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## Research and Applications

# The electronic health record as a patient engagement tool: mirroring clinicians' screen to create a shared mental model

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### ABSTRACT

**Objective:** Electronic health records (EHRs) in physician offices can both enhance and detract from the patient experience. Best practices have emerged focusing on screen sharing. We sought to determine if adding a second monitor, mirroring the EHR for patients, would be welcome and useful for patients and clinicians.

**Materials and Methods:** This mixed-method study was conducted in a general medicine clinic from March to June 2016. Clinicians and patients met in a specially equipped exam room with a patient-facing monitor. Visits were video-recorded to assess time spent viewing the EHR and followed by interviews, which were transcribed and analyzed using established qualitative methods.

**Results:** Eight clinicians and 24 patients participated. Main themes included the second screen serving as a catalyst for patient engagement, augmenting the clinic visit in a meaningful way, improving transparency of the care process and documentation, and providing a substantially different experience for patients than a shared single screen. Concerns and suggestions for improvement were also reported. Quantitative results showed high patient engagement times with the EHR (25% of the visit length) compared to reports in previous studies. The median satisfaction score was 5 out of 5 for patients and 3.3 out of 5 for clinicians.

**Discussion and Conclusion:** Providing patient access to the EHRs with this design was linked with several benefits including improved patient engagement, education, transparency, comprehension, and trust. Future studies should explore how best to display information in such screens for patients and identify impact on care, safety, and quality.

**Key words:** collaborative health IT, patient empowerment, human–computer interaction, doctor–patient communication

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## BACKGROUND AND SIGNIFICANCE

Fueled by a \$32 billion federal investment through the Health Information Technology For Economic and Clinical Health Act (HITECH) of 2009 and the Center for Medicare and Medicaid's Electronic Health Record (EHR) Incentive Program known as "Meaningful Use," 86.9% of physicians now use some version of an EHR in their offices.<sup>1</sup> Improving the quality and safety of health care and making care more patient-centered have been strong

drivers for the adoption of EHRs.<sup>2,3</sup> However, EHR systems can harm patient–clinician interaction during ambulatory clinic visits by adversely affecting communication<sup>4,5</sup> and create less attentive clinicians.<sup>6,7</sup> These concerns have obscured the possibility that EHR use within visits could actually improve patient engagement and promote effective communication.

Emerging evidence shows EHR use in the visit room is complicated,<sup>8–10</sup> but under the right circumstances, can be quite patient-centered. Best practices for using EHRs with patients have emerged

and been promulgated, such as the Let the patient look on, Eye contact with the patient, Value the computer as a tool, Explain what you are doing, Log off and say you are doing so (LEVEL) mnemonic that incorporates sharing of the clinician's screen.<sup>11–14</sup> Such strategies mitigating the negative impact of EHRs and incorporating EHR use into patient–clinician communication during the visit can enhance patient–centered care.<sup>15,16</sup> Notably, active screen sharing has been linked to improved communication,<sup>16,17</sup> patient engagement,<sup>18</sup> trust,<sup>19</sup> and a reduced sense of alienation when clinicians focus on their screens.<sup>16,20,21</sup> Patients may feel more involved in their visits when they are able to see the screen<sup>19</sup> or access the information.<sup>22</sup>

An important limitation of screen sharing is that clinicians have complete control over when the patient can view the screen, determining if and when it might be helpful to turn the screen and invite patients to follow along. Even when invited, patients face an unfamiliar user interface that can be cognitively challenging and filled with jargon.<sup>16,23</sup> Further, most exam rooms are not designed for screen sharing, presenting ergonomic challenges to patients and clinicians alike.<sup>5</sup> Empowered with data from OpenNotes and other studies that have detailed several patient benefits to full access to their health record,<sup>24,25</sup> we sought to understand if providing patients a full and unfiltered view of the EHR in the exam room would be accepted and perceived as useful.

## OBJECTIVE

The purpose of this paper is to assess patients' and clinicians' perception of a second screen for the patient that mirrors the clinician's screen. Aligning with the concept of “nothing about me without me,”<sup>26</sup> this design allows patients to see everything their doctor is doing on the main screen, including the creation of documentation, review of data, and ordering of medications and tests. Our main outcomes of interest were perceived usefulness of the second screen, and its perceived impact on patient education, patient engagement, and mutual trust.

## MATERIALS AND METHODS

### Study setting

We used a mixed-method approach to gain a holistic understanding of our research questions. We conducted our study in a hospital-based general internal medicine clinic located within an urban academic medical center from March to June, 2016. Participating clinicians and patients met in a specially equipped exam room in an outpatient clinic. We video-recorded entire patient encounters to quantify EHR use and conducted post visit interviews with the patients in a private setting. The Institutional Review Board at the Medical College of Wisconsin approved this study.

### Recruitment process and participants

We recruited clinicians using purposeful convenience sampling by sending email invitations and announcing details of the study at a clinic department meeting. Eight of 15 clinicians agreed to participate. After receiving clinicians' consent, we worked with the staff to identify times we could recruit 3 of the clinician's patients without disrupting the clinic workflow. Additionally, staff helped to identify ineligible patients, such as those with language or health barriers, or diminished mental capacity; we limited enrollment to visits of established patients scheduled for less than 30 min. On 27 half days, the

research team visited the clinic and used convenience sampling to invite 57 eligible patients to participate. For patients who expressed interest, we gave detailed information about what to expect during their visit, asked if they could remain for a 30-min interview afterward, and proceeded with the informed consent process. We stopped recruiting patients when we had interviewed 3 patients of each clinician.

### Intervention and data collection

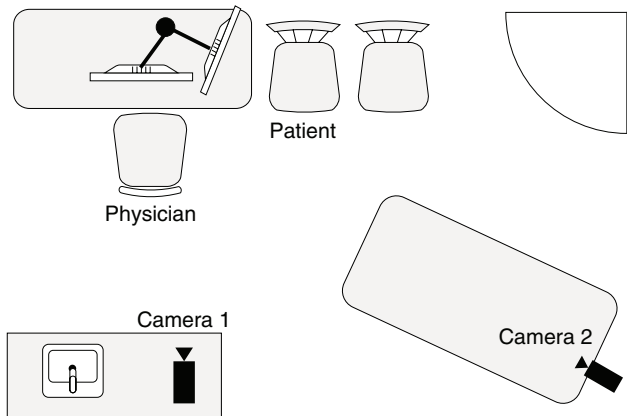
We placed a second monitor in the exam room on an articulating arm connected to the exam room's computer (Figure 1). The display mirrored the clinician's screen. Clinicians could disable the screen by turning the display off, which was done when schedules with other patient names were accessed. Once the medical assistant completed rooming procedures, the research coordinator turned on the cameras before the doctor entered the room. We placed 2 cameras at different angles to capture the interactions between the patients and clinicians. To ensure privacy, we provided cloths to mask the cameras during physical exams. Clinicians were also free to stop the recordings if they, or the patient, felt it necessary.

After the visit, we captured the patient's perceptions using a semi-structured interview. Similarly, after each clinician had used the second screen EHR with 3 patients, we interviewed her/him using a semi-structured guide. We developed interview guides for both patients and clinicians based on previous work<sup>19,21</sup> and included questions on their perceptions, such as perceived usefulness, perceived ease of use, second screen's contribution to communication and understanding, negative perceptions and concerns, and suggestions for improving the design. A digital audio recorder captured spoken data in all interviews. All participants provided a satisfaction rating of the experience and completed demographic surveys that assessed age, sex, race, and comfort with computer use on a scale of 1 (very uncomfortable) to 5 (very comfortable).

### Data analysis

All interviews were transcribed verbatim for the analysis. We then analyzed the transcripts using inductive content analysis.<sup>27</sup> We developed a coding book to guide the coding process and uploaded transcripts to NVivo 10 (QSR International) to facilitate coding and analyzes. After thorough review of the data by 2 experienced qualitative investigators (O.A. and J.T.), we created a preliminary codebook, with separate codes for patient and clinician transcripts. Using inductive content analysis, the RA (J.T.) coded all transcripts; a second coder (O.A.) analyzed 5 patients (20%) and 5 clinician transcripts (63%). A third experienced qualitative investigator (B.C.) reviewed each patient and clinician transcript to ensure validity. We addressed discrepancies and reached consensus in bi-weekly meetings. Throughout the coding process, the team discussed and revised the codebook, and returned to previously analyzed transcripts to ensure consistency. We analyzed patient and clinician data separately, though found that they had high degrees of conceptual overlap.

To quantify behaviors in the visit, we used Noldus Observer XT 12 for video-based analysis. We coded the adjusted visit length, defined as total length of visit time excluding the physical exam period, the duration of doctor's gaze at the EHR (main screen), the duration of typing, and the duration of the patient's gaze at the patient display (second screen). Start and stop times for each behavior were annotated using the software, which calculates total duration and frequency of behavior.



**Figure 1.** The layout of the exam room with the cameras.

We had 2 coders, each trained with 5 practice videos. When the coders achieved certain Kappa scores (0.60), they started to code study videos. Each coder reviewed and coded 2 videos per week, 1 being mutual for reliability check. Coders had 0.80 Kappa reliability score on average, considered very good for such work.<sup>28</sup>

## RESULTS

Twenty-four patients and 8 clinicians participated (Table 1). The content analysis yielded 4 themes from patients, and 2 from clinicians, with high degrees of overlap, along with concerns and opportunities for improvement from both groups. Themes are described in detail below.

### Characteristics' of participants

The average length of time patients had known their clinicians was 11 years (SD 10 years). Clinicians' experience in using an EHR system ranged from 8 to 16 years, with a mean of 11 years.

### Quantitative reports

The video analysis also helped us to quantify the visit length and both clinicians' and patients' interactions with the EHR. The average adjusted visit length, which excludes the physical exam period, was 23.6 (SD 11.2) min. Doctors looked at EHR (main screen) 39.1% (SD 14.4%) of adjusted visit length and typed/documented 8.2% (SD 6.3%) of the adjusted visit length on average. Clinicians typed for documentation purposes in 19 encounters. Patients also looked at the "patient display" 25% (SD 16.7%) of the adjusted visit length.

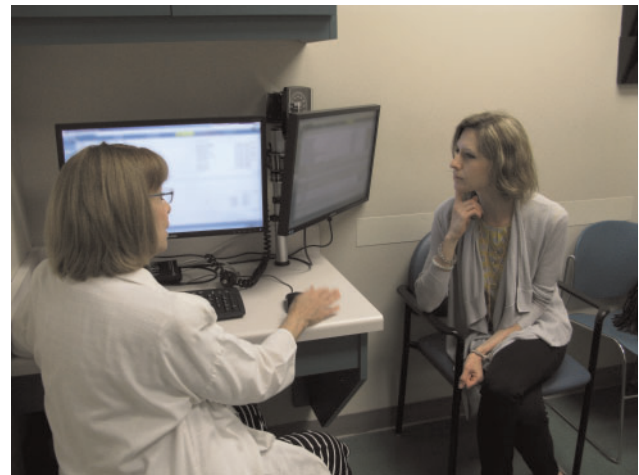
We also assessed both patient and clinician satisfaction scores with the intervention. The patient scale was from 1 (not at all satisfied) to 5 (highly satisfied), with a median of 5 [interquartile range (IQR) 4.5–5] out of 5. The clinician scale was 1–6 initially and adjusted to 1–5, and adjusted satisfaction median was 3.3 (IQR 2.3–3.9).

### Patients' perceptions

Four main themes emerged from our analysis of interviews with patients: the second screen (1) served as a catalyst for patient engagement through design; (2) augmented the clinical visit in a meaningful way; (3) improved the transparency of the care process; and (4) was a substantially different experience than sharing a single

**Table 1.** Demographics' of patients and clinicians

| Demographics                        | Patients   | Clinicians |
|-------------------------------------|------------|------------|
| Gender                              |            |            |
| Male                                | 8 (23%)    | 4 (50%)    |
| Female                              | 16 (67%)   | 4 (50%)    |
| Age (in years)                      |            |            |
| 18–34                               | 0 (0%)     | 1 (12.5%)  |
| 35–44                               | 4 (16.6%)  | 1 (12.5%)  |
| 45–64                               | 8 (33.3%)  | 6 (75%)    |
| Above 65                            | 12 (50%)   | 0 (0%)     |
| Race                                |            |            |
| Non-Hispanic white                  | 10 (41.6%) | 6 (75%)    |
| Non-Hispanic black/African American | 14 (58.3%) | 1 (12.5%)  |
| Non-Hispanic Asian                  | 0 (0%)     | 1 (12.5%)  |
| Computer use                        |            |            |
| Comfortable                         | 21 (87.5%) | 7 (87.5%)  |
| Not comfortable                     | 3 (12.5%)  | 1 (12.5%)  |



**Figure 2.** A representative snapshot of interaction with second screen EHR (interactions simulated by the research team, and the screens are blurred). EHR: electronic health record.

screen. We also captured suggestions for improvement, and concerns about interest and health literacy as derived from patient interviews. Figure 2 illustrates the room configuration.

### Catalyst for patient engagement through design

Patients noted that they felt more engaged in the discussions and process of care. The mere presence of the second screen invited patients into the care process more so than a single screen. Patients described the configuration as "more inclusive," "more personal," and some patients noted that it made them feel "more important." One patient commented, "So I think it shows you that a person really do care. They took the time out to put that in there." Patients provided descriptions of the second screen prompting questions or comments, such as offering or amending family history, clarifying medications, and augmenting the conversation about data.

*I think it generates a more inclusive feeling. When you're there and not looking at it and just listening to the doctor explain to you what's happening, it – it's a little bit more like you're a bystander. When you're watching the – the secondary screen. . . it's more inclusive. And, I don't know. I don't—I don't wanna*

*oversell it, but I—to me, it feels like you're taking more ownership in your own process and health and what should be happening next.*

Patients also reported being more engaged in the note-writing process, for example being able to clarify a new diagnosis. One patient likened it to sports, “I’m on the field. I’m playing. I’m not on the sidelines.”

#### Augmented clinical visit in a meaningful way

We identified several areas where patients felt that the second screen improved their experience of care, including better patient education, better discussions, and an ability to clarify concepts, instructions, and orders. Patients noted that being able to follow along on the screen improved their processing and internalization of trends, activating both their auditory and visual pathways for learning. One patient noted, “you gettin’ it from both angles. You’re getting it the verbal. . . and then you getting actually to see it. So that I – I think it helps you to better understand instead of just somebody just telling you something, versus you tellin’ and you seein’ it.” In particular, patients felt that seeing their clinician type notes served as a “whiteboard,” enabling more of a shared mental model of the issues with their clinicians. The second screen helped patients “follow along” and maintain their attention to the discussions at hand. One patient commented, “Because some doctors, when they speak, they don’t make it clear enough. If they have a screen in front of them, they can show them the direction, they can point it out just like in school.” Additionally, patients appreciated opportunities to ask questions or offer corrections, such as removing old medications from the list: “I – I had the chance to ask right away, you know. . . what, you know, what that meant. . . and this and that meant, so. . . it gave me better visibility.”

#### Improved transparency of the care process

The second screen demystified the care process, shedding light on what clinicians were typing and how they ordered medications, consultations, and tests. Our patient participants generally reported that they had high levels of trust in their clinicians, but that they appreciated the opportunity to observe, and this seemed to marginally make them more confident in the process of care. Patients likened this to a “trust but verify” approach, which they felt empowered to do. They could see that the doctor “wasn’t hiding something” by seeing the screen.

*When the doctor has the screen by himself, you almost get the sensation like something’s being kept from you. Like there’s not full disclosure, like they have some kind of secret information. Whereas when you have the second screen. . . you – you know that’s not the case*

The transparency also provided for patients to see exactly how the clinician was documenting the visit, and that seeing diagnoses, goals, and instructions in “black and white” helped solidify their understanding of what they needed to do for next steps. Lastly, patients noted that seeing data and medications in real time, as opposed to after the fact on after visit summaries, improved their confidence in the care process.

*I like seeing that the medications that were correct, even though we get a – a, um. . . a paper at the end -right in the real time I like to see that and. . . I like to see what she was typing when I had questions and she was going to do follow-up work. Um, I*

*thought that gave me confidence, even though I do have a lot of confidence in her. I just feel comfortable.*

#### Substantially different from sharing a single screen

The second screen was substantially different from sharing a conventional single screen managed by clinicians. For reasons mentioned above, it was inherently more inviting and welcoming. The second screen was “available” and (with rare exception) always on, providing a more consistent viewing opportunity:

*Um, if there’s any question that’s laying in my mind or thoughts, it – it takes from interrupting the doctor where she’s doing what she needs to do and I can just turn around and visualize it right on the computer. I mean, right on the screen.*

It was also ergonomically more appealing.

*I would’ve craned my neck and I would’ve looked around, but because it was not facing me. . . um, I know there’s all these privacies and – and I wonder – I would wonder because I’m a, um, I follow the rules, whether I should be doing that. And here it was open to me, so I knew that this was comfortable. Just like the charts on the doors? Oh, secret, secret.*

We heard that patients were concerned about privacy or appropriateness of looking at the conventional clinician’s monitor, even when prompted to do so by the clinician. One patient noted that she felt “like I was invading privacy of my doctor.”

#### Patients’ suggestions for improvement

Patients provided concerns and suggestions regarding the mirrored second screen as implemented in our study. Patients noted that the user interface of the EHR was very confusing to them, but assumed that they, like clinicians, might become more familiar with “where to look” with more experience. Nearly all terms were medical jargon or technical terms; while some patients noted that this substantially impacted their ability to derive benefit from the screen, others were aware of this but nonetheless appreciated the opportunity to follow along and learn. Patients were interested in a more simplified interface that could hide some of the clutter of the user interface and focus attention on important elements for patients.

Not all patients perceived benefits. Some found that the “flipping” through different screens in a fast manner made it difficult to follow along. Others voiced a lack of interest. Two patients thought that the computer was distracting and taking away from the ability to converse with the clinician: “I didn’t know what to do, should I look at the doctor, should I look at the screen. Um, she was typing and stuff that she always puts on this sheet anyway.” Interestingly, even the patients who voiced at the beginning of the interview that they did not find interest in the second screen identified potential benefits of the screen.

#### Clinicians’ perceptions

Two primary themes emerged from clinician data: (1) the second screen provided an opportunity to promote engagement and (2) documentation was transparent, with related benefits and concerns. Clinicians identified areas of improvement, centering on ergonomics, and information display.

#### Opportunities to promote patient engagement

Similar to patients, clinicians also identified ways that the second screen could enable better patient engagement and improve patient

education. Most clinicians thought that the second screen made screen sharing substantially easier. One clinician reported that the presence of the second screen seemed to give patients the unspoken message that they were allowed, and even encouraged, to look at the EHR screen: “my experience with two of the three patients was that they were – they felt allowed, entitled to look at the other screen. . . I think probably gives the patients an extra layer of ‘oh this is okay to do.’” This continuous access might improve communication according to some clinicians, especially if patients see clinicians’ entries in notes, and confirm or offer edits to the notes.

*I’ve already had it happen. Patients look at their after-visit summary, they come back the next time and they say this is listed as a diagnosis, this is incorrect. . . [the second screen] is huge for patient empowerment. Especially the patients that want the information, the more access they have to their own health information really oughta help.*

Clinicians had diverging opinions on the potential of the second screen to lead to more productive patient questions than would a single shared screen. In order to lead to more productive questions, one clinician stated there is a need for guidance on where to focus on the screen for patients. Finally, several clinicians thought that having a second screen would prolong the visit, as patients might unnecessarily question more.

Clinicians had mixed reports regarding the impact of the second screen on patient education, engagement, and empowerment. Clinicians reported that this setting has potential to improve patient engagement, but also noted that it depends on patient interest. Some other clinicians supported this with saying it might give more empowerment to those patients who are more engaged and want more information. Many clinicians noted that they tried to be engaging and to share the screen when they considered it helpful, as to make a point with an X-ray, weight trend, or lab value. Some clinicians compared this setting to the OpenNotes concept and highlighted the potential to facilitate overall patient empowerment and engagement.<sup>29,30</sup> Furthermore, a few clinicians thought the mirrored EHR experience on the second screen did not necessarily augment patient education by itself; if they had specific content for patients; however, the second screen would have the potential to improve patient education. Some clinicians also reported that the second screen was really helpful to use for risk calculators, decision aids tools and sharing web pages. In contrast, a few clinicians argued that the second screen made them lose the feeling of a shared experience with the same screen.

#### Transparency of documentation

Clinicians’ level of comfort in sharing documentation with their patients emerged as another theme; some were completely at ease with sharing, while others reported less comfort for 2 reasons: (1) the notes might contain sensitive information, and (2) during the visit, the note is a draft rather than a finished product—as such it might lead to misunderstanding. A few clinicians reported this affecting their workflow, their documentation style (typing less than usual), and their awareness of the patient’s loss of focus: “I definitely was not writing my note, because I was very conscious that he was, uh, was there and regularly looking at it.” Another doctor noted, “I actually think because I was worried about distraction. . . that I did a little less computer order entry and typing than I might normally have, because they could see me doing it.” Other clinicians thought it was helpful to share the writing process, “I actually think that patients should have access to their notes. I see on one hand a

bonus of them seeing while I’m typing, so they can correct me if they see any mistakes that I make based on what they are saying to me.”

A clinician also reported turning off the second screen from time to time due to sensitive material, but then felt it created a feeling of less transparency or might impact trust negatively. Another clinician expressed a desire to control when the screen would be shared. On the other hand, several clinicians also acknowledged the information belongs to patients and should not be hidden from them. In addition, 2 clinicians thought the second screen would distract some patients, and they reported not being sure if patients were listening to them while they looked at the second screen.

#### Clinicians’ suggestions for improvement

One of the major concepts reported was about the current physical design of the monitors and physical layout of the room in which we tested the intervention. Although the potential of the second screen was recognized, a few clinicians reported the current design of the room limited the benefits due to small desk space and large screens, sometimes blocking the eye gaze or impeding nonverbal communication. Clinicians also acknowledged that this is something that could easily be fixed with a better ergonomic design of the seating and the room.

Finally, themes also emerged regarding the design and information presentation in the current EHR, regardless of the number of screens. One argument was that most information in the EHR is not presented in a patient-centered way and might overwhelm patients. Another clinician thought that the second screen will create sympathy for clinicians, since patients will be able to see how cumbersome the EHR is to navigate, so they might blame the technology (rather than clinician) for some of the technical difficulties or delays in finding certain information.

Clinicians voiced privacy concerns when using mirrored screens, such as when needing to look for a piece of information in their email that was germane to the visit, when desiring to make a private note to self, or when needing to flip to a schedule screen that may contain other patient names.

## DISCUSSION

In this study of clinicians and their patients using a second screen dedicated to mirroring the clinician’s EHR view for the patient, participants identified several benefits for patient engagement, education, and transparency, as well as opportunities for improvement. Overall, patients perceived more benefits than clinicians and were more satisfied with the additional screen than clinicians. Patients in particular identified that the second screen was more inviting of their participation in the care process, complemented conversation to enhance comprehension, and fostered additional trust in their doctors.

Despite the majority of patients voicing that their clinicians often share screens, our data show that patients experience their dedicated screen in a fundamentally different way than when looking onto the clinician’s screen. Compared with our prior studies of screen sharing, patients’ viewing of the EHR was increased when using the second screen. Patients looked at the “second screen” 25% of the adjusted visit length on average which is longer than reported values in our previous studies where the most active clinician sharing led to patients viewing the screen 18% of the time.<sup>18,31</sup> The typical exam room configuration, with a monitor and keyboard aligned for the clinician, project a sense of the computer belonging to the domain of

the clinician. While some patients voiced that they were curious and would peek, others felt uncertain about the ethics and rules around looking at the screen. Self-motivated and empowered patients are more likely to regard the invitation to view their information on the screen as an act of transparency that might enhance the collaborative nature of the patient–clinician relationship as well as patient trust in clinicians.<sup>16</sup> The simple presence of the second screen invited all patients to participate.

A principal inference from our study is that patients gained control in the visit and in their relationship with their clinician, despite only being able to view what the clinician was doing or viewing. Control over the data and narrative recorded in these EHRs still rests primarily with the clinician. In our study, patients voiced that they felt more in control of visits, and the clinicians noted areas where their control was ceded, such as enabling patients to pause and reflect on what they see within the chart, and to see notes being composed. We heard recurrently that patients had high trust in their clinicians before the second screen, which was augmented further through this access. Clinicians may also need to trust their patients, such that the distributed control will not interfere or distract with tasks but rather make the visits even more useful for patients.

As clinicians, practices, and hospitals seek to improve patient engagement, looking at the physical design of space and resources may be very helpful. Our experience strongly suggests that patient engagement can be positively facilitated by design that is unambiguously inviting of their participation. Despite the majority of patients noting that their clinicians often share screens, our data show that patients experience their dedicated screen in a fundamentally different way. The second screen dispelled concerns about propriety of looking at the screen and also projected a sense that the patient was important and respected.

It is difficult to not compare the experience to that of OpenNotes. In the OpenNotes study, patients valued access to their notes far above the expectations of their clinicians, suggesting that clinicians may take data for granted but patients increasingly are seeing direct access as valuable. It is therefore unsurprising that patients also valued the ability to see the clinician create the note in real time. Also similar to OpenNotes is the concept that clinicians are developing trust in their patients to engage without unduly or unnecessarily hindering flow.<sup>24</sup> Clinicians voiced some concerns about notes not being finished products, or typing in sensitive information. The future of OpenNotes is of shared note creation among patients and their clinicians.<sup>32</sup> The second screen may facilitate such future endeavors.

### Concerns related to mirrored EHR displays

Several caveats exist to mirrored screens that are important to mention. Clinicians commonly need to access other areas of the EHR or other secured systems that could expose sensitive information, such as other patient names when accessing schedules. Being able to suppress displays as necessary and outline workflows for rooming that address these important areas are needed. The literacy levels of patients, including health literacy and computer literacy specifically, likely will impact benefits experienced by patients. We found evidence, however, that patients perceived benefits despite the challenging interface and jargon. Lastly, the second screen may indeed take away from a shared experience, such as with a large wall-mounted monitor for both clinicians and patients to use.

Our research also supported the concern that the screens of modern EHRs are poorly laid out and cognitively challenging,<sup>33</sup> limiting

the potential to make use of the screen for patient interactions.<sup>21,34</sup> The usability of EHRs presents well known challenges to clinicians, but also makes it challenging to clearly present data to the patient. Screens that focus on single tasks or enable a “focus” view may help facilitate discussions. Despite these challenges, however, patients were able to identify benefits to viewing the record. Future iterations may also include dedicated “patient views” that simplify the tasks at hand while enabling clinicians to access advanced options when needed.

Our results must be interpreted within the confines of the study design and limitations. The study was done at a single site at an academic medical center. However, our participants were very diverse in terms of age, race, and education. The sample size was modest, but within generally accepted ranges for qualitative studies focused on usability. As patients opted into the study, a selection bias favoring the technology might have been present; we found, however, while patient ratings were fairly high, not all patients found it immediately useful.

## CONCLUSION

In conclusion, this study shows that designs providing patient access to the EHRs during the visit may improve patient engagement. According to respondents in our study, this type of design also might contribute to education, transparency, enhancing comprehension, and improving trust. Finally, future studies should explore the best ergonomic approach for various exam rooms layout as well as eliminating clutter and making the information display in the second screen more patient-friendly.

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*Conflict of interest statement.* None declared.

## CONTRIBUTORS

O.A. conceived and designed the study, obtained funding, participated in data collection, analysis, and interpretation, drafted and revised the manuscript, and approved the final version for submission. B.C. assisted with study conception and design and data interpretation, made critical manuscript revisions and approved the final version for submission. J.T. assisted with data collection, and data analysis, and made critical manuscript revisions and approved the final version for submission.

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