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Impact of healthcare education on preferences for electronic health records: Results from national survey of patient users in Sweden

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Impact of healthcare education on preferences for electronic health records: Results from national survey of patient users in Sweden

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Abstract

Electronic health records (EHR) are continuously evolving to better meet user needs, but the process is complicated by healthcare professionals and patients often disagreeing on priority areas of development. While this may be due to differences between professional and personal experiences, little is known whether specialist healthcare knowledge also affects user needs when using EHRs as patients. To investigate this, we analysed the responses of patient users in Sweden from the NORDeHEALTH 2022 Patient Survey. In the survey, respondents indicated whether they had healthcare education, and rated how useful various EHR information types and functions are. Average ratings were comparable between the two user groups, but significant differences were observed for information types and functions. Those without healthcare education

rated the ability to point out errors as most useful, while those with healthcare education – the ability to contribute health information. The findings suggest healthcare education can influence users' EHR preferences.

CCS Concepts

• **Human-centered computing** → Human computer interaction (HCI); HCI design and evaluation methods; User studies.

Keywords

Electronic health record, EHR, patient accessible electronic health record, online records access, ORA, patient users, healthcare education, patient portal, national survey, usefulness, functionality

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1 Introduction

As the access of *electronic health records* (EHR) by patients is increasing worldwide, understanding how to better design them to meet users' needs is crucial. Sweden was among the first adopters of patient-accessible EHRs, with their implementation strategy acting as a blueprint for countries at the initial stages of adoption [19]. In Sweden, patients first gained *online records access* (ORA) in Region Uppsala in 2012, and by 2018 the last of the 21 regions implemented it. Today, *1177 journal*, the national patient-accessible EHR in Sweden, has become a key digital health tool for delivering “good and close care” (“God och nära vård” in Swedish) [48]. This was not always the case, with clinicians initially opposing patient ORA in Sweden, citing concerns related to increased work burden and patient safety [17]. Since then, a considerable body of cross-cultural survey research demonstrates that, despite initial reservations, patients report a variety of benefits. These include among others: feeling more in control of care [39]; improved understanding of treatment plans [13]; better recollection about what was communicated during healthcare visits [51]; and increased communication with and trust in providers [5, 6].

Patient experiences with ORA, however, vary significantly based on factors such as age, education, ethnicity, language and digital proficiencies, suggesting that current systems may not fully accommodate the diversity of user needs [4, 24, 25, 50]. Frequent internet users and those with higher health literacy more readily adopt ORA [49] as well as gain greater insight from their EHRs, likely because the information is more attainable to them compared to other patients [54]. Similarly, patients with higher digital literacy - the ability to effectively use digital tools and internet-enabled technologies to find, evaluate, create, and communicate information - is relevant to the uptake of ORA. Lack of access to digital devices, broadband or reduced literacy influence who uses and benefits from ORA to such an extent that digital inclusion is now regarded as a social determinant of health [43, 45]. Given that the health record was originally devised to serve as an aide-mémoire to the *healthcare professional* (HCP) who wrote it, as well as a communication tool between HCPs who are tasked with delivering continuity of care, the design of EHRs is not always patient-centred.

The contrasting opinions of perceived risks and benefits expressed by patients and HCPs [10] further raise the question of whether it is the additional specialist knowledge of how healthcare operates that drives opinions about EHRs. Unlike patient users, HCPs have both personal and professional insight into ORA. Incorporating their unique experience into the development of EHRs could improve the experience for both patients and HCPs. As patients, users with a healthcare background may value different EHR features but little is known about it. In Sweden, first steps to exploring this were taken when ORA was still being implemented across the country and findings are limited to early adopters in select regions [35]. Our aim was, thus, to revisit the research question now that ORA is available on a national level and routinely used.

1.1 Contribution

The study leverages the Swedish healthcare context to analyse how healthcare education influences user preferences for the design

of patient-accessible EHRs. We contribute to *human-computer interaction* (HCI) research by exploring how user diversity shapes interest in ORA. By identifying EHR features that vary in usefulness between user groups, our research offers actionable insights for designing more intuitive EHR systems. Anchored in the core HCI principle of user-centred design, we contextualised the findings to inform the iterative design process of EHR systems, ensuring they are more inclusive and tailored to effectively meet the needs of users.

2 Methods

We used the Swedish dataset from the NORDeHEALTH 2022 Patient Survey [18] to analyse whether healthcare education influences user preferences for patient-accessible EHRs.

2.1 Study design

The NORDeHEALTH 2022 Patient Survey is an online survey that gathered opinions of patient users on their experience with the national patient-accessible EHRs in Sweden, Norway, Estonia, and Finland. The survey was developed by researchers from the four countries as well as partners from the US, who previously conducted similar surveys [51]. The questions were either adapted from previous research [31, 35, 55] or novel to address topical research objectives. In Sweden, the study was advertised for 3 weeks in January and February 2022 to verified patient users who logged into *1177 journal*. The minimum age for participation was 15 years old, with no upper age limit. The survey consisted of 83 items, with a mixture of closed-ended and open-ended questions. All closed-ended items required a response and were not skippable. In this paper, a subset of 25 survey items were used (see Figure 1). The original wording of the items in Swedish and their translation in English can be found in Appendix A.

Answer options for the socio-demographic and experience with EHR items were single-choice categorical answer options tailored to the question. For the items evaluating the usefulness of EHR information types (Items 7–13) and EHR functions (Items 14–25), the answer option was a single choice rating on a 5-point Likert scale, in which points were labelled as: 1 – “Not useful at all”, 2 – “Not very useful”, 3 – “Neither useful nor useless”, 4 – “Useful”, 5 – “Very useful”.

2.2 Participants

Out of the estimated 1,085,092 patient users who logged into *1177 journal* during the survey advertisement period, 13,008 unique users completed the survey resulting in a response rate of 1.2%. To explore the impact of healthcare education, we used the survey items asking about the highest attained education (Item 3) and the presence of any healthcare education (Item 4). First, we removed all participants who indicated that they had ‘No formal education’ ($n = 76$), ‘Primary education’ ($n = 1,106$), or ‘12 years of school – Upper secondary education’ ($n = 3,434$). This was done in order to focus on respondents who had received specialised healthcare education and not general healthcare education, for example, as part of a school curriculum. It was decided that all such respondents would be excluded from analysis, and not only from the healthcare education group. Previous research shows that education can impact EHR

Analysed questions from the NORDeHEALTH 2022 PATIENT SURVEY	USEFULNESS OF PORTAL INFORMATION & FUNCTIONS
<p>SOCIO-DEMOGRAPHIC INFORMATION</p> <ol style="list-style-type: none"> 1. Gender 2. Age 3. Education 4. Healthcare education 5. Employment status <p>EXPERIENCE WITH ORA</p> <ol style="list-style-type: none"> 6. Frequency of EHR access in the last 12 months 	<p><i>How useful would it be to have this information on the portal:</i></p> <ol style="list-style-type: none"> 7. ... Referrals 8. ... List of all pharmaceuticals / my medications 9. ... Overview of vaccinations 10. ... Test results 11. ... Clinical notes from primary care 12. ... Clinical notes from hospital care 13. ... Overview of all healthcare contacts <p><i>How useful would it be to have this function on the portal:</i></p> <ol style="list-style-type: none"> 14. ... Core/summary record 15. ... Access and manage children's information 16. ... Access and manage family members' information 17. ... See log data 18. ... Block clinical notes from some HCPs 19. ... Contact HCPs electronically and ask questions 20. ... Point out errors in the HR 21. ... Write text comments in the HR 22. ... Contribute with health information 23. ... Contribute with self-monitoring information 24. ... Contribute with expectations about healthcare visit 25. ... Order and manage certificates
<p><i>EHR</i> – electronic health record <i>HCP</i> – healthcare professional <i>HR</i> – health record <i>ORA</i> – online record access</p> <p><i>Note:</i> For original wording, please refer to the supplementary material.</p>	

Figure 1: Survey questions included in analysis.

preferences [50] so removal of lower education levels from one group only would have likely introduced a confounding factor. Next, the remaining 8,392 respondents were divided into two groups: those without healthcare education ($n = 5,216$; 62.15%) and those with healthcare education ($n = 3,176$; 37.85%). The question on healthcare education did not provide additional instructions on what educational background is considered to be within healthcare, and was open to participant interpretation.

2.3 Analysis

Socio-demographic variables (Items 1–5; gender, age, education, and employment) and experience with EHR variables (Item 6) were compared between the two user groups using the Chi-square of Independence test. Information and function variables were summarised through descriptive statistics (Median and Mean) and comparisons between the user groups were made using the Wilcoxon Mann-Whitney U test. The non-parametric test was chosen because during the initial phase of data exploration a negatively skewed distribution of responses was observed for all information and function variables for both user groups. Deviation of distribution was further confirmed by the Shakiro-Wilk test of normality for all information and function variables. The significance threshold for all analyses was pre-set to $p \leq .05$. Analyses were carried out by authors AK and JLL in JASP v0.18.3. Figures were created by AK.

2.4 Ethics and Data Management

The study received ethical approval from the Ethical Review Authority in Sweden (Approval #2021-05229). Prior to data collection, participants were informed of the study's aims and consented to take part. The collected data were anonymised and stored on a password-protected data platform provided by Uppsala University and approved for storing sensitive research data. Data used in this analysis can be made available upon reasonable request to Maria

Häggglund (maria.haggglund@uu.se) following agreement from all data owners.

3 Results

3.1 Socio-demographic characteristics

Socio-demographic characteristics are presented in Table 1. The user groups differed significantly by gender, with more women in the healthcare education group, $\chi^2 = 614.42$, $df = 2$, $p < .001$, *Cramer's V* = .27. Age distribution was also significantly different: users without healthcare education tended to be older, though the association was weak, $\chi^2 = 127.52$, $df = 8$, $p < .001$, *Cramer's V* = .12. There were no statistically significant differences in education levels, $\chi^2 = 7.46$, $df = 3$, $p = .059$, *Cramer's V* = .03, but there was for employment, which had a weak association with user group, $\chi^2 = 177.70$, $df = 6$, $p < .001$, *Cramer's V* = .15. A larger proportion of the healthcare-educated group were employed full-time or part-time.

3.2 Experience with ORA

There was a significant relationship between healthcare education and frequency of access to the health record, although the association was weak, $\chi^2 = 11.81$, $df = 3$, $p < .001$, *Cramer's V* = .04. There were more first-time visitors among users without healthcare education and a larger proportion of more frequent users among those with healthcare education (see Table 2).

3.3 EHR Information

All types of EHR information achieved a median rating of 5 – “Very useful” in both user groups. The Wilcoxon Mann-Whitney U tests identified significant group differences for three information types: test results, primary care notes, and hospital care notes (see Table 3).

When ranking the types of EHR information by average rating in descending order, both users with and without healthcare education

Table 1: Socio-demographic characteristics.

	No Healthcare Education(<i>n</i> = 5216)	Healthcare Education(<i>n</i> = 3176)
Gender, <i>n</i> (%)		
Woman	3143 (60.26%)	2725 (85.80%)
Man	2046 (39.23%)	440 (13.85%)
Other	27 (0.52%)	11 (0.35%)
Age, <i>n</i> (%)		
15 – 19 years	4 (0.08%)	0 (0%)
20 – 24 years	80 (1.53%)	45 (1.42%)
25 – 34 years	661 (12.67%)	483 (15.21%)
35 – 44 years	806 (15.45%)	580 (18.26%)
45 – 54 years	914 (17.52%)	631 (19.87%)
55 – 64 years	946 (18.14%)	636 (20.03%)
65 – 74 years	1097 (21.03%)	594 (18.70%)
75 – 84 years	657 (12.60%)	197 (6.20%)
85 years or older	51 (0.98%)	10 (0.31%)
Education, <i>n</i> (%)		
Higher vocational education	1208 (23.16%)	770 (24.24%)
Higher education: Bachelor’s	1535 (29.43%)	939 (29.57%)
Higher education: Master’s	2258 (43.29%)	1305 (41.09%)
Higher education: Research	215 (4.12%)	162 (5.10%)
Employment, <i>n</i> (%)		
Full-time	2283 (43.77%)	1450 (45.65%)
Part-time	383 (7.34%)	448 (14.11%)
Student	183 (3.51%)	119 (3.75%)
Retired	1803 (34.57%)	787 (24.78%)
Unable to work	205 (3.93%)	126 (3.97%)
Unemployed	105 (2.01%)	33 (1.04%)
None of the above	254 (4.87%)	213 (6.71%)

Table 2: Frequency of access to the health record in the last 12 months.

	No Healthcare Education(<i>n</i> = 5216)	Healthcare Education(<i>n</i> = 3176)
Frequency of EHR access, <i>n</i> (%)		
This is my first time	139 (2.66%)	52 (1.64%)
2 to 9 times	2016 (38.65%)	1194 (37.59%)
10 to 20 times	1377 (26.40%)	846 (26.64%)
More than 20 times	1684 (32.29%)	1084 (34.13%)

Table 3: Median usefulness ratings of EHR information types and results from the Wilcoxon Mann-Whitney U tests.

	No Healthcare Education	Healthcare Education	W-statistic	<i>p</i> -value
Referrals	5	5	8.25	.73
Medication	5	5	8.13	.09
Vaccinations	5	5	8.28	.95
Test results	5	5	8.07	.004 ***
Primary care notes	5	5	8.05	.004 ***
Hospital care notes	5	5	8.15	.009 **

Note: For the original wording of each survey item, please see Appendix A. Ratings ranged from 1 – “Not useful at all” to 5 – “Very useful”. Significance level annotation: * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .005$.

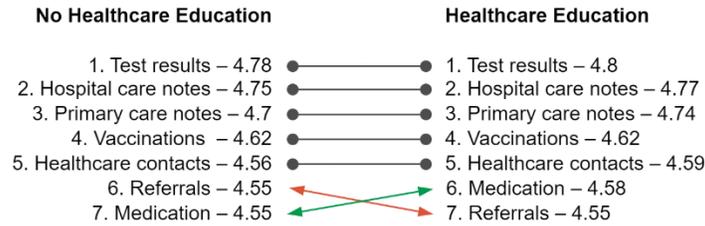


Figure 2: Types of EHR information ranked by average rating for each user group in descending order. Differences in ranking positions between groups is denoted by an arrow, red for a lower ranking in the healthcare education group, and green – for a higher ranking.

Table 4: Median usefulness ratings of EHR information types and results from the Wilcoxon Mann-Whitney U tests.

	No Healthcare Education	Healthcare Education	W-statistic	<i>p</i> -value
Summary of record	4	4	8.46	.07
Proxy access for children	4	4	7.63	< .001 ***
Proxy access for family members	3	3	8.04	.02 *
Block notes from HCPs	3	3	7.64	< .001 ***
Log data	4	4	8.03	.01 **
Ability to contact HCPs	4	4	8.87	< .001 ***
Ability to point out errors	4	4	8.20	.38
Ability to write comments	4	3	8.88	< .001 ***
Contribute health information	4	5	7.57	< .001 ***
Contribute self-testing	4	4	7.59	< .001 ***
Contribute visit expectations	4	4	7.85	< .001 ***
Manage medical certificates	4	5	7.84	< .001 ***

Note: For the original wording of each survey item, please see Appendix A. Ratings ranged from 1 – “Not useful at all” to 5 – “Very useful”. Significance level annotation: * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .005$.

most valued test results, hospital care notes, and primary care notes (see Figure 2). Differences in ranking positions were observed for the least useful items only: medication and referrals.

3.4 EHR Functions

Unlike types of EHR information, EHR functions received mostly median ratings of 3 – “Neither useful nor useless” and 4 – “Useful”. The Wilcoxon Mann-Whitney U tests found significant group differences for all functions except two: summary of record and the ability to point out errors (see Table 4).

Ranking the EHR functions by average usefulness rating also pointed to further group differences (see Figure 3). The most useful function for users without healthcare education was an ability to point out errors, while for users with healthcare education it was a function allowing to contribute health information.

4 Discussion

Research has repeatedly found that although patients describe a variety of benefits from ORA [6], some HCPs remain sceptical towards the practice. This is commonly related to concerns over patient wellbeing and satisfaction [9], but also increase in administrative burden [11], or changes in documentation practices [34]. It is not known if, as patients, healthcare-educated users’ opinions about

patient-accessible EHRs continue being affected by their specialist knowledge. To investigate patient-accessible EHR preferences now that ORA has reached maturity in Sweden, we analysed the opinions of patient users with and without healthcare education about various types of EHR features. We found that, largely, healthcare education did not influence ratings of EHR information items, and both user groups provided the same high median ratings. Greater differences emerged in the ratings of EHR functions and their ranking.

4.1 EHR Information

Both patient users with and without healthcare education rated all presented types of EHR information highly. Test results, hospital care notes and primary care notes received the highest average usefulness scores by both user groups. Some notable findings regarding EHR information types are discussed.

4.1.1 Test results. Patients’ uniform high opinion of test results is understandable. Previous research has found that patients highly value being able to see laboratory and diagnostic results through the patient accessible EHR due to the reduced waiting times [38]. At the time of publication, *1177 journal* provides several customisable options for viewing test results, including variations of single-entry

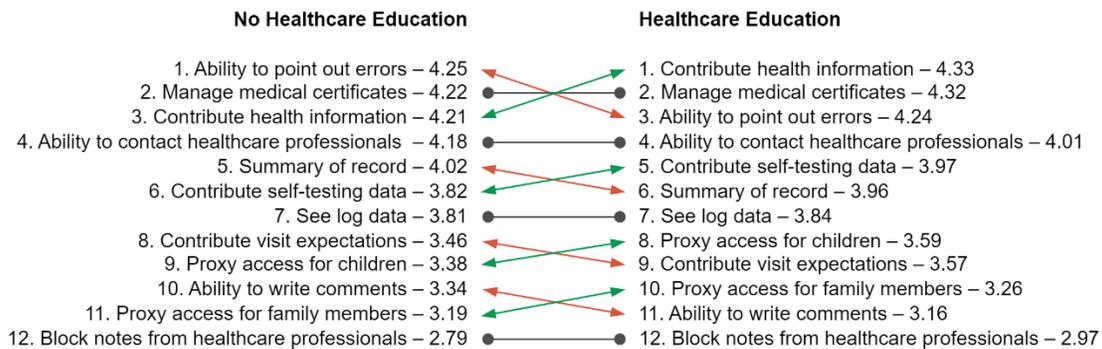


Figure 3: EHR functions ranked by average rating for each user group in descending order. Differences in ranking positions between groups is denoted by an arrow, red for a lower ranking in the healthcare education group, and green – for a higher ranking.

or grouped text and graphical presentations, as well as the option to download the data. With some regional differences, test results are immediately visible to patients as soon as they are added to the record, with a note that they have not yet been reviewed by a HCP. The immediate release has been resisted by HCPs due to the potential of worrying patients, and some even suggesting limiting access to signed off entries only [37]. In this analysis, the healthcare-educated users seemingly were not influenced by such concerns.

4.1.2 Primary and Hospital Care Notes. The high usefulness scores of primary and hospital care notes are also in line with previous findings. The practice of giving patient ORA to the notes written by clinicians about a healthcare visit, or so-called *open notes*, has been extensively researched in the US. Patients report that open notes enhance their healthcare in a variety of ways [51]. Many HCPs, on the other hand, have been apprehensive due to the potential negative consequences of releasing what some considered an internal documentation tool and using it as such. Prominent concerns include worsening health outcomes among the most vulnerable patients, especially those in mental care [7], increased workload [29], more contact requests from patients [44], and an increase in litigation [9]. As with test results, such reservations seemingly did not affect the healthcare-educated users in the survey. Both primary and hospital care notes received consistently high scores from users regardless of healthcare education status.

4.1.3 Medication. It is notable that medication was either the final or penultimate item when ranked, even if still highly rated. Alongside test results, medication and prescriptions are one of the most common types of information available to patients through ORA [28]. One potential reason for the low-ranking position could be the somewhat limited medication information available through *1177 journal*. While patient users can see active prescriptions, details such as the remaining times a prescription can be used are not visible. At the time of writing, such usage information can be accessed by patients through third party-solutions, for example, pharmacy websites or mobile apps. Expanding the medication information would likely make it more appealing to users both with and without healthcare education.

4.2 EHR Functions

Unlike EHR information items, EHR functions mostly received useful or neutral scores, and showed greater variability in ranking when comparing the user groups. Notable findings are discussed in the context of recent literature.

4.2.1 Ability to point out errors. Based on average ratings, the ability to point out errors was the most useful function according to users without healthcare education, and the third most useful to users with healthcare education. Analysis revealed that the group ratings were not significantly different, and the function ranked lower for the healthcare-educated users due to other functions receiving higher average scores. The difference in ranking between the two groups is an interesting observation due to the challenge that EHR errors present both for patients and HCPs. As most of the health record is populated manually by HCPs, it is to be expected that a number of entries will be erroneous. Left uncorrected, however, errors have the potential to cause detrimental impact on patients' concurrent care [8, 16] or impair patients' trust towards HCPs [12]. For HCPs, EHR errors are challenging to spot and to correct, not least due to a lack of education and workplace guidance. In Sweden, between 28 and 50% of patients have found a serious error embedded in their record [3, 21], and at the time of surveying, there was no dedicated function for reporting suspected errors through *1177 journal*. It is unclear why healthcare-educated users found other functions more important. Possibly, with the added knowledge of clinical workflow, these users expect only a minority of patient-reported errors require correction and thus not warranting a dedicated EHR function.

4.2.2 Manage medical certificates. The ability to order and manage medical certificates was one of the functions users with healthcare education found more useful than the error notification. It received both a higher median and mean rating compared to the users without healthcare education, and the difference was significant. An example of common medical certificate required by patients is one needed for a sick leave application at work. At present, if a patient requires medical certificates, they would have to schedule an appointment with a HCP. The time resources spent both by the patient

and HCP on addressing such bureaucratic tasks could be saved by a dedicated EHR function that allows both digitally ordering the certificate and receiving its digital copy.

4.2.3 Ability to contact HCPs. A function allowing to contact HCPs through the patient-accessible EHR system itself was viewed as useful by both user groups, though it received a significantly higher average rating from the those without healthcare education. Increase in time spent addressing patient queries outside care visits is a central concern cited by HCPs who oppose ORA [9]. Similar views may have influenced the healthcare-educated users in this survey. It is important to note that analysis of adolescent patient users who completed the same survey found that they considered the ability to contact HCPs as the most useful function [22]. The differences in our findings further highlight that EHR preferences depend on user factors.

4.2.4 Patient input functions. There were several EHR functions listed in the survey that captured different aspects of patient input: contributing health information, writing comments, contributing self-testing data, and contributing visit expectations. The ability to contribute health information received the highest usefulness rating on average from the healthcare education group. This may be due to the users' specialist insight into EHR documentation and the burden that comes with it [36]. Work environment studies have linked HCPs' burnout and workplace dissatisfaction to EHR administrative work [1]. Providing patients with a function that enables them to add health information could alleviate some of that burden. EHR integration of clinically useful patient-reported health outcomes is receiving increasingly more attention with evaluations of various solutions underway worldwide [14, 23, 56]. From this perspective, the high ratings from the healthcare-educated users are understandable.

The function of *writing comments* had lower average usefulness ratings from both user groups but even less so from users with healthcare education. *1177 journal* used to have a function that allowed patients to add a short comment about a care visit note, with the choice of making it visible to HCPs or keeping it private. The service was available regionally from 2013 until 2021, when it was decommissioned, partially due to the low use rate. In this context, the survey findings are in line with practice. Two reasons for the low interest may be the obscure location of the feature and the unclear purpose of patient-written notes. An example of a well-integrated patient comment function that has been found useful is *OurNotes*, in which patients complete a form briefly describing health updates and expectations for an upcoming care visit [52]. These comments are then discussed during the visit, which has been found helpful by both patients and HCPs. If a comment function was to be reintroduced in *1177 journal*, clear communication of its purpose and use could motivate patients to engage with it. Whether it should be used for communication of visit expectations, like *OurNotes*, is debatable. In our analysis, the item *contribution of visit expectations* was in the lower positions ranking for both groups.

Another patient input function was the *contribution of self-testing measurements*, which was seen as more useful by users with healthcare education than those without. Higher interest may have been expected due to the ever-increasing public availability of commercial self-testing and home-monitoring devices. In some countries,

patients already can and do link their smart health devices to the EHR [15]. As with the contribution of health information item, healthcare-educated users likely welcome such an option more due to the knowledge of the time and resources needed to enter health data into the EHR. Patients without healthcare education, in comparison, may lack an understanding of how the integration of their self-testing data could be useful for their care. Health self-tracking is laborious and knowing why it should be done is a key motivator [42].

4.2.5 Proxy access functions. There were two proxy access, also known as shared access, functions listed in the survey: proxy access on behalf of a child and proxy access on behalf of a family member. Healthcare-educated users regarded the proxy functions as more useful than users without healthcare education, but in both groups, the average ratings placed them in the lower half of the ranking. The lower ranking may be a result of only a minority of the polled users being engaged in parental or caregiver duties. When parents and guardians of minors are asked about their interest in EHR proxy access, a majority regard them beneficial [20]. Healthcare-educated users may be more aware of the importance of caregivers, and the benefits of ORA in informal care, and they may also be more frequently asked to support family members in contacts with healthcare. For example, HCPs experience enhanced communication with parents [27] and improved parental care support [47]. However, a key concern regarding proxy access, particularly during childhood and adolescence, is maintaining the confidentiality of patient and proxy while documenting in the EHR. It should be noted that without a proxy access function, pressed by circumstances individuals could still access and manage the record on behalf of someone else by using their login credentials, even if the practice is unsafe and potentially illegal. In a recent US study, half of messages sent from adolescents' accounts had been penned by their parents [26]. Moreover, unpublished work by the researchers indicates a lack of knowledge about proxy access regulations among Swedish HCPs. Together, these factors likely reduced the perceived appeal of the function to the majority of users in the survey.

4.3 Limitations and Future directions

There are several limitations related to the study design that should be considered when interpreting the findings. First, the question distinguishing the two user groups recorded the presence or absence of healthcare education without establishing what type of education that was. It was also not recorded if a respondent was further employed as a HCP. Future iterations of the survey should include clarifying questions about healthcare education and employment to better study the interaction between expert knowledge, professional experience and patient perspectives. Second, the exclusion of respondents with lower education levels from both user groups has resulted in a highly educated sample that is less representative of the overall patient user population in Sweden. Research indicates that educational background can influence both ORA behaviours and EHR preferences [50]. Future studies investigating the impact of healthcare education should ensure the inclusion of respondents of various educational backgrounds. Third, the presentation of the survey items was fixed, and not randomised. This has potentially introduced an order effect, with the initial ratings of each item

grouping anchoring further ratings [33]. Future survey iterations should counterbalance the presentation of the items. Lastly, in Sweden, the combination of types of information and functions that are available to patient users is determined by each of the 21 regions [22, 32]. This means that patients could have had personal experience in accessing some listed patient-accessible EHR features but not others. While this could have affected some usefulness ratings, the availability of the feature does not necessarily mean that patients have used it, as users often struggle with finding information and functions in the EHR [32, 46]. Asking participants whether they had personally accessed a feature before asking to consider its usefulness could be beneficial.

4.4 Implications for HCI

Previous HCI research has shown that in large health information systems, direct and indirect stakeholders may have contrasting assumptions and expectations, and more knowledge is needed on how to consider these conflicting perspectives in design [10]. This study contributes to HCI research by providing new insights into how user diversity, specifically healthcare education, influences preferences for patient-accessible EHR features. Our findings align with previous work that emphasised the importance of understanding user diversity in the design of health information systems [2], such as user experience of different patient groups [30, 40, 41] and age brackets [22, 25]. We extend this understanding by highlighting the specific needs of users with varying educational backgrounds.

We found that while users with and without healthcare education shared similar preferences for EHR information when they are patients, those without healthcare education had a stronger need for functionalities that allow them to flag errors. This finding is important in the context of prior studies on EHR errors, which found that patients commonly identify both erroneous and missing information in their EHR but struggle with reporting it [3, 53].

4.5 Design implications

Several key recommendations emerge to enhance the design and functionality of patient-accessible EHRs. By implementing these recommendations, EHRs can better accommodate user needs, ultimately leading to improved user experience of healthcare delivery.

- **Customisable Interface:** Allow users to prioritise EHR features. Users' most preferred function changed based on their educational background, indicating the importance of customisable access settings.
- **Error Reporting:** Introduce error reporting functionality. Users without healthcare education rated the ability to point out errors as most useful, highlighting the need for error reporting tools.
- **Patient Input:** Enable patient input in EHRs. Functions allowing patients to contribute health information were highly valued by both user groups, suggesting the need to promote patient engagement.
- **Proxy Access:** Integrate a proxy access function for minor and adult care recipients. Although the function had lower usefulness ratings, likely due to being relevant only to a minority of users who are caregivers, the function is vital for safe and secure digital healthcare support.

5 Conclusion

Healthcare education can guide patient users' opinions about patient-accessible EHR features but response trends are comparative. Users with and without healthcare education shared high regard for all types of available EHR information. Average usefulness ratings were also comparable for EHR functions, but ordering them showed that ability to point errors is not as important for users with healthcare education among other differences. Given that ORA continues evolving, incorporating the opinions of patient users with healthcare education could improve EHR design to better serve a variety of users.

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