Original Paper

Aligning the Electronic Health Record With Age-Friendly Care in Hospitals: Qualitative Multisite Study

Daniel Gilmore[1], PhD, RDN; Lauren T Southerland[1], MD, MPH; Sadie Chen[1], MLIS; Sean S Huang[2], MD; Fernanda Bellolio[3], MD; Juliessa M Pavon[4], MD, MHS; Elizabeth M Goldberg[5], MD; Daniel M Walker[1], PhD, MPH

[1]The Ohio State University College of Medicine, Columbus, OH, United States

[2]Vanderbilt University Medical Center, Nashville, TN, United States

[3]Mayo Clinic, Rochester, MN, United States

[4]Duke Medical Center, Durham, NC, United States

[5]University of Colorado Anschutz Medical Campus, Aurora, CO, United States

Corresponding Author:
Daniel Gilmore, PhD, RDN
The Ohio State University College of Medicine
700 Ackerman Road
Columbus, OH, 43202
United States
Phone: 1 9372425367
Email: daniel.gilmore@osumc.edu

Abstract

Background: The geriatric 4Ms framework conceptualizes 4 evidence-based elements (ie, Mobility, Mentation, Medication, and what Matters) that are important to high-quality care for older adults. Improving on these measures is central to the Age-Friendly Health Systems initiative. Electronic health records (EHRs) are critical to modern health systems including being able to review patient information and act on geriatric health concerns.

Objective: This study aimed to examine how clinicians use a commercial EHR to access 4Ms-relevant information during inpatient and emergency care of older adults to inform the design of scalable, age-friendly 4Ms EHR tools.

Methods: We interviewed clinicians and clinical staff (n=20), including physicians, advanced practice providers, nurses, pharmacists, and physical therapists from 5 large academic health systems across the United States regarding their experiences using the EHR during inpatient and emergency care for older adults. All included health systems used the same EHR and had geriatric quality programs in place. Participants completed virtual interviews that included narrated walkthroughs of their local EHR builds in response to 3 brief clinical vignettes focused on falls, home care needs, and delirium. Interviews were screen-recorded with audio and transcribed for coding and thematic analysis.

Results: Major themes spanned the 4Ms and consisted of (1) difficulty finding information about the 4Ms, (2) poor 4Ms data quality, (3) sparse EHR data sharing, (4) variable intrafacility practices, and (5) homegrown 4Ms EHR tools. Interviewees shared some examples of tools that had been implemented in their practice settings that increased access to 4Ms data, including documentation search workarounds, trackboards, and alerts.

Conclusions: Among a sample of clinicians and clinical staff representing large academic medical centers, 4Ms data in the EHR were characterized by multilevel barriers related to access and accuracy. Alternatively, interviewees demonstrated innovative EHR-embedded tools to improve accessibility of some 4Ms-relevant data. These findings inform the future development and refinement of a comprehensive geriatric 4Ms EHR tool for the emergency department and inpatient setting.

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KEYWORDS

qualitative; informatics; emergency department; age-friendly; 4Ms; electronic health records; geriatrics

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Introduction

Older adults are a rapidly growing patient population that experiences significantly higher rates of emergency department (ED) use and hospitalization than other demographic groups [1,2]. Annually, 17% of adults aged 65 years and older are hospitalized in the United States, so improvements in the hospital care of older patients would reach a large proportion of older Americans [3]. Widespread adoption of electronic health records (EHRs) has resulted in improvements in clinical care, particularly around promoting data-driven clinical decision-making, increased efficiency, and patient safety [2,4,5]. Yet, EHRs are still fraught with problems that present barriers to immediate access to longitudinal, up-to-date, and organized information needed for evidence-based treatment guidelines such as age-friendly care for older adults. For example, EHRs often have cluttered user interfaces that are overwhelming for providers and obfuscate acutely needed information [6,7]. Further, information gaps are ubiquitous; data are often inaccurate or incomplete, and there is inconsistent infrastructure for inter-EHR data sharing and interoperability [8,9]. These impacts of EHR shortcomings may be particularly poignant for patient populations with unique needs and complex health conditions like older adults.

In recognition of their unique needs, important work has been done to support health systems' capacity to provide population-focused care for older adults. Entities like the American College of Emergency Physicians serve as geriatric accrediting authorities and can confer geriatric accreditation to EDs based on adherence to geriatric best practices via a multipart rubric [10]. Additionally, other organizations including the John A. Hartford Foundation and Institute for Healthcare Improvement introduced the 4Ms framework in 2017 – a framework containing 4 evidence-based elements important to providing high-quality care for older adults including mobility, medication, mentation, and what matters [11]. Since its inception, some research has suggested that the 4Ms may be expanded to include additional elements (ie, 5Ms) [12]. This related framework adds "multicomplexity" and has been applied to inform training of geriatricians and other providers not specializing in geriatrics. However, the 4Ms framework has solidified as a blueprint for designing health care systems that are prepared to care for older adults. Since its development, the 4Ms framework has been used to propel health care systems toward quality geriatric care, and despite encountering typical implementation challenges, has shown effectiveness in improving outcomes like health status and safety [13,14]. The 4Ms framework is central to the rubric used to define Age-Friendly Health Systems [15] and, in 2025, was adopted by the Centers for Medicare and Medicaid Services as part of its mandatory inpatient quality reporting program (CMS Age-Friendly Hospitals Measure) [16].

Extant research examining EHR design and strategies to increase usability is prevalent, and this work acknowledges the need to improve EHR design – particularly given the negative relationship between usability and clinician burnout. However, less attention has been paid to EHR design in the specific context of older adults given the recency of national focus on age-friendly care. Some studies seeking to prioritize the 4Ms in EHR design have provided valuable evidence of feasibility and effectiveness but have mostly been limited to single sites with little capacity for scaling in larger health systems which dominate inpatient care settings [17-19]. To address this gap, we sought to understand the perspectives and experiences of clinical staff using a large, commercial EHR to understand what current users do to access geriatric care information and what modifications would be desired considering feasibility within their health system. These findings will contribute to our future efforts to enhance the design of the EHR to align with the 4Ms framework. Improving the design of the EHR will help in catalyze the improvements in the quality of care for older adults and aligning care with evidence-based guidelines and federal quality standards.

Methods

Study Design

This qualitative study is part of the National Institutes of Health (NIH)-funded project, Leveraging EHRs to Promote Age-Friendly Care in Hospitals (LEAF). The study was approved by a single-site institutional review board (IRB 2024B0383). The overall goal of LEAF is to apply a user-centered design process to inpatient and emergency care for older adults from multiple organizations to inform the design and implementation of an EHR tool that will align with the Age-Friendly Health Systems 4Ms framework from the Institute for Healthcare Improvement [11]. This study reports on the first phase of LEAF, in which we conducted a workflow analysis and cognitive walkthrough of existing EHR practices. Standardized reporting guidelines were followed using the COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist for qualitative research (Multimedia Appendix 1) [20].

Setting

Five large, geographically diverse academic hospitals in the Midwest, Southern, and Western United States that use the Epic Systems EHR (Epic Systems) were included. The hospitals had different combinations of geriatric programs, including geriatric emergency departments, IHI Age-Friendly certification, and geriatric surgery verification.

Sample Selection and Recruitment

Consistent with a convenience sampling approach, each site leader assisted with recruiting up to 5 individuals from different units by forwarding recruitment emails to participants via hospital listservs or workgroups. Individuals who expressed interest completed an online screening form, and eligible participants worked with the project manager to schedule a virtual interview. Any adult from these sites who provided clinical care to older adults in a US inpatient service or ED and was fluent in English was eligible.

Data Collection Instrument

We created a semistructured qualitative interview guide based on the 4Ms framework which included questions about interviewees' health care work experience and 3 brief clinical

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vignettes representing common geriatric care situations (falls, delirium, and home care needs). We reviewed the existing literature and incorporated subject matter expertise from the study team to inform interview questions. The vignettes were designed by a geriatric-trained physician (LTS). The interview guide was piloted with 3 clinicians and refined prior to recruitment (Multimedia Appendix 2).

The interview guide was designed as a cognitive walk-through where participants screen-shared their organization's EHR playground (a practice environment without patient information) and demonstrated their workflow tasks. Researchers encouraged interviewees to "talk-aloud," sharing their thought processes as they navigated through the EHR playground while answering questions associated with the vignettes (eg, Can you show me how you would document or find information on the patient's cognitive status? Can you show me where you find caregiver information for an older patient?). The guide also included questions about desired modifications for their EHR, as well as other considerations necessary when developing care tools for older patients (eg, In regard to caring for older adults, what are the biggest areas for improvement you would like to see in your EHR?).

Data Collection

Data collection began in May 2025 and was completed in November 2025. All participants provided electronic acknowledgement of consent. Three individuals on the study team with substantial qualitative research experience and graduate and doctoral-level training conducted virtual interviews using the semistructured guide. At the end of the interview, participants completed a brief demographic survey. All interviews were screen-recorded with audio.

Data Analysis

Transcription and Coding

A skilled transcription team at the Ohio State Recruitment, Intervention, and Survey Shared Resource (RISSR) transcribed the interview audio recordings. NVivo 14 (Lumivero, Denver, CO) was used for analysis. Coding used a combined deductive and inductive approach [21]. Coding was deductive in that the initial codebook was based on the interview guide questions but allowed for inductive identification of additional codes. To promote rigor and investigator triangulation [22], 3 coders (DG, SC, and DMW) worked as a coding team. To develop the codebook, the coders independently coded 2 transcripts and subsequently met to review the transcripts, discuss code definitions, and resolve coding discrepancies [23,24]. The coders revised the codebook as needed (eg, adding new codes, deleting unnecessary codes, and revising code descriptions) via consensus discussions. A third transcript was then selected for independent coding by the coding team. After this round of coding and codebook revisions by the coding team, no additional modifications to the codebook were suggested and the codebook was finalized. Two coders (DG and SC) independently coded the remaining transcripts using the finalized codebook and reviewed interview recordings for relevant examples shared by interviewees. Coding began in September 2025 and was completed in January 2026.

Thematic Analysis

Thematic analysis was led by a single investigator (DG) and supported by the coding team. The 4Ms framework was used as a sensitizing framework to guide data collection during interviews [25], while analysis used an inductive-deductive thematic approach to identify cross-cutting patterns in how clinicians accessed and used 4Ms. Consistent with commonly used methods for thematic analysis, themes were developed via prolonged immersion in the dataset and identification of patterns of meaning [26] surrounding the experience of using the EHR, and the design of the EHR to obtain 4Ms data across clinician types (deductive). However, this approach allowed for development of themes not anticipated given the focus of the qualitative questioning (inductive). To ensure rigor, the study team met throughout the analysis process to discuss emergent themes and theme descriptions. Saturation was reached to the extent that no additional themes related to the EHR and 4Ms were identified among the available interviews. We shared themes with the recruitment site principal investigators to promote trustworthiness and alignment of themes with their experiences.

Ethical Considerations

This study was reviewed and approved by the IRB at The Ohio State University (IRB 2024B0383). All participants provided electronic acknowledgement of consent, and all data were deidentified. All interviews were screen-recorded with audio. Interviewees were compensated for their participation time with a US $25 gift card.

Results

Overview

In total, there were 19 cognitive walk-through interviews with 20 participants that were conducted and analyzed across the 5 health systems. Eighteen of the interviews were individual interviews, and one interview was a group interview with 2 clinical staff members. All 5 academic health systems were represented in this sample. Eleven of the 20 interviewees were aged 35 to 49 years (55%), 15 (75%) were female, and 16 (80%) were non-Hispanic White. Most respondents (n=11, 55%) were physicians or advanced practice providers, but nurses (n=5, 25%) and other providers (eg, physical therapists) were also represented (n=4, 20%). Demographic characteristics of interviewees are provided in Table 1. Quotations in-text are presented with the participants' study ID in parentheses and clinical role.

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Table 1. Interviewee demographic characteristics.

Characteristics	Values
Age (years), n (%)	
18-34	4 (20)
35-49	11 (55)
>49	5 (25)
Sex, n (%)	
Male	5 (25)
Female	15 (75)
Race, n (%)	
non-Hispanic White	16 (80)
African American or other race	4 (20)
Ethnicity, n (%)	
Not Hispanic or Latino	19 (95)
Clinical role, n (%)	
Physician or advanced practice provider[a]	11 (55)
Nurse	5 (25)
Other[b]	4 (20)

[a]Includes physician assistant or nurse practitioner.

[b]Includes physical therapist and pharmacist.

Our thematic analysis resulted in five themes describing clinicians' experiences using the EHR to access 4Ms information, each with an associated subtheme(s). Themes included (1) difficulty finding information about the 4Ms, (2) poor 4Ms data quality, (3) sparse EHR data sharing, (4) variable intrafacility practices, and (5) homegrown 4Ms EHR tools. Table 2 includes descriptions of themes and subthemes with representative quotes.

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Table 2. Descriptions of themes, subthemes, and representative quotes.

Theme/subtheme	Representative quote
Difficulty finding information about the 4Ms: 4Ms data are difficult to find in the EHR[a], usually requiring clinicians to search through past documentation	
Subtheme: searching through notes and documentation	"*I don't know of how else I would find it aside from either looking through the clinical notes or checking into the flowsheets for like discrete documentation.*" [P[b]11, Physical therapist]
Subtheme: strategies to find information more quickly	"*I think the easiest way is just using that search bar. […]older adults have a lot of healthcare visits so there's just a lot of data and a lot of notes to sift through. he search function makes that, specific search a lot easier […].*" [P14, Physician]
Poor 4Ms data quality: 4Ms data is often inaccurate or missing in the EHR. Clinicians desire accurate, aggregated, accessible 4Ms data to improve patient care	
Subtheme: inaccurate or missing 4Ms data	"*Well, it's so I think the time is always taken to document in the note, but whether or not the note is linked, whether or not it's in the right way and in the right place to where that note links to something that's on the problem list is extremely rare.*" [P08, Physician]
Subtheme: desire for accurate and complete 4Ms data	"*But you know, yeah, if the healthcare power of attorney and their home health services could be readily available without me having to look at a note, you know, if it were somewhere over here, then that would be helpful.*" [P10, Physician]
Sparse EHR data sharing: Limited data sharing among hospitals using different EHR providers impacts availability of 4Ms data	
Subtheme: lack of intersystem data sharing is a barrier to accessing 4Ms data	"*We don't have- the ability to see if their PCP[c], who's not on Epic, if they were to recommend home health and then some home health agencies are Epic friendly, but most aren't.*" [P15, Physical therapist]
Variable intrafacility practices: Standards and requirements for documenting 4Ms data varies by hospital service type	
Subtheme: service-level variability in 4Ms EHR tools and data prioritization	"*If anyone's doing it, it would be the physician right now, because we are- we don't have a nurse driven assessment for delirium, unfortunately. […]I don't think that we have a designated spot for delirium screening. At least not on the emergency department side.*" [P30, Physician]
Homegrown 4Ms EHR tools: Examples of EHR tools that increase access to 4Ms data	
Subtheme: icons and alerts	"*[…] if a patient's screened positive [for delirium], it will, it'll alert you on your overview summary screen. […] It'll be yellow. And then, if it's persistent, it'll actually turn red.*" [P42, Physician]
Subtheme: geriatric dashboards and EHR defaults	"*[…] we are trying to develop a geriatric tab. […] So here it is. So this is our standard so far, like so a patient is, you know, here's the bed. These are their alert icons. If they're delirious, it will come here.*" [P18, Nurse]

[a]EHR: electronic health record.

[b]P: participant.

[c]PCP: primary care provider.

Theme: Difficulty Finding Information about 4Ms

Data about the 4Ms: Mobility, Mentation, Medication, and what Matters, were generally difficult for clinicians to find in the EHR. Finding 4Ms information typically involved scrolling through large quantities of documentation and clinical notes from prior medical encounters. Some standard EHR tools and other strategies were helpful to find information more quickly.

Subtheme: Searching Through Notes and Documentation

Referring to finding information in the EHR generally, one clinician said:

> *"[…] I use all the notes. And I scroll, I scroll looking [laughter] for what I might need."*

[P12, Advanced practice provider]

To find information about a patient's power of attorney (POA), one clinician described the time-consuming process of searching through many scanned documents:

> *"I mean it's time consuming. You have to−there's lists and lists of every document that's ever been scanned and you scroll through.*" [P08, Physician]

Regarding finding information about a patient's cognitive status, a physician described the lack of a designated spot for this information in the EHR, and how they would search prior notes from the patient's primary care provider to find it.

> *"The only place…I could think of would be to go to prior [primary care provider] notes. So, either in previous encounters, or notes. There isn't going to be anything else that I can think of, that we have designated, or we've outlined what their cognitive status might be unfortunately […].*" [P30, Physician]

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One therapist expressed how some clinicians' notes were more likely to contain certain types of 4Ms information than others due to different documentation requirements. Referring to finding a patient's living information, this individual said:

> *"[…] I'd start to look back to try and see like, OK, who has seen this this individual. […] I would look for if they were seen by a prior therapist, because I happen to know that a physical therapist or an occupational therapist is required to collect that information during their initial evaluation. So I would go back and I would check their notes. If that doesn't exist, I would also check the case manager's notes."* [P11, Physical therapist]

Similarly, a physician described how social work notes were convenient for finding home health information.

> *"I would look for the social work note. Because a lot of times [home health] information is likely going to be listed in their note which is very convenient as a provider to find it there. If they hadn't been engaged yet, I can't think of a place in the chart where it like lists that honestly, I'd be looking at notes […]."* [P23, Physician]

Subtheme: Strategies to Find Information More Quickly

Global chart search capability via a search bar in the EHR was available in many interviewees' practice settings. Clinicians shared various examples of how they used the global search function to find 4Ms information more quickly, as well as other strategies.

A physician interviewee described how they used the search function to find information about patients' dementia status.

> *"[…] I really like chart search, so at the top of the chart there's the ability to use chart search. The way that we have it set up is you can search for different specific words so I can look to see if there's a mention of dementia in the record."* [P21, Physician]

Another individual found the search function helpful for finding information about delirium screening.

> *"I'll type in [delirium screening test name] and see what comes up because it's just sometimes too hard to tease through all the notes if there's someone that frequently is in the hospital or goes to a lot of appointments."* [P15, Physical therapist]

However, clinicians discussed some challenges with the global search function. For one physician, the inability to provide context to searches and high variation in words used to describe similar concepts searched function a fallback strategy relative to searching for information in other places.

> *"The search option is like a good fall back, but it does require you then to scroll through snippets of all these different notes […..] If you're looking for like delirium, altered, that kind of thing. Like you can't…give the keyword any context. You're just typing it in as a standalone word and hoping that there's some match. So it tends to be a bit of a last resort for me of like huh, I don't know where to look. Let me see if anything pops up with the keyword."* [P08, Physician]

When unable to find needed 4Ms information in the EHR, clinicians shared some examples of what they would do next. For example, to find information about the type of facility a patient was coming from, one physician said "I'd probably Google the address" [P21]. Other clinicians shared next steps that involved talking to other members of the care team. Referring to not finding needed information about a patient's POA in the EHR, one individual said:

> *"And if I exhausted all those efforts and still found no information, I would reach out to the social worker."* [P20, Nurse]

Theme: Poor 4Ms Data Quality

Clinicians often described inaccurate or missing data related to the 4Ms in the EHR which was a barrier to patient care. Clinicians highlighted the benefits of accurate, aggregated, and accessible 4Ms data to improve patient care.

Subtheme: Inaccurate or Missing 4Ms Data

Referring to identifying dementia via the problem list in the EHR, one clinician described how they did not use the problem list for this purpose because they did not trust that it was updated and often contained duplicate or information or information unrelated to chronic conditions.

> *"[…] honestly the problem list should be appropriately updated. Unfortunately, it not always is. So I don't trust that-honestly that's the last place I would look. I really don't trust the problem [list]. A lot of times […] primary care, and you know anybody the patient sees in the outpatient setting will put the reason for visit in the problem list. So it'll−the problem list would have just like a list full of acute diagnoses. It'll be like sinusitis or you know, knee MRI, or something like that. And it's busy to try and search through all these acute reasons for visits to actually see what chronic conditions the patients have. […] It's just not a great place, for me to look. It takes too much time."* [P10, Physician]

A nurse interviewee also discussed the inaccuracy of the problem list.

> *"A huge problem is [that] a patient's problem list may have a diagnosis that don't even apply to that patient. […] I don't know whether it's they're not taking care to put in the right ICD9s or they're not paying, you know, not having enough time to be diligent about it, but it's the diagnoses differentials are sometimes vastly different."* [P29, Nurse]

For one mid-level provider, there were similar accuracy concerns regarding the EHR medication list.

> *"[I] glance at medications obviously if I'm working on some of the discharge or just seeing [if] patients are on them. It's hard to trust those and it's really hard to like narrow down what they take at home. I usually have to get into the, their [EHR patient information screen]. And manage orders like and*

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> *then I can kind of go that way. And then I kind of see, but these are often not accurate, so it's just, it's hard. I am interested in home meds a lot, but they're oftentimes so inaccurate [...].*" [P12, Advanced practice provider]

Clinicians also discussed accuracy or availability of living information in the EHR. A physician explained challenges accessing current residency for patients, particularly those who received care at multiple facilities.

> *"[…] say somebody is in a nursing home, under this address. Often this is not updated to reflect […] if it's a nursing home, it'll just give the address. It won't say like, you know, [facility name]. […] It will just say that the street and zip. So you don't know, is that like a house? Is that a−? So you end up having to do detective work and like, huh?.*" [P08, Physician]

Another physician highlighted that missing information about current residency was a barrier to prescribing medications upon discharge.

> *"[…] I can't prescribe medications to patients if I don't have an address [in the] system.*" [P14, Physician]

Subtheme: Desire for Accurate and Complete 4Ms Data

Clinicians desired EHR designs and tools that allowed easier access to 4Ms data, particularly data that was aggregated and up-to-date.

For example, a nurse highlighted the need for up-to-date POA information for patients in the ED.

> *"In all the things you've mentioned today, I would love for all of that [POA information] to be somehow updated by all of the different clinics, whoever last touches the patient, you know, to keep it updated in Epic so that any of us can access it when the patient comes to the Emergency Room. All these things you've mentioned would be helpful. I mean, we're just like little detectives searching around for this information.*" [P36, Nurse]

Referring to patients' advance care planning information, a therapist described how they would like to have this information in one place for quick access.

> *"[…] if they have an adverse reaction to [a stressor] and we need to consider do we start chest compressions or not start chest compressions, you know, are we calling codes or are we not calling codes? Those sorts of things, again, would be nice to have like sort of a really quick one stop shop as part of that would save some time.*" [P11, Physical therapist]

The same individual suggested a quick view dashboard to better assess patients' baseline mental status.

> *"I would love to see like a quick view dashboard around a like by pulling in a lot of these elements that gives like a quick view of this patient at baseline and then any of these like more acute like recently documented variables during their existing hospital stay. So for example, opening to see like a dashboard that would first show their like baseline cognition, right? And when that was documented and by whom? And then their most recent, if they've had any formal documentation completed.*" [P11, Physical therapist]

A physician interviewee also described the benefit of a singular place where patients' cognitive status was documented.

> *"Yeah, I've gotten really good at being a detective, but it would be really nice if it was just one place somewhere where you could see you know, what what's doing with their cognition. […] You have to piece it all together.*" [P08, Physician]

Similarly, another clinician suggested aggregation of home health information for easier access.

> *"Imean, I think it would be great if there was like a specific area on there, kind of overview sheet, that states you know that, you know, like, right here, home health. And then who does it, what their orders for home health are, that kind of thing. And then it's all in this kind of succinct overview and you don't have to peck and hunt for it.*" [P29, Nurse]

In one instance, a physician interviewee suggested having a place in the EHR for emergency medical services (EMS) providers to document their assessment of older adults' home environment to provide additional context to existing processes for EMS information relay.

> *"I think- it would be really great to capture some thoughts from EMS to be honest with you. If they had any concerns about the home environment or, they might be able to comment on who is at home with them […]. So, I do think an EMS assessment of the home would be really, really helpful [...].*" [P30, Physician]

A nurse interviewee described some ways that the EHR could be organized differently to prioritize 4M domains.

> *"[…] it would be really great if [the EHR] had−was organized a little bit differently. So their function was prioritized, their cognition was prioritized. And I think goals of care needs, any advanced care planning had been done, like what is their−what are their wishes? And then I think the other part would be: are there any flags that need to be addressed, like medications that are not appropriate for that age group, orders that need to be−that are not appropriate for this age group or are missing that are appropriate for this age group? So it's really kind of I think, as I'm talking about it, it's like the four M's, like it should be organized to follow the four M's.*" [P20, Nurse]

Theme: Sparse EHR Data Sharing

Clinicians discussed the challenges of sparse EHR data sharing between hospitals, particularly those that used different EHR platforms. Even among facilities using the same platform, incomplete data transfer affected availability of 4Ms data.

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Subtheme: Lack of Intersystem Data Sharing Is a Barrier to Accessing 4Ms Data

A physician interviewee shared an example of how home health information did not transfer between hospitals that did not use the same EHR platform.

> *"[…] Because I think the challenge too is, like, hey—if the patient isn't in our system because they get all their healthcare at a hospital that doesn't have Epic, and the medical records don't sync, it's essentially a black box. Because if I search, similar to what I'm doing now, like, maybe this lady has gotten all of her care at a different hospital in the area. She might have home health, might have all that stuff set up, but if I search for it, I get no information."* [P14, Physician]

Even among hospitals using the same platform, one interviewee described incomplete sharing of patient data like POA, living information, and demographics.

> *"We're really good at making sure that it's in all the right places, so we do all of this right at [institution 1 name]. And caregiver calls 911. Patient goes to [institution 2 name]. None of this stuff that we have done at [institution 1], even though it's information that does not change right? I mean people's addresses, people's like, you know, demographics, who their power of attorney is, none of that stuff goes across to that. […] But for this stuff, which is I would say probably more important to the actual patient, none of it gets pulled across […]."* [P08, Physician]

Availability of information about patients' medication was also impacted by sparse data sharing between hospitals and nonhospital facilities. One interviewee said:

> *"I think the other area that we always really struggle in is medications. […] it's oftentimes very challenging early on in a patient's data to understand what medication they're on, if they're taking it, and if they're on any high-risk medications. […] Maybe they changed their blood pressure medication and now they had a syncopal episode and fell, right? That would be super helpful to know. But because so many of the assisted living facilities, nursing homes, or you know, obviously coming from private care, they aren't on an EHR like this. It doesn't really talk with our system."* [P21, Physician]

Another individual expressed a similar sentiment when reflecting about building care tools for older adult patients and the importance of data sharing between facilities to promote transparency of care.

> *"Epic can really see a lot of Epic, like if another health system has that, but being able to integrate with other [EHRs] seems quite limited."* [P42, Physician]

Theme: Variable Intrafacility Practices

Clinicians described service or location-level variability in standards and requirements for acquiring and documenting 4Ms data particularly regarding cognitive status and fall risk, even among services within the same hospital.

Subtheme: Service-Level Variability in 4Ms EHR Tools and Data Prioritization

A physician interviewee shared an example of how recognizing delirium and delirium documentation was different on the general medicine hospital floor relative to the ICU.

> *"Now the most common is actually the hypoactive delirium So in the ICU, it's I think it's pretty good on step down, it's probably a little better […] And then on the GenMed floor, the nurse has 5 or 6 patients. Those little ladies that aren't a problem, they're just documented as sleeping or drowsy or something like that."* [P08, Physician]

Regarding delirium screening in the ED, another interviewee was unsure about whether delirium screening was conducted and felt that it was more likely done for inpatients.

> *"I'll be honest and I'm not 100% sure. I know that, I believe nursing would, but in the emergency department I don't know if that's a routine nursing, something that's screened for. […] There is a delirium order set that's more of the inpatient side […]."* [P14, Physician]

One clinician shared how next steps to address identified delirium were dependent on whether it was identified on a unit with a best practice alert in place:

> *"[…] so it depends on the unit. Let's say you're on a unit that has integrated best practice for delirium. On that unit, if you say your [delirium screening test] says positive, indicating that patient had delirium, a BPA, or best practice alert, pops up and encourages you to contact the team and at the same time, a notification is sent to the team that says that person did have a [screening test name] positive and suggests ordering a delirium order set."* [P20, Nurse]

Regarding mobility and fall risk, one therapist discussed how a fall risk tool functioned on the hospital floor units, but not in the ED, and advocated for consistency across settings.

> *"I guess our hospital uses like this very interesting way to predict fall risk based on a lot of other factors, but again in the emergency department, that doesn't function there. It only functions on the floors."* [P15, Physical therapist]

Theme: Homegrown 4Ms EHR tools

Homegrown 4Ms EHR tools, defined here as locally developed, nonvendor standardized modifications created by individual institutions or service lines, were described as improving visibility and access to geriatric-relevant information. Clinicians shared some examples of EHR tools that had been implemented in their practice settings that increased access to 4Ms data.

Subtheme: Icons and Alerts

Some individuals worked in EHR builds that used icons to display results of screening tests. A nurse interviewee described

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how positive delirium screening produced a "brain" icon in the EHR to alert providers (Figure 1).

> *"On our track board, so say this person does have delirium. I'm going to close this and this is [patient name]. I'm going to go to our track board and [patient name] should get an icon in the alert section. You see this brain icon? Yeah, that's a [positive delirium screen]."* [P18, Nurse]

A physician in the same hospital system also mentioned the use of icons in a facility "map" in the EHR and felt that they were helpful for gathering information quickly (Figure 2).

> *"This is the dementia icon that I was talking about−or delirium. These big icons, fire, that's the one for sepsis, this is one for procedural sedation. This is one for a stroke. So at a quick glance, I know where kind of the sickest of the sickest patients are located, which I think is really, really helpful. […]. So there's really a ton of information you can get at a very quick glance […]."* [P21, Physician]

Figure 1. An example of an alert for delirium in the playground environment of one health system electronic health record system. When a patient screens positive for delirium, a small brain icon appears in the Emergency Department trackboard in column 2 (nurse view), highlighted by the interviewee's cursor arrow.

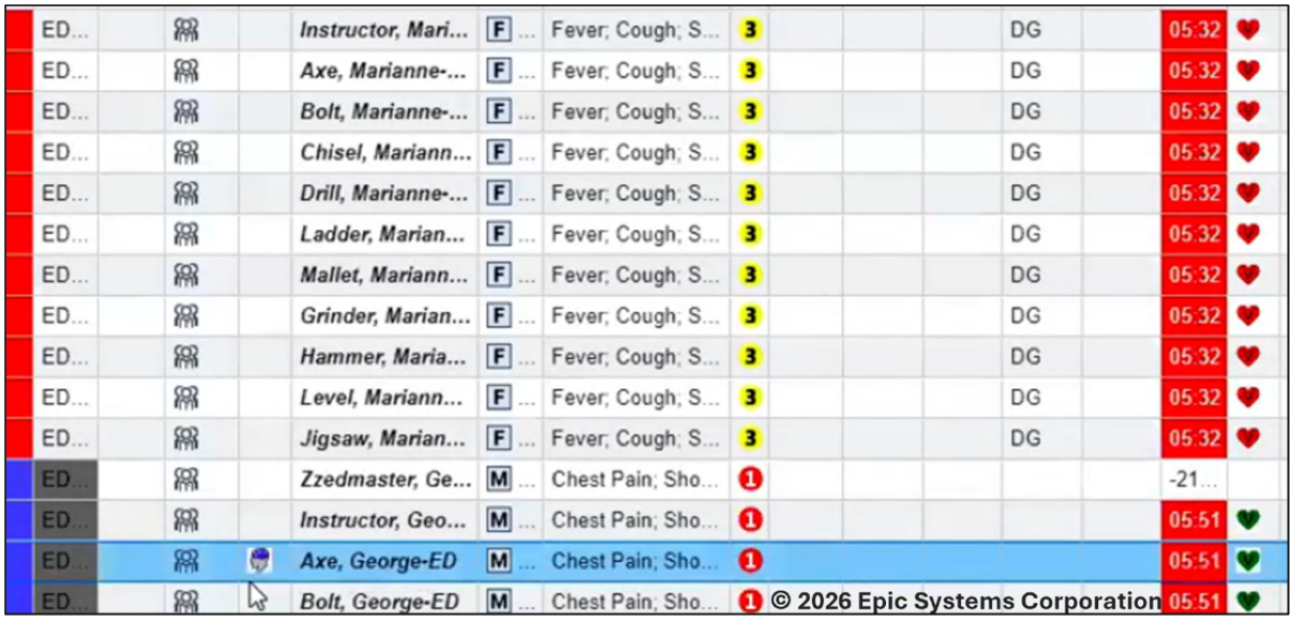
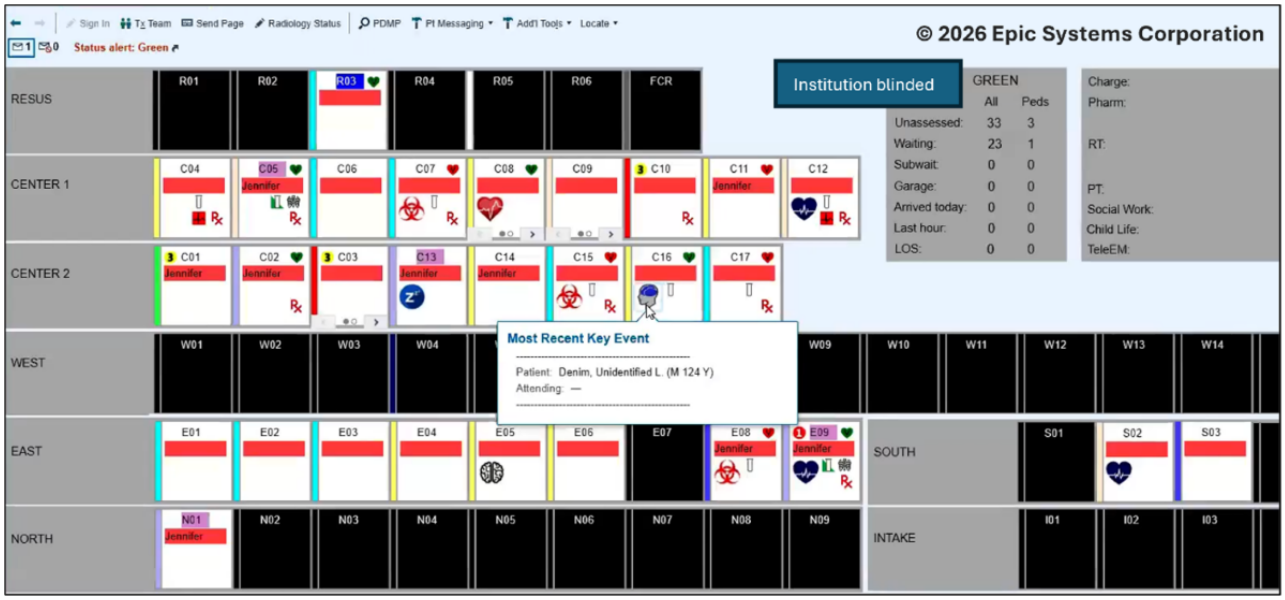


Figure 2. An example from the playground environment of how visual icons for patients allow providers to quickly see which patients on their unit have delirium. A blue brain icon is visible for room C16 and highlighted by the interviewee's cursor.



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Another clinician discussed the use of notifications about positive delirium screening and a best practice alert (BPA) to add delirium to the patient's problem list.

> *"[…] our delirium screening if it pops positive, triggers a BPA for the provider to put delirium on the problem list. […] That's where the BPA has been helpful, because now it should be on the problem list more often."* [P23, Physician]

Subtheme: Geriatric Dashboards and EHR Defaults

Some clinicians discussed the development of geriatric-focused dashboards in their EHR builds. One clinician described how their institution had implemented a geriatric EHR panel to monitor older adults' risk factors for various geriatric syndromes or outcomes (Figure 3).

> *"But this [tool] kind of pulls in a lot of information about the older adults. This was also developed by our geriatrics team at the health system. […] It'll pull in high-risk medications, so Beers list medications […] So if they have delirium going on you can look here and see are they on any meds that might be contributing. I guess it does pull the [delirium screening tool] and the [dementia screening tool] scores in here. I personally don't look at it very often. But that will be pulled in here, they pull in last bowel movements, which can be important in delirium prevention. Ins and outs if they're documented. And then the other PT/OT [physical therapy/ occupational therapy] to order, so kind of a multidisciplinary everything's pulled into this location."* [P39, Pharmacist]

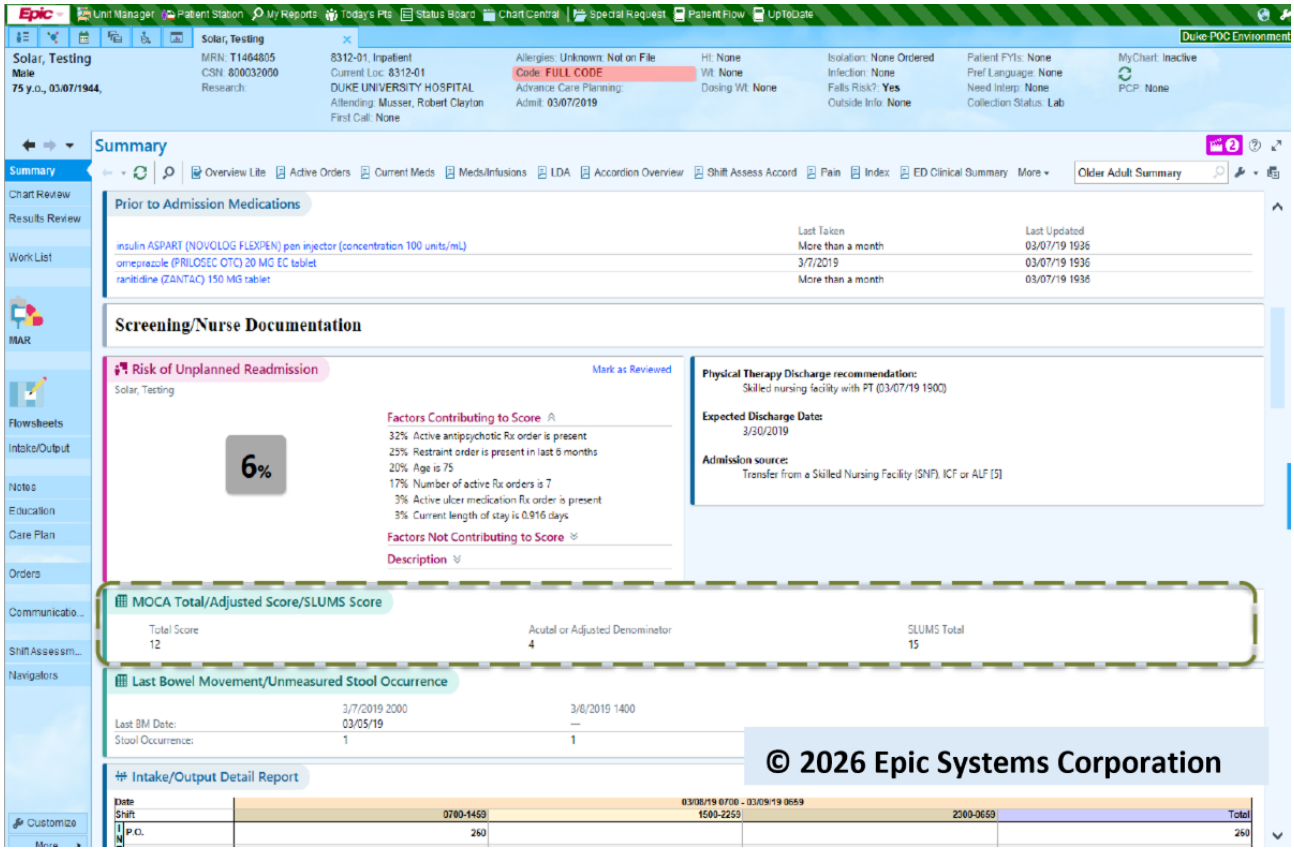
The same individual described their health system's use of a medication ordering tool which defaulted to geriatric safe doses for geriatric patients (Figure 4).

> *"So, we have implemented […] a geriatric prescribing context for older adults and they targeted certain higher risk medications so that when you order them in an older adult, the defaults dose buttons are lower."* [P39, Pharmacist]

A clinician explained how their hospital prioritized connecting geriatric patients and caregivers to resources that they might need upon discharge and automatically displayed discharge information in a larger font size for geriatric patients.

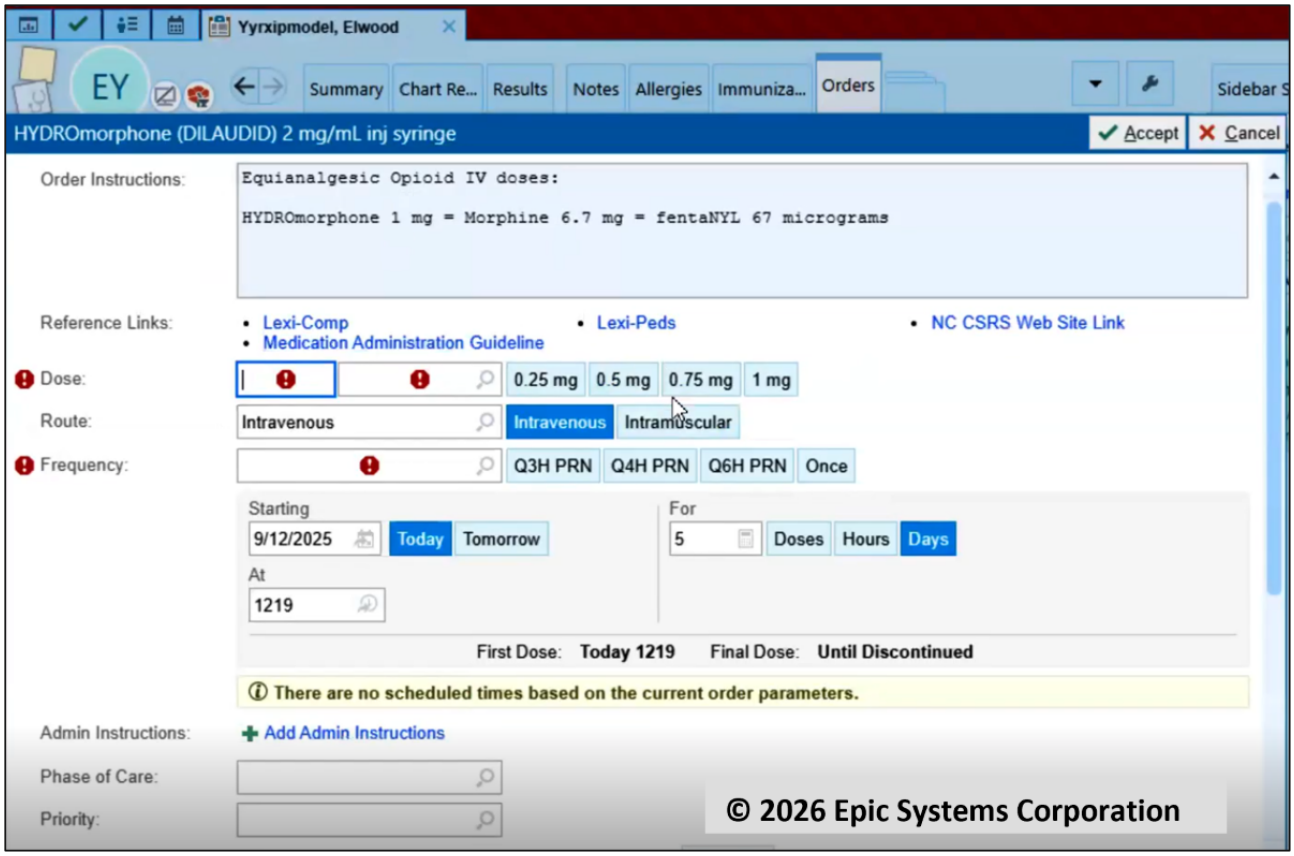
> *"[…] we can get this [website resource] to them, and it has every, you know, health insurance, where to stay, Meals on Wheels, insurance, help at home, how, how to get legal help, financial, consumer, everything you can imagine […]. And it also, if they're 65 and older, the font automatically increases so they can read their discharge instructions easier. And we, and it's for caregivers as well."* [P36, Nurse]

Figure 3. A home-grown dashboard for monitoring the 4Ms, including cognition, therapy recommendations, medication administration, and other aspects of the 4Ms.



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Figure 4. An example from the playground environment of an electronic health record tool to reduce inappropriate medication prescribing by providing a reminder of equal analgesic dosing and defaulting the ordering system to geriatric dosing based on age.



Discussion

Principal Findings

In this multicenter evaluation of current EHR use in the care of hospitalized older adults, interviews with providers and clinical staff revealed multilevel barriers to finding 4Ms data and suggested modifications to enhance the EHR for better care of geriatric patients. Interviewees also shared several innovative local tools around 4Ms elements that could be deployed in other settings. We found that targeted search strategies, icons, or alerts help clinicians identify when a person has important conditions such as dementia or delirium. A second theme was that accurate and accessible information on the 4Ms is limited by interfacility data sharing and intrafacility differences in practice, even between inpatient departments within the same institution. Taken together, these findings highlight specific design priorities, centralization of 4Ms data, reduction of documentation search burden, and consistent cross-setting visibility, that are not addressed by current EHR default configurations.

Data accuracy is challenging. Due to the evolving nature of medical conditions such as dementia and mobility, as well as changes in care partners or home situation, even data such as home address can quickly become outdated or be misleading. An example given was the person who lists their home address as their house but is currently living in a rehabilitation facility or nursing facility. Data issues such as currency/recency and correctness/accuracy [27,28] are well known in medical records, as it takes staff time to verify or update data, and may affect interoperability with other EHR systems. Underdocumentation or narrative descriptions of dementia diagnosis are also a well-known phenomenon, which led participants in our study to not "trust" the problem list to be accurate [29]. While there is currently no automated way to increase the accuracy of data, easier visualization of the 4Ms within the EHR could improve clinicians' ability and opportunity to update information. Participants also recommended a cognitive assessment section or area to make it easier to find this information. Attention to data visualization and dedicated space for information important for older adults like cognitive assessment is congruent with hallmark user design heuristics that prioritize critical information [30]. User design principles are generally intended to promote usability and optimal user experience, but in the context of EHR design, they may be additionally important for supporting high-quality geriatric care.

A novel theme identified in the analysis was that even within a health system, there is high variability in how clinical staff navigate the EHR and use 4Ms data. Documentation may be different in different units, such as the Emergency Department, Intensive Care Unit, or medical wards [31]. This variability can complicate transitions of care from clinical unit to another or from the hospital to other care settings like skilled nursing facilities [32]. An example given was that clinical staff in one department may see a fall risk alert or icon that is not used in other units. Education on how to find 4Ms data in specific places or a centralized location for data could help overcome this barrier. Upgrades to the general text search feature would also help make available data more discoverable [33]. Opportunities in this area include AI approaches including natural language

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processing, or improved search functions that would automatically identify related keywords or phrases [34,35].

Our findings suggest that current approaches to interoperability may miss opportunities to support an Age-Friendly Health System. Inconsistent availability of 4Ms data may disproportionately impact older adults with cognitive impairment, limited caregiver presence, or fragmented care histories, thereby reinforcing existing disparities in hospital-based care. It is well documented that although most hospitals participate in some form of health information exchange, several barriers remain toward full interoperability [36,37]. To overcome these barriers, the Office of the National Coordinator for Health Information Technology has established the United States Core Data for Interoperability (USCDI) standards, which are routinely updated [38]. The newest draft version does include health status assessments, such as cognitive status, but does not mandate several relevant data points – such as residence type (eg, facility or home); or POA or advanced directives information. However, these instrumental data are critically important in caring for older patients who may not always present with caregivers, may have cognitive impairment, or may be too ill to share this information with the care team. Notably, these gaps exist not just for between vendor exchange, but also within a vendor. This challenge could result from institutional choices about data sharing, or from data that is available but not well integrated at the point-of-care. Promoting inclusion of 4Ms relevant data into USCDI standards could fill in missing data gaps.

Ultimately, our findings highlight several changes that could make 4Ms data more findable, accessible, interoperable, and usable [39] within the EHR– both for patient care delivery as well as research. Interviewees noted several examples that solve some of the challenges of the 4Ms data. In particular, interviewees described a geriatric dashboard or standard system as a helpful innovation. LEAF ultimately aims to refine and test a 4Ms navigator or report/dashboard system using the information from this study and our prior work [40]. Consistency in documenting and coding the 4Ms is necessary to report compliance with age-friendly measures, and intrafacility inconsistency worsens this problem. A group led by a University of California San Francisco team is working on building compliance measures with the 4Ms with promising initial external reproducibility [41]. These compliance measures may act as a benchmark for hospitals to evaluate the "Age-Friendliness" of their EHR systems, and aid in the effort to create universal dashboards of 4Ms data.

Limitations

Our findings should be interpreted with a few key limitations in mind. First, the interview sample was recruited from large academic health centers with geriatrics programs and clinicians in other settings may be both less motivated or face more challenges finding geriatric-relevant information. Similarly, all interviewees used the Epic EHR system, which could differ from other EHR vendors in terms of the available tools and interoperability and intraoperability characteristics. Although playground environments replicate local EHR build and workflows, they do not reflect real-time data volume, interruptions, or system latency present in live clinical settings. This made it harder for some interviewees to find clinical tools or data, as not all the nursing assessments or note features were populated in the playground environment. Next, we did not aim to reach saturation at any single site, limiting our ability to compare installed features or other differences between sites. Finally, while we initially aimed to determine common measures of usability, such as the number of clicks or time to find a particular piece of information, we found it more valuable to have participants narrate their workflow in detail rather than observing their task completion time without detailed narration.

Conclusions

We demonstrate common challenges clinical staff encounter when extracting 4M-relevant data from the EHR. These findings identify concrete, clinician-driven priorities for improving how 4Ms data are surfaced, shared, and acted upon within hospital EHRs. Addressing these gaps through centralized dashboards, standardized documentation practices, and improved interoperability may substantially reduce cognitive burden for frontline clinicians while advancing the goals of Age-Friendly Health Systems. These insights inform the next phase of LEAF, focused on implementing and testing scalable age-friendly EHR enhancements across diverse academic centers.

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Data Availability

Deidentified data from this study are not available in a public archive. Deidentified data from this study will be made available on a per-case basis (as allowable according to institutional IRB standards) by emailing Lauren T. Southerland, MD (Lauren.southerland@osumc.edu)

Generative AI Use

The authors declare that generative AI was not used in the preparation of this manuscript.

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Authors' Contributions

Conceptualization: LTS, SSH, FB, JMP, EMG, DMW
Data curation: LTS, DMW
Formal analysis: DG, SC, DMW
Funding acquisition: LTS, SSH, FB, JMP, EMG, DMW
Investigation: DG, LTS, SC, DMW
Methodology: DG, SC, DMW
Project administration: LTS, DMW
Resources: SSH, FB, JMP, EMG
Supervision: LTS, DMW
Visualization: DG
Writing – original draft: DG
Writing – review & editing: LTS, SC, SSH, FB, JMP, EMG, DMW

Conflicts of Interest

None declared.

Multimedia Appendix 1

COREQ checklist.
[PDF File (Adobe PDF File), 486 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Interview guide.
[DOCX File , 78 KB-Multimedia Appendix 2]

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Abbreviations

COREQ: Consolidated Criteria for Reporting Qualitative Research
ED: emergency department
EHR: electronic health record
EMS: emergency medical service
IRB: institutional review board
LEAF: Leveraging EHRs to Promote Age-Friendly Care in Hospitals
NIH: National Institutes of Health
POA: power of attorney
RISSR: Recruitment, Intervention, and Survey Shared Resource
USCDI: United States Core Data for Interoperability

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