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Physicians' Perspectives on EHR Usability: Results from Four Large Cross-Sectional Surveys from 2010 to 2021

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Abstract. Usability and user experience are central quality attributes of electronic health record (EHR) systems. Usability evaluation studies typically focus on short-term use and situational usability, although feedback collected during operational use provides input for future information systems development. An abundance of studies report on physicians' dissatisfaction with the usability of their EHR systems and many show an association between poor usability and physician burnout. However, there is a scarcity of large long-term monitoring studies assessing end users' experiences with EHRs. We report on the results from four large (n=3,929–4,628) national cross-sectional usability surveys conducted among Finnish physicians in 2010, 2014, 2017, and 2021. The main finding was that the perceptions of physicians working in public health centres had changed for the better but those working in public hospitals reported similar or even more negative experiences in 2021 than in 2010–17; they rated only system responsiveness to inputs as having improved. Based on this finding, systematic research-based monitoring of EHR development from the end users' perspectives should be continued.

Keywords. Usability, user experience, physician, electronic health record, national survey, long-term monitoring

1. Introduction

Physician dissatisfaction with electronic health record systems (EHRs) [1–4] has been associated with health information system (HIS)-related stress [5–6]. Despite this, there is a scarcity of large long-term monitoring studies on usability and end users' experiences with EHRs [7]. Typically, usability evaluation methods do not address the long-term aspects [7] although monitoring is considered important in user-centred evaluation and feedback collected during operational use provides input for future HIS development [8].

In Finland, public healthcare EHR coverage reached 100% in 2007 [9]. Public sector hospitals provide both inpatient and outpatient specialized care. Primary care physicians work mainly in health centres. Between 2010 and 2015, all public hospitals and health centres joined Kanta Services – a national patient data repository and electronic

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prescription system. Meeting the specifications for the data structures and integrations required considerable resources from EHR vendors [10]. Until 2018, the EHR brands used in Finnish healthcare remained relatively unchanged [11], but in 2018–21, a new EHR brand covering specialized and primary healthcare as well as social care was implemented in the Uusimaa region. In February 2021, all specialized care hospital physicians used this EHR, but its deployment in health centres had only begun.

The first national survey on physicians' experiences with EHR usability was conducted in 2010 [1], followed by surveys in 2014, 2017, and 2021 [12–14]. In this paper we report on results for public sector physicians. The research question was as follows: *How did physicians' experiences regarding the usability of their EHR systems evolve from 2010* to *2021?*

2. Methods

National cross-sectional surveys on physicians' experiences with HISs were conducted in Finland in 2010, 2014, 2017, and 2021. The individual email link for a web-based questionnaire was sent to all physicians <65 years of age and currently living in Finland. The email addresses were obtained from the register of the Finnish Medical Association.

We focus on the responses of public sector hospital and health centre physicians (Figure 1) as the patients treated in the private sector differ remarkably from the public sector. Moreover, the EHR brands are distinct. Six usability core statements were selected for the analysis from the national usability-focused HIS-scale (NuHISS) [15]; these statements were identical in the four surveys. The themes of the statements related to (1) technical quality – responsiveness of the system, errors in use, and implications for patient safety (Q1–2), (2) ease-of-use in terms of the success of the user interface (UI) design and system support for routine tasks (Q3–5), and (3) benefits (Q6) (Table 1).

Statistical analyses were carried out with SPSS 28 (IBM Corp, Armonk, NY). Five-point Likert scale responses were used for statistical analyses, but for the purposes of Table 1, the "fully agree" and "somewhat agree" responses were combined into "agree" and "somewhat disagree" and "fully disagree" into "disagree". Kruskall-Wallis tests and Bonferroni's post-hoc tests were conducted to compare the results between the years of study. Statistical significance was set at $p<0.05$.

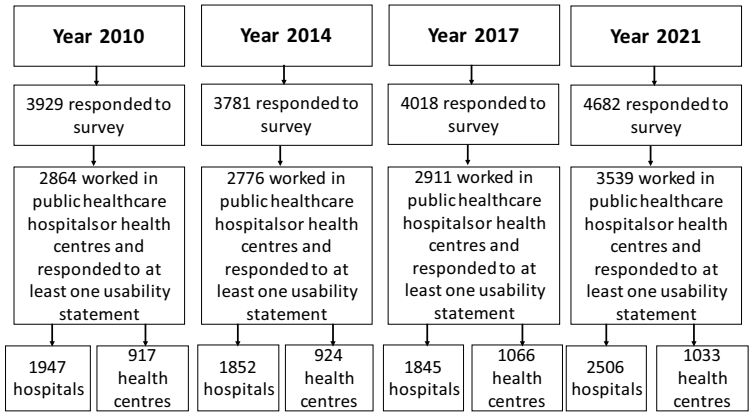


Figure 1. Flow chart of the study conduct.

3. Results

The results regarding physicians' experiences with the usability of their EHR systems from 2010 to 2021 are presented in Table 1. In 2021, a larger proportion of hospital physicians believed that their EHR responded quickly to inputs (Q1, 53% agreed with the statement) than in the three earlier surveys (29–37% agreed). Health centre physicians gave more negative assessments in 2017 than in 2010, but in 2021, they reported improved experiences back to the same level as 2010 (47% vs. 33% vs. 48% agreed). The proportion of those disagreeing with the statement of having experienced adverse events or near misses (Q2) increased during the study period (31–40% for hospitals; 43–51% health centres). The assessments about EHR user interfaces (UIs) (Q3-4) given by hospital physicians had become more positive between 2010 and 2017 but became more negative again in 2021. By contrast, health centre physicians' views were the most negative from 2014 to 2017 and improved in 2021. The EHR support for hospital physicians' routine tasks (Q6) does not appear to have improved from 2010 to 2021 (up to 60% disagreed). Physicians' perceptions on the ability of the HISs to assist in preventing medication errors had improved from 2010 to 2014 but remained relatively stable thereafter.

Table 1. Finnish physicians' perceptions of EHR usability in 2010, 2014, 2017, and 2021.

		2010	2014	2017	2021
Q1. The system responds quickly to inputs.					
Hospital[a,b,c,d,f]	Agree (%)	36.9	28.7	36.3	53.4
	Disagree (%)	45.7	56.2	49.9	34.3
Health centre[a,b,e,f]	Agree (%)	47.4	35.0	33.2	47.8
	Disagree (%)	36.8	51.4	53.7	40.8
Q2. Faulty system function has caused or has nearly caused a serious adverse event for the patient.					
Hospital[a,b,c,d,e,f]	Agree (%)	42.6	41.6	37.2	42.3
	Disagree (%)	30.6	36.8	41.4	40.4
Health centre[a,c]	Agree (%)	28.4	30.8	36.6	28.0
	Disagree (%)	42.7	44.4	43.6	51.4
Q3. The arrangement of the fields and functions is logical on the computer screen.					
Hospital[a,b,c]	Agree (%)	36.5	43.7	48.5	39.4
	Disagree (%)	44.4	42.2	38.1	53.3
Health centre[a,b,e,f]	Agree (%)	44.1	40.4	40.5	52.6
	Disagree (%)	38.5	47.0	47.9	36.5
Q4. Terminology on the screen is clear and understandable (for example, titles and labels).					
Hospital[a,b,c]	Agree (%)	39.9	39.9	41.7	40.4
	Disagree (%)	39.8	42.9	41.1	51.9
Health centre[a,b,e,f]	Agree (%)	54.1	44.8	43.0	58.0
	Disagree (%)	27.3	39.5	41.5	30.1
Q5. Routine tasks can be performed in a straightforward manner without the need for extra steps.					
Hospital	Agree (%)	28.1	28.2	30.3	33.7
	Disagree (%)	57.0	61.3	60.1	59.7
Health centre[a,b,e,f]	Agree (%)	36.6	26.0	24.2	39.2
	Disagree (%)	50.3	63.6	68.1	49.9
Q6. Information systems help in preventing errors and mistakes associated with medication.					
Hospital[a,b,c,e,f]	Agree (%)	19.1	37.7	37.7	32.5
	Disagree (%)	60.3	43.7	45.1	50.0
Health centre	Agree (%)	45.7	51.4	49.4	44.9
	Disagree (%)	36.7	34.3	38.1	39.0

$p<0.05$ between years: [a]2017–21; [b]2014–21; [c]2010–21; [d]2014–17; [e]2010–17; [f]2010–14

4. Discussion and Conclusions

One of the main findings of our study was that physicians' perceptions on several usability aspects had become more negative from 2010 to 2014–17 and then again more positive in 2021. This finding becomes most apparent in health centre physicians' responses regarding technical aspects, usability of UI, and support for routine tasks (Q1–Q5). One explanation for this finding is the implementation of Kanta Services from 2010 to 2015 [10,16]. During the early transition sending ePrescriptions to the national Prescription Centre could take over one minute. Moreover, some of the UIs and terminology used changed simultaneously. By 2021, most EHRs had allowed the end users to perform other tasks, meanwhile, the users had likely grown familiar with their UIs. Importantly, after 2015, EHR vendors were able to allocate more resources to EHR design. Our results suggest that changes in the UIs and terminology may disrupt perceived usability for years, even after applying possible improvements; this finding also applies to positive and wanted changes, like ePrescription.

Apart from the statement concerning the system responding quickly to inputs, hospital physicians' experiences had become more negative, especially for Q2–4. The largest specialty and tertiary care hospital in Finland employing a third of physicians working in specialized healthcare implemented a new EHR system just months before the 2021 survey. Physicians from this hospital provided negative feedback, which impacted the overall evaluations. The EHR support for hospital physicians' routine tasks appears not to have improved from 2010 to 2021 (up to 60% disagree). Due to the great variety in the tasks and roles in hospitals, it is likely that the EHRs are used differently by different users and use contexts – even in situations where support for routine tasks does exist. Another explanation may be that easy routine tasks have been automated or delegated to other staff or the patients themselves; physicians are left with the most complex cases.

Hospital physicians' perceptions on the HISs assisting in preventing medication errors improved from 2010 to 2014; medication interaction warnings were introduced during this period [16]. One of the reasons for the lack of improvement thereafter may be that other medication computerised decision-support systems were not integrated into the medication workflows [16]. If so, the number of alerts may have resulted in alert fatigue [17]. Indeed, healthcare organisations and EHR vendors alike struggle between choosing efforts to prevent all possible medication-related adverse events and worsened usability resulting from too many alerts [17].

It is possible that the usability of EHRs *per se* is not the only explanation for the dissatisfaction and distress related to the HISs: there is more data to review than before due to, for example, deeper integrations, a greater number of ancillary systems, and health information exchange via the Kanta [14].

Usability and user experience are central quality attributes of EHRs. While usability evaluation studies typically focus on short-term use and situational usability [6], long-term monitoring during operational use provides useful data, both for policymakers on the possible influences of legislation changes and for EHR vendors on the impact of their development efforts. In Finland, national monitoring has expanded to include nurses' and social welfare professionals' perspectives [13], and the validated NuHISS instrument has been used internationally [3]. It is important to continue the systematic research-based monitoring of EHR development from the end user's perspective, both nationally and internationally.

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