows a specific time for it. In addition, a concern for user participation in the deployment of new or updated IT systems was brought up: developing software and work activities at the same time was considered to be an important issue in IT system development. The respondents also wished that their needs, opinions and experiences were better acknowledged and appreciated.

5.4.3. Physicians' experiences in the use of their healthcare IT systems, N = 1191

In their positive comments physicians pointed out the following issues. A few respondents were satisfied with their current systems and suggested that only minor changes and corrections were needed. Some argued on behalf of combining the good features of the current systems and thereby developing an existing EHR system which would include all the necessary functionalities. In the open-ended answers some benefits of IT systems in comparison to "the papers" were also presented; for example, patient data (texts, results, radiology images) are available all the time. Furthermore, the answers pointed out the following positive experiences on healthcare IT system use: a summary view of patient data, regional information searching and viewing (for instance laboratory results from other organizations), an electronic to-do list or checklist, and an opportunity to send feedback.

Several comments argued that the currently used healthcare systems were poor and inappropriately designed. Firstly, many of the respondents pointed out that (a) a proper 'medication chart' and 'observation chart' were missing or were very poorly designed, (b) medication information was not reliable, (c) prescription handling was complicated, and (d) the diagnosis of the patient could not be found. It was also argued that an amount of patient data and complex user interfaces make it challenging to understand the big picture of a patient's condition and the navigation between different parts of an IT system was not logical or user-friendly. Secondly, several comments accused the systems of being old-fashioned, unstable, non-patient-safe and inflexible. Thirdly, respondents described a number of usability flaws which hindered their daily work. Physicians found their systems unsatisfactory, since the use of the systems was not intuitive; learning to use the system was too time consuming; the language used in the system was "engineer-language" and not understandable for clinical physicians; and the user interface of even the same system was not consistent. Many respondents wrote that a number of mouse clicks was needed to

complete a simple action, it was difficult to find the information needed, and search functions were poor. They indicated a need for an easy way, "kind of a Google", to find relevant data from the system. Fourthly, functionalities to support typical documentation and information retrieval activities were considered inadequate: textboxes were tiny, spell check was missing and there were no or limited options for text formatting. Fifthly, it was claimed that statistics should be done in an effortless manner. In the respondents' opinions, they were forced to be secretaries or typewriters and IT systems were excessively in control of their daily work. In general, physicians hoped the healthcare IT systems would become more consistent and their usability would be standardized. However, some comments pointed out that the same system was not suitable for all healthcare units, given the variety of speciality areas and procedures of work.

Some respondents experienced IT systems as having a negative impact on physician–patient communication. The computer, which should be just one of the tools of work, had become dominant. The systems reduced the time with patients. Several physicians argued that they spent more time with computers than with patients, and that was annoying and frustrating. It is also worth mentioning that physicians considered the nursing care planning part of the EHR systems unsatisfactory. What is more, the regulations for data privacy protection were a significant issue of concern. Physicians claimed that the same information had to be documented repeatedly because of a lack of data exchange between different organizations or even between one organization's different IT systems.

5.4.4. The future: physicians' hopes, proposals and visions for healthcare IT systems, N = 2854

The open-ended answers included a significant amount of comments addressing the future development of healthcare IT systems.

The future vision of the healthcare IT system was probably best summarized in this short comment: "Functioning. Just FUNCTIONING. Like PAPER and PEN." Similar to numerous other comments, this emphasizes the fact that the used system should simply work as expected without errors and technical problems, in other words, be as reliable and trustworthy a tool as a pen and paper. When describing a vision, there were quite a few respondents referring to "Apple, MAC or iPhone" kind-of characteristics and usability attributes. Some of the respondents (N = 9) referred to the vision of a physician's user interface presented by a prominent colleague, Dr. Ilkka Kunnamo, MD PhD [54]. Some respondents hoped for a totally new IT system or only one system in Finland. A need for common standards for clinical IT systems was also proposed. Most of the visions were conventional ("just easy to use", etc.), but there were a few innovative suggestions like the need for the desirable healthcare IT system presented in one physician's own words below:

I will start the whole IT system using only one password, when there appears today's patients list and meetings etc. on a beautiful touch screen like the iPhone without waiting. When the patient has arrived, I will be informed, then I'll touch patient name on the screen and user interface, in which are patient records and next to

it icons (links): laboratory results, radiology, other sectors' patient records, and growth charts will appear. There is also an icon (link) for personal management. By touching it, I will easily access personal management issues, for example, vacation forms and my own plan for this year's working hours appearing in a calendar format. Subjects of the meetings on the today's list, which I have selected to my weekly timetable, will be shown automatically. Timetables will remind me of issues in which I am interested. At the end of the day I will get the report: how effectively have I worked, how many patients have I cared for to profit the hospital and how much resources I have spent on caring for them. I can make the orders to nurses conveniently with a touch menu, since most common orders are ready to use as templates. It will also be easy to use prescription templates with helpful background information.

In addition to their future visions, physicians listed in their open-ended comments numerous functionalities they hoped to be implemented. Additionally, they described attributes or characteristics of an appropriate healthcare IT system. The various requirements presented by the respondents for an appropriate healthcare IT system are aggregated into a list in Table 6, with verbatim quotations from the responses as examples.

6.   Discussion

6.1.   *Answers to research questions*

The research questions and the main findings are as follows.

6.1.1.   *What kind of experiences do physicians have in participation in healthcare IT development?*
The results of this study support the earlier findings indicating a lack of user-centeredness in healthcare IT systems development. Almost half of the responding physicians disagreed with the statement, "*When I want to give feedback I know to whom and how I can send it.*" The results also showed strong dissatisfaction with the physicians' abilities to have an impact on system development. Fewer than one physician in three agreed that people in managerial positions in their organization were interested in end-users' experiences and opinions about the IT systems, and only 13.3% of all respondents thought that software providers were interested in end-users' feedback. In general, a significant number of the physicians were disappointed with the ability of IT system providers to produce corrections and changes rapidly and in a desired manner. On the other hand, the results pointed out significant differences between EHR systems providers.

The physicians' experiences regarding their participation were quite negative. They felt that their needs, which arise from clinical work with patients and working practices, were not guiding the development of healthcare IT systems. Physicians argued that developers do not understand their needs, because the developers never observe the work at hospitals or health centres. Furthermore, several respondents had frustrating experiences. Although they gave feedback and improvement ideas, they never received a response or notification that the message had reached the developers.

In general, the study findings indicated the need for enhanced communication between developers and end-users, as well as the need to improve methods and practices for participatory healthcare IT development. Software development is known to be time-consuming, and the development cycle from requirement gathering to deployment is quite prolonged, so in the users' point of view, it appears as an endless process if they only see the end-product. The study results showed that direct communication between developers and end-users is clearly lacking. The physicians wanted the developers to keep them better informed and aware of the use and significance of the feedback provided in order to avoid the impression that the users' opinions had no impact on system development. The development and procurement of IT systems needs to be more transparent. In addition, the present means of participation in system development – sending informal feedback, as well as using proxies of end-users (IT department persons, IT system instructors, and administrative physicians) who participate in development groups – seem to be ineffective in terms of usability and user-oriented development.

6.1.2.   *Are physicians interested in participating in development activities? If so, how?*
Physicians were definitely and surprisingly interested in participating in IT systems development in several ways to achieve better IT tools to support their work activities. This was a significant finding that encourages the application of user-centred development activities. According to study results, no fewer than every second physician was interested in discussing her own experiences if the organization had a physician responsible for collaborative actions with the software provider. More than one physician in three stated an interest in introducing their work to software developers if the latter would come to the workplaces.

The respondents preferred direct feedback, connection to discussions with developers, and an opportunity to develop IT systems in close collaboration with developers as the best methods of collaboration. However, certain physician preferences were represented: development activities should be done during standard working hours and should not create a need to work overtime. The respondents also suggested that IT companies should recruit physicians to their development units. The end-users could be responsible for defining and designing the solution, and the software provider could develop it to match these definitions. According to the physicians, it is currently done in the opposite way, i.e. IT systems are deployed and users need to adjust their work to fit the systems.

6.1.3.   *What kind of visions do physicians have regarding future IT systems?*
The free-form comments included only a few visions for future IT systems; in fact, there were considerable hopes for an IT system to simply work reliably and quickly. The descriptive expressions that appeared most frequently were: *quick*, $N = 407$; *functioning*, $N = 199$; *explicit*, $N = 161$; *easy to use*, $N = 92$; and *reliable*, $N = 80$. Additionally, open-ended answers pointed out generalizable user requirements for the IT systems, especially regarding usability issues. Thus, it can be concluded that the use of current healthcare systems in clinical work

Table 6 – Group of usability related requirements from respondent physicians for the appropriate healthcare IT system in alphabetical order.

Requirement	Example
All necessary patient information easily available	"Same system consisting of all functions, one UI, one login." "The data of the patient must be able to process in one window of software. It is needed to process the data of the several patients simultaneously (in different windows)." "A system which will discuss with every other system. It is possible to get physicians' texts, booked appointments, growth charts, X-rays and laboratory results in one system without logins to other system and typing patient ids again."
Appropriate presentation of patient data and balanced user interface design	"Graphical, icons, symbols, colours: in logical and consistent manner." "Permanent data of the patient-page. It is impractical that on a diagnosis page there are 14 acute respiratory infections and 3 gastroenteritis and 41 backaches, and then Diabetes Mellitus and other important diagnosis won't be seen clearly and easily."
Automatic data processing and templates	"No need to document the same issue separately in every part; data would complete automatically in every needed part of the system" "A system in which prescriptions would be updated automatically in the patient's medication list." "Partly fulfilled prescription and statement templates" "Possibility to save and utilize own phrases."
Convenient data security	"No exaggerated data security."
Customizable user interface	"User interface that could be modified to fit user needs." "Adjustable user interface (ward vs. emergency department vs. policlinic) in which all the necessary information is effortlessly available. For example, if a nurse or doctor calls the patient about the laboratory results, all required information (the laboratory results, date of the prescription and the medical report) is immediately available when the software is started."
Cross-organizational collaboration and information exchange	"Data searching in national patient archive, in which data consists of data documented in different sectors and in different locations."
Device integrations	"Bringing data from medical examination equipments to patient records."
Easy access to statistics of care	"Getting statistical information easily; for example, diabetics visited in one year period." "Getting monthly summaries of visits of own patients."
Easy to learn and intuitive to use	"Getting important information by clicking only one button." "The system should support the user: the user does not have to change his/her behaviour to fit with a system, but the opposite. Logical, going forward as physician behaves and thinks and care of patient naturally goes." "Predicting users' movements."
Ergonomic (usability)	"There is need to pay more attention to user ergonomics when developing the systems."
Getting extra information easily	"It would be good if there was a chance to get extra information easily (e.g. write a diagnosis and it will open medical database for the extra information)"
Getting to know relevant patient data at one glance	"Easy to see the big picture! Permanent diagnosis, medication, surgeries, hospital visits, etc."
IT support for physician–patient collaboration	"Structured and self-learning system, in which both healthcare professionals and patients would add data." "Patients' own measurement information would be saved automatically in the system." "Possibility for patient to contact from own computer at home, e.g. appointment booking, questions to patients of her/his problem. This would generate message to professionals and they could estimate the urgency. Then patient could see the free appointments and reserve suitably."
Logical and natural navigation	"User interface should simulate paper patient folder. User could spread it to own desk to go through and easily switch "pages" of other specialities and move/copy notes in between." "E.g. figuring out of some symptoms, e.g. dizziness, data would be collected in texts of specialities, and also in one folder. In this folder there would be every action, examination, etc. which has been done to clarify the situation of the patient. Data needs to be linked as a logical entirety,"
Possible to compare patient data (e.g. old and new)	"It is important to have possibility to compare old and current patient data." "Logical comparing feature–new results and a few of the old ones with dates."
Quick and stable functioning	"Quick, starts easily and rapidly and won't crash or be whimsical." "Starts in a blink of an eye (as quickly as a paper and pen from the pocket)." "Working 24 h a day and software upgrades won't disturb daily work."

– Table 6 (Continued)	
Requirement	Example
Simple data searching	"Effective search feature in the patient record system." "Possibility to search laboratory results (e.g. have some specific lab exam been taken and when)."
Support for communicating with co-workers	"Possibility to send notes to him/herself or colleague to ask later for consultation or reminder of some task (e.g. dictate statement of the patient)." "Easy consultation via video conferencing and secured email."
Support for patient data management: documentation and retrieval	"Two-way: now mostly data documenting; in the future there is need to utilize data in patient work and research." "It is important that the collected data is reported automatically. All collected information, for example written, numeric and graphical, should be conveniently accessed from the EHR." "The measurable variables (such as blood pressure, blood glucose, haemoglobin, etc.) and, for example, calculated trends that represent their changes, are easily available without laborious data collecting or additional calculating. Also remarks and propositions based on the treatment guidelines could be attached."
Support for individual's work and planning of tasks	"Possibility to write a note to myself (e.g. remember to check laboratory results and call the patient)."
Utilization of touch screen technology in future	"Touch screen like iPAD."
Warnings and reminders of interactions	"Alerts and warnings of user errors or even prevent the error. Reminders of laboratory tests, controls of X-rays, doctors' statements that need to be done."
Decision-making support	"Decision support—feature of medications, interactions, etc."

is hindered by usability flaws, and significant attention needs to be paid to make improvements in user interface and interaction design during the IT development cycles.

6.2. Strengths and weaknesses of the study

In the health informatics field, several studies have addressed the usability of healthcare IT systems, but as far as we know, healthcare professionals' experiences of participating in IT systems development have not been previously investigated as comprehensively as in this study. The main strengths of the study are: the exceptionally large number of respondents, which can be described as representing a comprehensive and inclusive sample of the target group, and study materials including both qualitative and quantitative materials, which complement each other. These materials enabled the researchers to create a comprehensive and in-depth understanding of the present state of healthcare IT systems development, experienced problems and collaboration experiences of physicians.

Nevertheless, the main limitations of the method used, a questionnaire, are related to the highly subjective nature of the data gathered and physicians' abilities to imagine or envision what their healthcare IT systems would be like in the future. "*If I had asked my customers what they wanted, they would have said a faster horse,*" said Henry Ford. The same probably happened with the question addressing physicians' future visions. Responses indicated that it was difficult for the users to envision the future, but easier to describe the present state and ask for changes in it. Additionally, questionnaire design is challenging, especially when the target group is characterized as being heterogeneous, like clinical physicians in the described study. Special attention should be paid to make sure the topics of the questions and options for the answers are correct and appropriate from the respondents' point of view. On the other hand, physicians were involved in all phases of the study design, including defining the questions and pre-testing the questionnaire form. Further the respondents had the potential to write open-ended feedback when responding to the web-based questionnaire.

6.3. Impact of the results

The findings of this study are new on the national and international levels–the viewpoints of end-user participation in healthcare IT systems development have not been studied before in this way. Almost 4000 physicians responded in this questionnaire and because of the size of the sample the findings can be considered quite representative. The results of this national questionnaire study point out serious problems in the use and development of current healthcare IT systems. Physicians feel that they are alone in their use of inconvenient IT systems, because their managers and especially the software providers are not interested in the end-users' feedback and experiences. Physicians are often viewed as having a negative attitude towards changes in working practices and adoption of new technology systems. Finnish physicians are experienced IT users and they may develop negative attitudes when the basic level of IT service is inadequate, thus the negative attitudes can result from this. IT systems are familiar to everyone, and a basic level of IT service is simply inadequate. It could be challenging to generalize these findings to other countries where healthcare IT is less widely adopted and users are less experienced, but the findings can be helpful when designing systems even for less experienced users. The study findings on physicians' negative experiences about giving feedback and about their managers' interest in end-users' experiences (Fig. 1, A1 and A2), send a strong message to healthcare managers to address organizational issues. Likewise, the findings on physicians' dissatisfaction with software providers (Fig. 1, A3 to A6) urge systems vendors to take action to improve end-user involvement.

Another main finding relates to the fact that systems developers need to achieve a better understanding of the healthcare context and tasks in order to develop appropriate tools for patient care. Toivonen et al. [19] have argued earlier for the need for the simultaneous development of IT systems and work activities, and our findings support that argument. IT infrastructure should be understood as a whole, and the software systems and work activities should be developed simultaneously. Our findings about the need for collaboration between end-users and developers and the lack of the use of participatory development methods support earlier findings by Shah and Robinson [27,42]. User participation during various phases of development work is crucial. However, it has to be remembered that users should not be considered as representing or replacing interaction designers. Instead, physicians are experts in medical practice and clinical work and able to determine the kind of problems they have with the currently used systems. Therefore, end-users are the primary source of use-related information, but they are not designers. Developing healthcare IT systems with high usability requires designers who are specialists in interaction design and user-centred system development.

In Finland the procurement of healthcare IT systems is regulated by laws and rules that do not sufficiently promote participation and communication between end-users and developers. In order to succeed, considerations of usability and user needs should be a part of the requirement elicitation process. If usability is not demanded, the chances of obtaining it are reduced. Since development work is often characterized as being iterative and healthcare systems are widely deployed, procurement specifications should require vendors to state how they will organize end-user participation in the further development of their products.

Furthermore, the development of IT systems in healthcare organizations in Finland does not start from scratch any more, but takes place as ongoing improvements to existing systems. Sometimes this ongoing development seems like fire fighting—fixing only errors or flaws from a user's point of view. Most participatory development methods, however, are implicitly intended for first-time development situations, even for in-house development type of settings where the limitations of commercial markets are not clearly addressed. The current widely used methods of participation, for instance, sending feedback to customer service, and using end-user representatives in user groups organized by software providers, leaves end-users dissatisfied and has not achieved notable improvements in the usability and user acceptance of the IT systems. The presented results indicate a strong need to develop new practices or introduce fresh methods of participatory IT development to the healthcare IT domain. The new European Medical Device Directive IEC 60601-1 will hopefully lead to more participatory development activities, because it demands usability and clinical evaluation of software products [55].

6.4. Future research

The rich materials of this study give rise to more detailed analyses on, for instance, (1) how the experiences and needs of the physicians working in various medical specialties, sectors or units differ from each other, and (2) if there is a correlation between high usability scores for an IT system and the perceived end-user participation in the on-going development of the particular product. This study provided the view of the physicians' experiences only. However, the opinions of other healthcare professionals – administrators, information officers and IT developers – regarding the same issues should be studied as well. It is assumable that the IT developers' experiences on end-user participation and particularly on the obstacles of participatory development activities would differ from those of the end-users.

As pointed out by other researchers and implied in the previous sub-section, there is a strong need for research on better practices and methods of end-user participation in healthcare IT development, particularly for the procurement, deployment and on-going development of commercial off-the-shelf applications. Firstly, it is important to consider how development activities could be a natural part of the physicians' work. Factors to be considered to that end include at the least resources, opportunities, attitudes and abilities of healthcare organizations and managers, attitudes of the developers, and innovativeness in considering new methods of collaboration. Secondly, a more theoretical understanding of fundamental issues around participation is needed to support the development and introduction of appropriate methods.

7. Conclusion

In this study we have analysed the responses of physicians' experiences of participation in healthcare IT development as a part of an exceptionally large questionnaire study conducted in Finland in the spring of 2010. The results confirmed that physicians were highly critical of their IT systems and their experiences of the current means of participation, or rather the lack of it, were very negative. However, the results also showed that a very significant proportion of the respondents were willing to contribute to IT systems development, contrary to a common assumption that clinicians are disinterested. The main conclusion from the study is that to enable physicians to contribute, better methods of participation need be to developed and applied, particularly for the procurement, deployment and on-going development of commercial off-the-shelf applications.

Authors' contributions

The original research idea and questions of user-oriented and participatory IT development in the questionnaire were defined by Martikainen. Viitanen and the others in the questionnaire group formatted these questions to fit the questionnaire. The analysis of qualitative and quantitative data and writing of the manuscript was carried out by the first two authors. Korpela mentored this research and wrote part of this paper. Lääveri contributed to the results of the data analysis as well as organizing the entire large national web-based questionnaire.

Summary points

What was already known on the topic?

- It is commonly known that healthcare IT systems have poor usability.
- Several researchers have argued on behalf of end-user involvement in healthcare IT system development.

What this study added to our knowledge?

- Physicians' experiences of the current methods of participation are highly negative.
- Physicians are willing to participate in healthcare IT systems development.
- Better methods for end-user participation are needed, particularly for the procurement, deployment and on-going development of commercial-off-the-shelf applications.

Conflict of interest

Martikainen is an employee of the company in which the System A was developed. The company has not supported or been involved with this study.

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